FOREWORD
Since 1951 the scientific diving community has endeavored to promote safe, effective diving through self-imposed diver training and education programs. Over the years, manuals for diving safety have been circulated between organizations, revised and modified for local implementation, and have resulted in an enviable safety record.

This document represents the minimal safety standards for scientific diving at the present day. As diving science progresses so shall this standard, and it is the responsibility of every member of the Academy to see that it always reflects state of the art, safe diving practice.

American Academy of Underwater Sciences

ACKNOWLEDGEMENTS
The Academy thanks the numerous dedicated individual and organizational members for their contributions and editorial comments in the production of these standards.

USC Dive Safety Manual Revision History
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   Added Sec 7.6.1 Nitrox Diving Guidelines.
   Revised Appendix 7 and 11.
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   Removed Appendix 7 AAUS Checkout Dive and Training Evaluation.
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August 2003
   Section 1.27.3 Delete reference to Appendix 9 (checkout dive).
   Section 1.4 Remove word "waiver".
Section 2.21 Change "supervisor" to "lead diver".

Section 2.72.2.1 Remove reference to Appendix 13, and remove Appendix 13. Replace with “at www.aaus.org” after Incident Report.

Section 3.28.3 Remove Appendix 10 (dive computers).

Section 5.32 Training and 100-hour requirement, eliminate "beyond the DIT level".

Section 5.32.1 Eliminate paragraph "Suggested topics include" and replace it with a list of topics for inclusion in the 100 hours. Some of these topics would be designated "R" (required).

Section 4.0 Remove lead sentence "This section describes for diving". Alter the lead sentence read as follows: "This section describes training for the non-diver applicant, previously not certified for diving, and equivalency for the certified diver."

Section 4.3 Delete this section.

Section 9 Update Required Decompression (9.10) and Mixed Gas Diving (9.60) to individual sections.

Appendices 9, 10, 11, and 12 Remove these and make available online as historic documents in the Virtual Office.

Formatted document for consistency.

Separated manual into two volumes. Volume 1 and the appendices are required for all manual and Volume 2 sections only apply when the referenced diving activity is being conducted. Volume 2 is where organizational specific information is contained.

October 2005

Section 11.70 Deleted section for rebreathers.

Section 12.00 Added new section for rebreathers.

March 2006

Section 13.00 Added new section for cave and cavern diving.

Section 11.5 and 11.6, revised definitions for Hookah and surfaced supplied diving.

April 2006

Section 5.30 Deleted emergency care training prerequisite.

Section 5.50 Added emergency care training requirements to Continuation of Certificate.

November 2006

Section 2.60 flying after diving rules updated to meet current DAN standards.

Section 3.20 dive computers reference changed to “appendix 8”.

Section 3.60 air quality guidelines updated to meet current CGA standards.

Section 5.30 – added words “Transect Sampling “to item #9.

Appendix 1 – Updated one medical web link.
Appendix 2 - Added the abbreviation “DO” to the MD signature line.
Appendix 6 – new LOR template.
Updated and added Appendix 8 dive computer recommendations
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August 2014 Section 1.20 Added DSO permission for Instructional Personnel
Require Dive Plan and Letter of Reciprocity for Visiting Sci-Diver
Section 1.30 Added “DSO” to reflect duty as stated in Section 5.70
Section 2.40 Define diver and lead diver reporting obligations
Section 2.70 Create online dive data and logging system [www.usc.diveaus.com](http://www.usc.diveaus.com)
Update required incident reporting
Section 3.10 Updated to reflect AAUS Standards May 2013
Section 3.20 Regulator - Added “serviced according to manufacturer recommendations”
Backpacks – updated to reflect AAUS Standards May 2013
Weight Systems – Replaced terminology “single motion of either hand” with “effective or prompt”
Added Additional Required Equipment
Added Exposure Protection
Section 3.30 Require training for underwater tool operations
Section 4.00 Updated section to reflect AAUS Standards May 2013
Section 5.00 Updated section to reflect AAUS Standards May 2013
Section 5.60 Updated requalification for active status and depth recertification
Added minimum insurance requirements
Section 14.4 Transfer boat training and authorization to Boating Safety Officer
Section 16.0 Added Chamber Diver Authorization Procedures
Section 17.0 Added Guest Diver Authorization Procedures
Appendix 1 Diving medical exam overview for the examining physician
Appendix 2 Medical evaluation of fitness for scuba diving report
Appendix 3 Diving medical history form
Appendix 4 Recommended physicians with expertise in diving medicine
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Verification of Certification (VOC)
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SECTION 1.00 GENERAL POLICY

1.10 Scientific Diving Standards

Purpose

The purpose of these Scientific Diving Standards is to ensure that all scientific diving 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 organizational members. Fulfillment of the purposes shall be consistent with the furtherance of research and safety.

This standard sets minimal 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.

This standard 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. 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 organizational member, 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 Exemption

OSHA has granted an exemption for scientific diving from commercial diving regulations under the following guidelines (Appendix B to 29CFR1910 Subpart T):

1. 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.
2. The purpose of the project using scientific diving is the advancement of science; therefore, information and data resulting from the project are non-proprietary.
3. 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.
4. 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.
5. In addition, the scientific diving program shall contain at least the following elements (29CFR1910.401):
   a. Diving safety manual which includes at a minimum: Procedures covering all diving operations specific to the program; including procedures for emergency care, recompression and evacuation, and the criteria for diver training and certification.
   b. Diving control (safety) board, with the majority of its members being active scientific divers, which shall 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.

Review of Standards

As part of each organizational member’s annual report, any recommendations for modifications of these standards shall be submitted to the AAUS for consideration.
1.20 Operational Control

USC Auspices Defined

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

It is USC’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 USC’s Diving Control Board (DCB).

The regulations herein shall be observed at all locations where scientific diving is conducted.

USC’s Scientific Diving Standards and Safety Manual

USC developed and maintains this scientific diving safety manual to provide for the development and implementation of policies and procedures that will enable University divers to meet requirements of local environments and conditions as well as to comply with the AAUS scientific diving standards. USC’s scientific diving manual includes, but is not limited to:

1. AAUS standards may be used as a set of minimal guidelines for the development of an organizational member’s scientific diving safety manual. Volume 1, Sections 1.00 through 6.00 and the Appendices are required for all manuals. Volume 2, Sections 7.00 through 9.00 are required only when the organizational member conducts that diving activity. Organizational member specific sections are placed in Volume 2.

2. Emergency evacuation and medical treatment procedures.


4. Standards written or adopted by reference for each diving mode utilized which include the following:
   a. Safety procedures for the diving operation.
   b. Responsibilities of the dive team members.
c. Equipment use and maintenance procedures.
d. Emergency procedures.

Diving Safety Officer

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

1. Qualifications
   a. Shall be appointed by the Senior Vice President for Administration or designee, with the advice and counsel of the Diving Control Board.
b. Shall be trained as a scientific diver.
c. Shall be a full member as defined by AAUS.
d. Shall be an active underwater instructor from an internationally recognized certifying agency.

2. Duties and Responsibilities
   a. Shall be responsible, through the DCB, to the Senior Vice President for Administration or designee, for the conduct of the scientific diving program of the University. The routine operational authority for this program, including the conduct of training and certification, approval of dive plans, maintenance of diving records, and ensuring compliance with this standard and all relevant regulations of the University, rests with the Diving Safety Officer.
b. May permit portions of this program to be carried out by a qualified delegate, although the Diving Safety Officer may not delegate responsibility for the safe conduct of the local diving program.
c. Shall be guided in the performance of the required duties by the advice of the DCB, but operational responsibility for the conduct of the local diving program will be retained by the Diving Safety Officer.
d. Shall suspend diving operations considered to be unsafe or unwise.

Diving Control Board

1. The Diving Control Board (DCB) shall consist of a majority of active scientific divers. Voting members shall include the Diving Safety Officer, the Senior Vice President for Administration, or designee, and should include other representatives of the diving program such as qualified divers and...
members selected by procedures established by the university. A chairperson and a secretary may be chosen from the membership of the board according to local procedure.

2. Has autonomous and absolute authority over the scientific diving program’s operation.
3. Shall approve and monitor diving projects.
4. Shall review and revise the diving safety manual.
5. Shall assure compliance with the diving safety manual.
6. Shall certify the depths to which a diver has been trained.
7. Shall take disciplinary action for unsafe practices.
8. Shall assure adherence to the buddy system for scuba diving.
9. Shall act as the official representative of the membership organization in matters concerning the scientific diving program.
10. Shall act as a board of appeal to consider diver-related problems.
11. Shall recommend the issue, reissue, or the revocation of diving certifications.
12. Shall recommend changes in policy and amendments to AAUS and the membership organization’s diving safety manual as the need arises.
13. Shall establish and/or approve training programs through which the applicants for certification can satisfy the requirements of USC’s diving safety manual.
14. Shall suspend diving programs that are considered to be unsafe or unwise.
15. Shall establish criteria for equipment selection and use.
16. Shall recommend new equipment or techniques.
17. Shall establish and/or approve facilities for the inspection/maintenance of diving and associated equipment.
18. Shall ensure that USC’s air station(s) meet air quality standards as described in Section 3.60.
19. Shall periodically review the Diving Safety Officer’s performance and program.
20. Shall sit as a board of investigation to inquire into the nature and cause of diving accidents or violations of USC’s diving safety manual.

Instructional Personnel

1. Qualifications - All personnel involved in diving instruction under the auspices of USC shall have the knowledge and permission of the Dive Safety Officer and must be qualified for the type of instruction being given.
2. Selection - Instructional personnel will be selected by the Senior Vice President for Administration, or designee, who will solicit the advice of the DCB in conducting preliminary screening of applicants for instructional positions.
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 certification and are qualified for the type of diving operation.
3. Planning dives in accordance with Section 2.20
4. Ensuring safety and emergency equipment is in working order and at the dive site.
5. Briefing 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 not safe.
7. Reporting to the DSO and DCB any physical problems or adverse physiological effects including symptoms of pressure-related injuries.

Reciprocity and Visiting Scientific Diver

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 AAUS Organizational Member shall apply for permission to dive under the auspices of USC by submitting to the Diving Safety Officer a Dive Plan and a Letter of Reciprocity (a document containing all the information described in Appendix 6), 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 USC denies a visiting Scientific Diver permission to dive, the USC Diving Control Board shall notify the visiting Scientific Diver and their Diving Control Board with an explanation of all reasons for the denial.
Waiver of Requirements

The USC Diving Control Board may grant a waiver for specific requirements of training, examinations, depth certification, and minimum activity to maintain certification.

1.30 Consequence of Violation of Regulations by Scientific Divers

Failure to comply with the regulations of USC’s diving safety manual may be cause for the revocation or restriction of the diver’s scientific diving certificate by action of the Diving Safety Officer or the USC Diving Control Board.

1.40 Consequences 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 organizational member’s recognition by AAUS.

1.50 Record Maintenance

The Diving Safety Officer or designee shall maintain permanent records for each Scientific Diver certified. The file shall include evidence of certification level, log sheets, results of current physical examination, reports of disciplinary actions by the USC Diving Control Board, and other pertinent information deemed necessary.

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 standard shall be retained by USC for the following period:
   a. Physician’s written reports of medical examinations for dive team members - 5 years.
   b. Diving safety manual - current document only.
   c. Records of dive - 1 year, except 5 years where there has been an incident of pressure-related injury.
   d. Pressure-related injury assessment - 5 years.
   e. Equipment inspection and testing records - current entry or tag, or until equipment is withdrawn from service.
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 USC scientific diving program unless they hold a current certification issued pursuant to the provisions of this standard.

2.20 Pre-Dive Procedures

Dive Plans

Dives should be planned around the competency of the least experienced diver. Before conducting any diving operations under the auspices of USC, the lead diver for a proposed operation must formulate a dive plan that should include the following:

1. Divers qualifications, and the type of certificate or certification held by each diver
2. Emergency plan (Appendix 7) with the following information:
   a. Name, telephone number, and relationship of person to be contacted for each diver in the event of an emergency.
   b. Nearest operational decompression chamber.
   c. Nearest accessible hospital.
   d. Available means of transport.
3. Approximate number of proposed dives.
4. Location(s) of proposed dives.
5. Estimated depth(s) and bottom time(s) anticipated.
6. Decompression status and repetitive dive plans, if required.
7. Proposed work, equipment, and boats to be employed.
8. Any hazardous conditions anticipated.
Pre-dive Safety Checks

Diver’s Responsibility:

1. Scientific divers shall conduct a functional check of their diving equipment in the presence of the diving buddy or tender.
2. It is the diver’s responsibility and duty to refuse to dive if, in their judgment, conditions are unfavorable, or if they would be violating the precepts of their training, of this standard, or the USC’s diving safety manual.
3. No dive team member shall be required to be exposed to hyperbaric conditions against their will, except when necessary to prevent or treat a pressure-related injury.
4. No dive team member shall be permitted to dive for the duration of any known condition, which is likely to adversely affect the safety and health of the diver or other dive members.

Equipment Evaluations

1. Divers shall ensure that their equipment is in proper working order and that the equipment is suitable for the type of diving operation.
2. Each diver shall have the capability of achieving and maintaining positive buoyancy.

Site Evaluation - Environmental conditions at the site will be evaluated.

2.30 Diving Procedures

Solo Diving Prohibition

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

Refusal to Dive

The decision to dive is that of the diver. A diver may refuse to dive, without fear of penalty, whenever they feel it is unsafe for them to make the dive.
Safety

The ultimate responsibility for safety rests with the individual diver. It is the diver’s responsibility and duty to refuse to dive if, in their judgment, conditions are unsafe or unfavorable, or if they would be violating the precepts of their training or the regulations in this standard.

Termination of the Dive

1. 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.

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

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.

2.40 Post-Dive Procedures

Post-Dive Safety Checks

1. After the completion of a dive, each diver shall report any physical problems, symptoms of decompression sickness, or equipment malfunctions to the lead diver or the Dive Safety Officer. The lead diver must inform the Dive Safety Officer of any known physical problems, symptoms of decompression sickness, or equipment malfunctions with themselves or any of their dive team members.

2. 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 decompression chamber if necessary.
2.50 Emergency Procedures

USC has developed emergency procedures, which follow the standards of care of the community and includes procedures for emergency care, recompression and evacuation for each dive location (See Section 14.20 and Appendix 7).

2.60 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.

2.70 Record Keeping Requirements

Personal Diving Log

Each certified scientific diver shall log every dive made under the auspices of USC’s program. Each active USC scientific diver is encouraged to log all other dives. USC provides divers a standard web based system for logging their dives: www.usc.diveaus.com. Log sheets shall be submitted to the Diving Safety Officer to be placed in the diver’s permanent file. The diving log shall include at least the following:

1. Name of 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 requiring recompression treatment, or resulting in moderate or serious injury, or death of a diver shall be reported to USC’s Diving Control Board and AAUS. USC’s regular procedures for incident reporting, including those required by the AAUS, shall be followed. The report will specify the circumstances of the incident and the extent of any injuries or illnesses.

Additional information must meet the following reporting requirements:

1. USC shall record and report occupational injuries and illnesses in accordance with requirements of the appropriate Labor Code section.
2. If pressure-related injuries are suspected, or if symptoms are evident, the following additional information shall be recorded and retained by USC, with the record of the dive, for a period of 5 years:
   b. Written descriptive report to include:
   c. Name, address, phone numbers of the principal parties involved.
   d. Summary of experience for the divers involved.
   e. Location, description of dive site, and description of conditions that led up to incident.
   f. Description of symptoms, including depth and time of onset.
   g. Description and results of treatment.
   h. Disposition of case.
   i. Recommendations to avoid repetition of incident.
3. USC shall investigate and document any incident of pressure-related injury and prepare a report that is to be forwarded to AAUS during the annual reporting cycle. This report must first be reviewed and released by the USC Diving Control Board.
SECTION 3.00 DIVING EQUIPMENT

3.10 General Policy

All equipment shall meet standards as determined by the Diving Safety Officer and the Diving Control Board. All equipment shall be regularly examined by the person using them and serviced according to manufacturer recommendations. Equipment that is subjected to extreme usage under adverse conditions should require more frequent testing and maintenance.

3.20 Equipment

Regulators

1. Only those makes and models specifically approved by the Diving Safety Officer and the Diving Control Board shall be used.
2. Scuba regulators shall be inspected and tested prior to first use and serviced according to manufacturer recommendations every 12 months thereafter.
3. Regulators will consist of a primary second stage and an alternate air source (such as an octopus second stage or redundant air supply).

Breathing Masks and Helmets

Breathing masks and helmets shall have:

1. A non-return valve at the attachment point between helmet or mask and hose, which shall close readily and positively.
2. An exhaust valve.
3. A minimum ventilation rate capable of maintaining the diver at the depth to which they are diving.

Scuba Cylinders

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

Backpacks

Backpacks without integrated flotation devices and weight systems shall have a quick release device designed to permit jettisoning with a single motion of either hand.

Weight Systems

Weight systems shall have a quick release device permitting effective and prompt jettisoning of all weight.

Gauges

Gauges shall be inspected and tested before first use and every 12 months thereafter.

Flotation Devices

1. Each diver shall have the capability of achieving and maintaining positive buoyancy.
2. Personal flotation systems, buoyancy compensators, dry suits, or other variable volume buoyancy compensation devices shall be equipped with an exhaust valve.
3. These devices shall be functionally inspected and tested at intervals not to exceed 12 months.

Additional Required Equipment

1. In addition to the AAUS requirements for equipment all divers must carry the following equipment while conducting dive operations under the auspices of USC: a safety sausage, an audible signaling device, a snorkel, a compass and a cutting tool.

Exposure Protection

1. All divers must have appropriate exposure protection.
Timing Devices, Depth, and Pressure Gauges

1. Both members of the buddy team must have an underwater timing device, an approved depth indicator, and a submersible pressure gauge.

Determination of Decompression Status: Dive Tables

1. A set of diving tables, approved by the Diving Control Board, must be available at the dive location.
2. Dive computers may be utilized in place of diving tables, and must be approved by the Diving Control Board. AAUS recommendations on dive computers are located in Appendix 8.

3.30 Auxiliary Equipment

Hand held underwater power tools.

1. All divers must be trained in the use, hazards, precautions, emergency procedures and maintenance of the tool being utilized.
2. Electrical tools and equipment used underwater shall be specifically approved for this purpose.
3. Electrical tools and equipment supplied with power from the surface shall be de-energized before being placed into or retrieved from the water.
4. Hand held power tools shall not be supplied with power from the dive location until requested by the diver.

3.40 Support Equipment

First Aid Supplies

A first aid kit and emergency oxygen shall be available.

Diver’s Flag

A diver’s flag shall be displayed prominently whenever diving is conducted under circumstances where required or where water traffic is probable.
Compressor Systems - USC Controlled

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

1. 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.
2. Compressed air systems over 500 psig shall have slow-opening shut-off valves.
3. All air compressor intakes shall be located away from areas containing exhaust or other contaminants.

3.50 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:

1. Regulators
2. Submersible pressure gauges
3. Depth gauges
4. Scuba cylinders
5. Cylinder valves
6. Diving helmets
7. Submersible breathing masks
8. Compressors
9. Gas control panels
10. Air storage cylinders
11. Air filtration systems
12. Analytical instruments
13. Buoyancy control devices
14. Dry suits
Compressor Operation and Air Test Records

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

2. A log shall be maintained showing operation, repair, overhaul, filter maintenance, and temperature adjustment for each compressor.

3.60 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).

<table>
<thead>
<tr>
<th>Component</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oxygen</td>
<td>20 - 22% v/v</td>
</tr>
<tr>
<td>Carbon Monoxide</td>
<td>10 PPM/v</td>
</tr>
<tr>
<td>Carbon Dioxide</td>
<td>1000 PPM/v</td>
</tr>
<tr>
<td>Condensed Hydrocarbons</td>
<td>5 mg/m³</td>
</tr>
<tr>
<td>Total Hydrocarbons as Methane</td>
<td>25 PPM/v</td>
</tr>
<tr>
<td>Water Vapor ppm</td>
<td>(2)</td>
</tr>
<tr>
<td>Objectionable Odors</td>
<td>None</td>
</tr>
</tbody>
</table>

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.
SECTION 4.00 ENTRY-LEVEL TRAINING REQUIREMENTS

4.10 General Policy

Training and certification as an entry-level diver is a prerequisite to AAUS Scientific Diver Training. In lieu of writing/promulgating AAUS specific standards for entry-level divers, AAUS references here, the standards for entry-level diver training as defined by the WRSTC and/or ISO. AAUS programs who wish to train entry-level 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 entry-level diver standards.

4.20 References

This section describes the training and performance standards for AAUS Scientific Divers. These standards represent the minimum required level of knowledge and skills presented in a generalized format. Individual diving programs are encouraged to expand upon and augment these requirements, develop or utilize appropriate educational materials, and optimize instructional programs to suit and reflect their specific needs.

5.10 Prerequisites

Administrative

The applicant/candidate must complete all administrative and legal documentation required by USC.

Diver Certification

The applicant/candidate must, at minimum, show documented proof of entry-level diver certification from an internationally recognized training agency. As an alternative, AAUS OMs who wish to train and certify entry-level divers under AAUS auspices may do so under the guidelines presented in Section 4.0.

Medical Examination

The applicant/candidate must be medically qualified for diving as described in Section 6.0 of the USC Dive Safety Manual.

Swimming/Watermanship Evaluation

The applicant/candidate must demonstrate the following in the presence of the Diving Safety Officer, instructor, or other approved examiner. All tests are to be performed without swim aids, however, where exposure protection is needed, the applicant must be appropriately weighted to provide for neutral buoyancy.

1. Swim underwater for a distance of 25 yards/meters without surfacing.
2. Swim 400 yards/meters in less than 12 minutes.
3. Tread water for 10 minutes, or 2 minutes without the use of hands.
4. Transport a passive person of equal size a distance of 25 yards/meters in the water.

5.20 Training

The diver must complete theoretical aspects and practical training for a minimum cumulative time of 100 hours. Theoretical aspects shall include principles and activities appropriate to the intended area of scientific study.

Theoretical Training/ Knowledge Development

Required Topics:

1. Diving Emergency Care Training
   - Cardiopulmonary Resuscitation (CPR)
   - Standard or Basic First Aid
   - Recognition of DCS and AGE
   - Accident Management
   - Field Neurological Exam
   - Oxygen Administration
2. Dive Rescue
3. Dive Physics
4. Dive Physiology
5. Dive Environments
6. Decompression Theory and its Application
7. AAUS Scientific Diving Regulations and History
   - Scientific Dive Planning
   - Coordination with other Agencies
   - Appropriate Governmental Regulations
8. Scientific Method
9. Data Gathering Techniques (Only Items specific to area of study required)
   - Transect Sampling (Quadrating)
   - Transecting
   - Mapping
• Coring
• Photography
• Tagging
• Collecting
• Animal Handling
• Archaeology
• Common Biota
• Organism Identification
• Behavior
• Ecology
• Site Selection, Location, and Re-location
• Specialized Equipment for data gathering
• HazMat Training
• HP Cylinders
• Chemical Hygiene, Laboratory Safety (Use Of Chemicals)

Suggested Topics:

10. Specific Dive Modes (methods of gas delivery)
   • Open Circuit
   • Hooka
   • Surface Supplied diving

11. Small Boat Operation

12. Rebreathers
   • Closed
   • Semi-closed

13. Specialized Breathing Gas
   • Nitrox
   • Mixed Gas

14. Specialized Environments and Conditions
   • Blue Water Diving,
   • Ice and Polar Diving (Cold Water Diving)
   • Zero Visibility Diving
- Polluted Water Diving
- Saturation Diving
- Decompression Diving
- Overhead Environments
- Aquarium Diving
- Night Diving
- Kelp Diving
- Strong Current Diving (Live-boating)
- Potential Entanglement

15. Specialized Diving Equipment
- Full face mask
- Dry Suit
- Communications

Practical Training / Skill Development

Confined Water Evaluation

At the completion of training, the trainee must satisfy the Diving Safety Officer or the instructor of their ability to perform the following, as a minimum, in a pool or in sheltered water:

1. Enter water with full equipment.
2. Clear face mask.
3. Demonstrate air sharing, including both buddy breathing and the use of alternate air source, as both donor and recipient, with and without a face mask.
4. Demonstrate ability to alternate between snorkel and scuba while kicking.
5. Demonstrate understanding of underwater signs and signals.
6. Demonstrate simulated in-water mouth-to-mouth resuscitation.
7. Rescue and transport, as a diver, a passive simulated victim of an accident.
8. Demonstrate ability to remove and replace equipment while submerged.
9. Demonstrate watermanship ability, which is acceptable to the instructor.
Open Water Evaluation

The trainee must satisfy an instructor, approved by the Diving Safety Officer, of their ability to perform at least the following in open water:

1. Surface dive to a depth of 10 feet in open water without scuba.
2. Demonstrate proficiency in air sharing as both donor and receiver.
3. Enter and leave open water or surf, or leave and board a diving vessel, while wearing scuba gear.
4. Kick on the surface 400 yards while wearing scuba gear, but not breathing from the scuba unit.
5. Demonstrate judgment adequate for safe diving.
6. Demonstrate, where appropriate, the ability to maneuver efficiently in the environment, at and below the surface.
7. Complete a simulated emergency swimming ascent.
8. Demonstrate clearing of mask and regulator while submerged.
9. Demonstrate ability to achieve and maintain neutral buoyancy while submerged.
10. Demonstrate techniques of self-rescue and buddy rescue.
11. Navigate underwater.
12. Plan and execute a dive.

Checkout Dive/Additional Experience

Practical training must include an Open Water checkout dive(s), with evaluation of the skills listed in Open Water Evaluation, with the Dive Safety Officer or qualified delegate followed by at least 11 ocean or open water dives in a variety of dive sites and diving conditions, for a cumulative bottom time of 6 hours. Dives following the checkout dive must be supervised by a certified Scientific Diver with experience in the type of diving planned, with the knowledge and permission of the Dive Safety Officer.

5.30 Examinations

Written Exams

Before completing training, the trainee must pass a written examination that demonstrates knowledge of at least the following:

1. Dangerous marine animals.
2. Emergency procedures, including buoyant ascent and ascent by air sharing.
3. Currently accepted decompression procedures.
4. Demonstrate the proper use of dive tables.
5. Underwater communications.
6. Aspects of freshwater and altitude diving.
7. Hazards of breath-hold diving and ascents.
8. Planning and supervision of diving operations.
10. Cause, symptoms, treatment, and prevention of the following: near drowning, air embolism, carbon dioxide excess, squeezes, oxygen poisoning, nitrogen narcosis, exhaustion and panic, respiratory fatigue, motion sickness, decompression sickness, hypothermia, and hypoxia/anoxia.
11. Suggested topics (Sec. 5.20) at the Dive Safety Officer’s discretion.

**Equipment**

The trainee will be subject to examination/review of:

1. Personal diving equipment
2. Task specific equipment

**5.40 Diver Permits/Certifications**

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 a person diving under the auspices of the organizational member that subscribes to the practices of AAUS is eligible for a scientific diver certification.

**Scientific Diver-In-Training Permit**

This is a permit to dive, usable only while it is current and for the purpose intended. This permit signifies that a diver has completed and been certified as at least an entry level diver through an internationally recognized certifying agency or scientific diving program, and has the knowledge skills and experience necessary to continue training as a scientific diver under supervision, as approved by the Dive Safety Officer.
USC Scientific Diver Certification

This permit signifies a diver has completed all requirements in Section 5.0 and is authorized by USC to engage in scientific diving without supervision, as approved by the Dive Safety Officer. Submission of documents and participation in aptitude examinations does not automatically result in certification. The applicant must convince the Diving Safety Officer and members of the DCB that they are sufficiently skilled and proficient to be certified. This skill will be acknowledged by the signature of the Diving Safety Officer. Any applicant who does not possess the necessary judgment, under diving conditions, for the safety of the diver and their partner, may be denied USC scientific diving privileges.

5.50 Depth Certifications

Depth Certifications and Progression to Next Depth Level

A certified diver diving under the auspices of the organizational member may progress to the next depth level after successfully completing the required dives for the next level. Under these circumstances the diver may exceed their depth limit. Dives shall be planned and executed under close supervision of a diver certified to this depth, with the knowledge and permission of the DSO.

1. Certification to 40 Foot Depth - Initial permit level, approved upon the successful completion of training listed in Section 4.00 and 5.00.
2. Certification to 60 Foot Depth - A diver holding a 40 foot certificate may be certified to a depth of 60 feet after successfully completing, under supervision, 12 logged training dives to depths between 41 and 60 feet, for a minimum total time of 4 hours.
3. Certification to 100 Foot Depth - A diver holding a 60 foot certificate may be certified to a depth of 100 feet after successfully completing, 4 dives to depths between 61 and 100 feet. The diver shall also demonstrate proficiency in the use of the appropriate Dive Tables.
4. Certification to 130 Foot Depth - A diver holding a 100 foot certificate may be certified to a depth of 130 feet after successfully completing, 4 dives to depths between 100 and 130 feet. The diver shall also demonstrate proficiency in the use of the appropriate Dive Tables.
5. Certification to 150 Foot Depth - A diver holding a 130 foot certificate may be certified to a depth of 150 feet after successfully completing, 4 dives to depths between 130 and 150 feet. The diver must also demonstrate knowledge of the special problems of deep diving, and of special safety requirements.
6. Certification to 190 Foot Depth - A diver holding a 150 foot certificate may be certified to a depth of 190 feet after successfully completing, 4 dives to depths between 150 and 190 feet. The diver must also demonstrate knowledge of the special problems of deep diving, and of special safety requirements.

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

5.60 Continuation of Certificate

Minimum Activity to Maintain Certification

During any 12-month period, each certified scientific diver must log a minimum of 12 dives. At least one dive must be logged near the maximum depth of the diver’s certification during each 6-month period. Divers certified to 150 feet or deeper may satisfy these requirements with dives to 130 feet or over. Failure to meet these requirements may be cause for revocation or restriction of certification.

Requalification of Active Status and Depth Certification

Once the initial certification requirements of Section 5.00 are met, divers whose depth certification has lapsed due to lack of activity may be re-qualified by the following procedures:

Less than 12 dives annually:

Diver loses active scientific diving status. The re-qualify, diver must complete a checkout dive as defined in Section 5.20 with the Dive Safety Officer or designee. If required, to requalify at last highest depth rating, diver must make two observation dives (with no assigned scientific work tasks) with another active scientific diver qualified at that depth with the knowledge and permission of the Dive Safety Officer.

Less than 1 dive in a 6 month period:

Diver loses active scientific diving status. The re-qualify, diver must make two observation dives (with no assigned scientific work tasks) with another active scientific diver qualified at that depth with the knowledge and permission of the Dive Safety Officer.
Less than 2 dives annually at maximum depth rating

Diver’s depth rating is reduced according to the deepest two dives of the last 12 months. To requalify at last highest depth rating, diver must make two observation dives (with no assigned scientific work tasks) with another active scientific diver qualified at that depth with the knowledge and permission of the Dive Safety Officer.

Inability to requalify at maximum depth rating for more than 2 years:

Diver’s depth rating remains reduced according to the deepest two dives of the last 12 months. To requalify at last highest depth rating, diver must completely requalify at all depths deeper than current rating.

No required rescue requalification within the last 24 months:
Diver loses active scientific diving status. To requalify, diver must demonstrate proficiency in a field rescue scenario while supervised by the Dive Safety Officer or designee.

No dives in 1 year period:
Diver loses active scientific diving status. To requalify, after completing all initial training dives and rescue training with the Dive Safety Officer or designee, diver must pass a final exam and complete an open water check-out as defined in Section 5.20 with the Dive Safety Officer.

No dives in a 2 year period:
Diver loses active scientific diving status. To requalify, divers must be re-trained.

Medical Examination

All certified scientific divers shall pass a medical examination at the intervals specified in Section 6.10. After each major illness or injury, as described in Section 6.10, a certified scientific diver shall receive clearance to return to diving from a physician before resuming diving activities.
Minimum Insurance Requirements

All active USC divers must maintain supplemental dive insurance such as Divers Alert Network (DAN) or equivalent.

Emergency Care Training

The scientific diver must provide proof of training in the following:

- Adult CPR (must be current).
- Emergency oxygen administration (must be current)
- First aid for diving accidents (must be current)

5.70 Revocation of Certification

A diving certificate may be revoked or restricted for cause by the Diving Safety Officer or the DCB. Violations of regulations set forth in this standard, or other governmental subdivisions not in conflict with this standard, may be considered cause. The Diving Safety Officer shall inform the diver in writing of the reason(s) for revocation. The diver will be given the opportunity to present their case in writing for reconsideration and/or re-certification. All such written statements and requests, as identified in this section, are formal documents, which will become part of the diver’s file.

5.80 Recertification

If a diver’s certificate expires or is revoked, they may be re-certified after complying with such conditions as the Diving Safety Officer or the DCB may impose. The diver shall be given an opportunity to present their case to the DCB before conditions for re-certification are stipulated.

5.90 Waiver of Requirements/Temporary Diver

A temporary diver permit constitutes a waiver of the requirements of Section 5.0 and is issued only following a demonstration of the required proficiency in diving. It is valid only for a limited time, as determined by the Diving Safety Officer. This permit is not to be construed as a mechanism to circumvent existing standards set forth in this standard. Requirements of Section 5.0 may be waived by the Diving
Safety Officer if the person in question has demonstrated proficiency in diving and can contribute measurably to a planned dive. A statement of the temporary diver’s qualifications shall be submitted to the Diving Safety Officer as a part of the dive plan. Temporary permits shall be restricted to the planned diving operation and shall comply with all other policies, regulations, and standards of this standard, including medical requirements.
SECTION 6.00 MEDICAL STANDARDS

6.10 Medical Requirements

General

1. USC shall determine that divers have passed a current diving physical examination and have been declared by the examining physician to be fit to engage in diving activities as may be limited or restricted in the medical evaluation report.
2. All medical evaluations required by this standard shall be performed by, or under the direction of, a licensed physician of the applicant-diver’s choice, preferably one trained in diving/undersea medicine.
3. 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. (Appendix 1)

6.20 Frequency of Medical Evaluations

Medical evaluation shall be completed:

1. Before a diver may begin diving, unless an equivalent initial medical evaluation has been given within the preceding 5 years (3 years if over the age of 40, 2 years if over the age of 60), USC has obtained the results of that examination, and those results have been reviewed and found satisfactory by USC.
2. Thereafter, at 5 year intervals up to age 40, every 3 years after the age of 40, and every 2 years after the age of 60.
3. Clearance to return to diving must be obtained from a physician following any major injury or illness, or any condition requiring hospital care or chronic medication. If the injury or illness is pressure related, then the clearance to return to diving must come from a physician trained in diving medicine.

6.30 Information Provided Examining Physician

USC shall provide a copy of the medical evaluation requirements of this standard to the examining physician. (Appendices 1, 2, and 3).
6.40 Content of Medical Evaluations

Medical examinations conducted initially and at the intervals specified in Section 6.10 shall consist of the following:

1. Applicant agreement for release of medical information to the Diving Safety Officer and the DCB (Appendix 2).
2. Medical history (Appendix 3).
3. Diving physical examination (Required tests listed below and in Appendix 2).

6.50 Conditions Which May Disqualify Candidates from Diving (Adapted from Bove, 1998)

1. Abnormalities of the tympanic membrane, such as perforation, presence of a monomeric membrane, or inability to auto inflate the middle ears.
2. Hearing loss; Vertigo including Meniere’s Disease.
3. Stapedectomy or middle ear reconstructive surgery.
4. Recent ocular surgery.
5. Psychiatric disorders including claustrophobia, suicidal ideation, psychosis, anxiety states, depression.
6. Substance abuse, including alcohol.
7. Episodic loss of consciousness.
8. History of seizure or pulmonary edema.
9. History of stroke or a fixed neurological deficit.
10. Recurring neurologic disorders, including transient ischemic attacks.
11. History of intracranial aneurysm, other vascular malformation or intracranial hemorrhage.
12. History of neurological decompression illness with residual deficit.
13. Head injury.
14. Hematologic disorders including coagulopathies.
15. Risk factors or evidence of coronary artery disease.
16. Atrial septal defects.
17. Significant valvular heart disease - isolated mitral valve prolapse is not disqualifying.
18. Significant cardiac rhythm or conduction abnormalities.
19. Implanted cardiac pacemakers and cardiac defibrillators (ICD).
20. Inadequate exercise tolerance.
22. History of pneumothorax.
23. Asthma.
24. Chronic pulmonary disease, including radiographic evidence of pulmonary blebs, bullae or cysts.
25. Diabetes mellitus.

6.60 Laboratory Requirements for Diving Medical Evaluation and Intervals

Initial examination under age 40:

1. Medical History
2. Complete Physical Exam, emphasis on neurological and otological components
3. Urinalysis
4. Any further tests deemed necessary by the physician.

Periodic re-examination under age 40 (every 5 years):

1. Medical History
2. Complete Physical Exam, emphasis on neurological and otological components
3. Urinalysis
4. Any further tests deemed necessary by the physician

First exam over age 40:

1. Medical History
2. Complete Physical Exam, emphasis on neurological and otological components
3. Detailed assessment of coronary artery disease risk factors using Multiple-Risk-Factor Assessment\(^1\)\(^2\) (age, family history, lipid profile, blood pressure, diabetic screening, smoking history). Further cardiac screening may be indicated based on risk factor assessment.
4. Resting EKG
5. Chest X-ray
6. Urinalysis
7. Any further tests deemed necessary by the physician
Periodic re-examination over age 40 (every 3 years); over age 60 (every 2 years):

1. Medical History
2. Complete Physical Exam, emphasis on neurological and otological components
3. Detailed assessment of coronary artery disease risk factors using Multiple-Risk-Factor Assessment¹ (age, family history, lipid profile, blood pressure, diabetic screening, smoking history). Further cardiac screening may be indicated based on risk factor assessment.
4. Resting EKG
5. Urinalysis
6. Any further tests deemed necessary by the physician

6.70 Physician’s Written Report

After any medical examination relating to the individual’s fitness to dive, USC shall obtain a written report prepared by the examining physician that shall contain the examining physician’s opinion of the individual’s fitness to dive, including any recommended restrictions or limitations. This report will be reviewed by the DCB. USC shall make a copy of the physician’s written report available to the individual.

Volume 2

Sections 7.00 through 12.00
Required Only When Conducting Described Diving Activities

Sections 14.00 through 17.00
USC Organizational Member Specific Sections
SECTION 7.00 NITROX DIVING GUIDELINES

The following guidelines address the use of nitrox by scientific divers under the auspices of USC. Nitrox is defined for these guidelines as breathing mixtures composed predominately of nitrogen and oxygen, most commonly produced by the addition of oxygen or the removal of nitrogen from air.

7.10 Prerequisites

Eligibility

Only a certified Scientific Diver or Scientific Diver In Training (Sections 4.00 and 5.00) diving under the auspices of USC is eligible for authorization to use nitrox. After completion, review and acceptance of application materials, training and qualification, an applicant will be authorized to use nitrox within their depth authorization, as specified in Section 5.50 and Section 5.60.

Application and Documentation

Application and documentation for authorization to use nitrox should be made on forms specified by the Diving Control Board.

7.20 Requirements for Authorization to Use Nitrox

Submission of documents and participation in aptitude examinations does not automatically result in authorization to use nitrox. The applicant must convince the Dive Safety Officer and members of the DCB that they are sufficiently skilled and proficient. The signature of the Dive Safety Officer on the authorization form will acknowledge authorization. After completion of training and evaluation, authorization to use nitrox may be denied to any diver who does not demonstrate to the satisfaction of the Dive Safety Officer or DCB the appropriate judgment or proficiency to ensure the safety of the diver and dive buddy. Prior to authorization to use nitrox, the following minimum requirements should be met:

Training

The diver must complete additional theoretical and practical training beyond the Scientific Diver In Training air certification level, to the satisfaction of the member organizations Dive Safety Officer and DCB (Section 7.30).
Examinations

Each diver should demonstrate proficiency in skills and theory in written, oral, and practical examinations covering:

1. Written examinations covering the information presented in the classroom training session(s) (i.e., gas theory, oxygen toxicity, partial pressure determination, etc.);
2. Practical examinations covering the information presented in the practical training session(s) (i.e., gas analysis, documentation procedures, etc.);
3. Openwater checkout dives, to appropriate depths, to demonstrate the application of theoretical and practical skills learned.

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 restriction or revocation of nitrox authorization.

7.30 Nitrox Training Guidelines

Training in these guidelines should be in addition to training for Diver-In-Training authorization (Section 4.00). It may be included as part of training to satisfy the Scientific Diver training requirements (Section 5.30).

Classroom Instruction

1. Topics should include, but are not limited to: review of previous training; physical gas laws pertaining to nitrox; partial pressure calculations and limits; equivalent air depth (EAD) concept and calculations; oxygen physiology and oxygen toxicity; calculation of oxygen exposure and maximum safe operating depth (MOD); determination of decompression schedules (both by EAD method using approved air dive tables, and using approved nitrox dive tables); dive planning and emergency procedures; mixing procedures and calculations; gas analysis; personnel requirements; equipment marking and maintenance requirements; dive station requirements.
2. DCB may choose to limit standard nitrox diver training to procedures applicable to diving, and subsequently reserve training such as nitrox production methods, oxygen cleaning, and dive station topics to divers requiring specialized authorization in these areas.
Practical Training

The practical training portion will consist of a review of skills as stated for scuba (Section 4.00), with additional training as follows:

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

Written Examination (based on classroom instruction and practical training)

Before authorization, the trainee should successfully pass a written examination demonstrating knowledge of at least the following:

1. Function, care, use, and maintenance of equipment cleaned for nitrox use.
2. Physical and physiological considerations of nitrox diving (ex.: O2 and CO2 toxicity).
3. Diving regulations and procedures as related to nitrox diving, either scuba or surface supplied (depending on intended mode).
4. Given the proper information, calculation of:
   a. Equivalent air depth (EAD) for a given fO2 and actual depth;
   b. pO2 exposure for a given fO2 and depth;
   c. Optimal nitrox mixture for a given pO2 exposure limit and planned depth;
   d. Maximum operational depth (MOD) for a given mix and pO2 exposure limit;
   e. For nitrox production purposes, percentages/psi of oxygen present in a given mixture, and psi of each gas required to produce a fO2 by partial pressure mixing.
5. Dive table and dive computer selection and usage;
7. Oxygen analysis.
8. Nitrox operational guidelines (Section 7.40), dive planning, and dive station components.
Openwater Dives

A minimum of two supervised openwater dives using nitrox is required for authorization. The mode used in the dives should correspond to the intended application (i.e., scuba or surface supplied). If the MOD for the mix being used can be exceeded at the training location, direct, inwater supervision is required.

Surface-Supplied Training

All training as applied to surface-supplied diving (practical, classroom, and openwater) will follow the member organization’s surface-supplied diving standards, including additions listed in Section 11.60.

7.40 Scientific Nitrox Diving Regulations

Dive Personnel Requirements

1. Nitrox Diver In Training - A Diver in Training, who has completed the requirements of Section 4.00 and the training and authorization sections of these guidelines, may be authorized by the Dive Safety Officer to use nitrox under the direct supervision a Scientific Diver who also holds nitrox authorization. Dive depths should be restricted to those specified in the diver’s authorization.

2. Scientific Diver - A Scientific Diver who has completed the requirements of Section 5.00 and the training and authorization sections of these guidelines, may be authorized by the DSO to use nitrox. Depth authorization to use nitrox should be the same as those specified in the diver’s authorization, as described in Section 5.40.

3. Lead Diver - On any dive during which nitrox will be used by any team member, the Lead Diver should be authorized to use nitrox, and hold appropriate authorizations required for the dive, as specified in AAUS Standards. Lead Diver authorization for nitrox dives by the Dive Safety Officer and/or DCB should occur as part of the dive plan approval process.

In addition to responsibilities listed in Section 1.20, the Lead Diver should:

1. As part of the dive planning process, verify that all divers using nitrox on a dive are properly qualified and authorized;
2. As part of the pre-dive procedures, confirm with each diver the nitrox mixture the diver is using, and establish dive team maximum depth and time limits, according to the shortest time limit or shallowest depth limit among the team members.

3. The Lead Diver should also reduce the maximum allowable pO2 exposure limit for the dive team if on-site conditions so indicate.

Dive Parameters

1. Oxygen Exposure Limits
   a. The inspired oxygen partial pressure experienced at depth should not exceed 1.6 ATA. All dives performed using nitrox breathing mixtures should comply with the current NOAA Diving Manual “Oxygen Partial Pressure Limits for ‘Normal’ Exposures”
   b. The maximum allowable exposure limit should be reduced in cases where cold or strenuous dive conditions, or extended exposure times are expected. The DCB should consider this in the review of any dive plan application, which proposes to use nitrox. The Lead Diver should also review on-site conditions and reduce the allowable pO2 exposure limits if conditions indicate.
   c. If using the equivalent air depth (EAD) method the maximum depth of a dive should be based on the oxygen partial pressure for the specific nitrox breathing mix to be used.

2. Bottom Time Limits
   a. Maximum bottom time should be based on the depth of the dive and the nitrox mixture being used.
   b. Bottom time for a single dive should not exceed the NOAA maximum allowable “Single Exposure Limit” for a given oxygen partial pressure, as listed in the current NOAA Diving Manual.

3. Dive Tables and Gases
   a. A set of DCB approved nitrox dive tables should be available at the dive site.
   b. When using the equivalent air depth (EAD) method, dives should be conducted using air dive tables approved by the DCB.
   c. If nitrox is used to increase the safety margin of air-based dive tables, the MOD and oxygen exposure and time limits for the nitrox mixture being dived should not be exceeded.
   d. Breathing mixtures used while performing in-water decompression, or for bail-out purposes, should contain the same or greater oxygen content as that being used during the dive, within the confines of depth limitations and oxygen partial pressure limits set forth in Section 7.40 Dive Parameters.
4. Nitrox Dive Computers
   a. Dive computers may be used to compute decompression status during nitrox dives. Manufacturers’ guidelines and operations instructions should be followed. Use of Nitrox dive computers should comply with dive computer guidelines included in the AAUS Standards.
   b. Nitrox dive computer users should demonstrate a clear understanding of the display, operations, and manipulation of the unit being used for nitrox diving prior to using the computer, to the satisfaction of the Dive Safety Officer or designee.
   c. If nitrox is used to increase the safety margin of an air-based dive computer, the MOD and oxygen exposure and time limits for the nitrox mixture being dived shall not be exceeded.
   d. Dive computers capable of pO2 limit and fO2 adjustment should be checked by the diver prior to the start each dive to assure compatibility with the mix being used.

5. Repetitive Diving
   a. Repetitive dives using nitrox mixtures should be performed in compliance with procedures required of the specific dive tables used.
   b. Residual nitrogen time should be based on the EAD for the specific nitrox mixture to be used on the repetitive dive, and not that of the previous dive.
   c. The total cumulative exposure (bottom time) to a partial pressure of oxygen in a given 24 hour period should not exceed the current NOAA Diving Manual 24-hour Oxygen Partial Pressure Limits for “Normal” Exposures.
   d. When repetitive dives expose divers to different oxygen partial pressures from dive to dive, divers should account for accumulated oxygen exposure from previous dives when determining acceptable exposures for repetitive dives. Both acute (CNS) and chronic (pulmonary) oxygen toxicity concerns should be addressed.

6. Oxygen Parameters
   a. Authorized Mixtures - Mixtures meeting the criteria outlined in Section 7.40 may be used for nitrox diving operations, upon approval of the DCB.
   b. Purity - Oxygen used for mixing nitrox-breathing gas should meet the purity levels for “Medical Grade” (U.S.P.) or “Aviator Grade” standards.
   c. In addition to the AAUS Air Purity Guidelines (Section 3.60), the following standard should be met for breathing air that is either:
      i. Placed in contact with oxygen concentrations greater than 40%.
      ii. Used in nitrox production by the partial pressure mixing method with gas mixtures containing greater than 40% oxygen as the enriching agent.
7. Gas Mixing and Analysis
   a. Personnel Requirements
      i. Individuals responsible for producing and/or analyzing nitrox mixtures should be knowledgeable and experienced in all aspects of the technique.
      ii. Only those individuals approved by the Dive Safety Officer and/or DCB should be responsible for mixing and/or analyzing nitrox mixtures.
   b. Production Methods - It is the responsibility of the DCB to approve the specific nitrox production method used.
   c. Analysis Verification by User
      i. It is the responsibility of each diver to analyze prior to the dive the oxygen content of his/her scuba cylinder and acknowledge in writing the following information for each cylinder: fO2, MOD, cylinder pressure, date of analysis, and user’s name.
      ii. Individual dive log reporting forms should report fO2 of nitrox used, if different than 21%.

7.50 Nitrox Diving Equipment

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

- Labeled SCUBA Cylinders
- Oxygen Analyzers

Oxygen Cleaning and Maintenance Requirements

1. Requirement for Oxygen Service
   a. All equipment, which during the dive or cylinder filling process is exposed to concentrations greater than 40% oxygen at pressures above 150 psi, should be cleaned and maintained for oxygen service.
b. Equipment used with oxygen or mixtures containing over 40% by volume oxygen shall be
designed and maintained for oxygen service. Oxygen systems over 125 psig shall have slow-
opening shut-off valves. This should include the following equipment: scuba cylinders,
cylinder valves, scuba and other regulators, cylinder pressure gauges, hoses, diver support
equipment, compressors, and fill station components and plumbing.

2. Scuba Cylinder Identification Marking
   a. Scuba cylinders to be used with nitrox mixtures should have the following identification
documentation affixed to the cylinder.
   b. Cylinders should be marked “NITROX”, or “EANx”, or “Enriched Air”.
   c. Nitrox identification color-coding should include a 4-inch wide green band around the
cylinder, starting immediately below the shoulder curvature. If the cylinder is not yellow, the
green band should be bordered above and below by a 1-inch yellow band.
   d. The alternate marking of a yellow cylinder by painting the cylinder crown green and printing
the word “NITROX” parallel to the length of the cylinder in green print is acceptable.
   e. Other markings, which identify the cylinder as containing gas mixes other than Air, may be
used as the approval of the DCB.
   f. A contents label should be affixed, to include the current fO2, date of analysis, and MOD.
   g. The cylinder should be labeled to indicate whether the cylinder is prepared for oxygen or
nitrox mixtures containing greater than 40% oxygen.

3. Regulators - Regulators to be used with nitrox mixtures containing greater than 40% oxygen should
be cleaned and maintained for oxygen service, and marked in an identifying manner.

4. Other Support Equipment
   a. An oxygen analyzer is required which is capable of determining the oxygen content in the
scuba cylinder. Two analyzers are recommended to reduce the likelihood of errors due to a
faulty analyzer. The analyzer should be capable of reading a scale of 0 to 100% oxygen,
within 1% accuracy.
   b. All diver and support equipment should be suitable for the fO2 being used.

5. Compressor system
   a. Compressor/filtration system must produce oil-free air.
   b. An oil-lubricated compressor placed in service for a nitrox system should be checked for oil
and hydrocarbon contamination at least quarterly.

6. Fill Station Components - All components of a nitrox fill station that will contact nitrox mixtures
containing greater than 40% oxygen should be cleaned and maintained for oxygen service. This
includes cylinders, whips, gauges, valves, and connecting lines.
Decompression diving shall be defined as any diving during which the diver cannot perform a direct return to the surface without performing a mandatory decompression stop to allow the release of inert gas from the diver’s body.

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

9.10 Minimum Experience and Training Requirements

Prerequisites

1. Scientific Diver qualification according to Section 5.00.
2. Minimum of 100 logged dives.
3. Demonstration of the ability to safely plan and conduct dives deeper than 100 feet.
4. Nitrox certification/authorization according to AAUS Section 7.00 recommended.

Training

Training shall be appropriate for the conditions in which dive operations are to be conducted. Minimum Training shall include the following:

- 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 method, emergency procedures, and omitted decompression.
- 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 gas consumption rates, and to practice emergency procedures.
- At least 6 open-water training dives simulating/requiring decompression shall be conducted, emphasizing planning and execution of required decompression dives, and including practice of emergency procedures.
- Progression to greater depths shall be by 4-dive increments at depth intervals as specified in Section 5.40.
• No training dives requiring decompression shall be conducted until the diver has demonstrated acceptable skills under simulated conditions.
• The following are the minimum skills the diver must demonstrate proficiently during dives simulating and requiring decompression:
  o Buoyancy control
  o Proper ascent rate
  o Proper depth control
  o Equipment manipulation
  o Stage/decompression bottle use as pertinent to planned diving operation
  o Buddy skills
  o Gas management
  o Time management
  o Task loading
  o Emergency skills
• Divers shall demonstrate to the satisfaction of the Dive Safety Officer 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 shall be authorized to conduct required decompression dives with the Dive Safety Officer’s approval.

9.20 Minimum Equipment Requirements

• Valve and regulator systems for primary (bottom) gas supplies shall 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.
• Cylinders with volume and configuration adequate for planned diving operations
• One of the second stages on the primary gas supply shall be configured with a hose of adequate length to facilitate effective emergency gas sharing in the intended environment.
• Minimum dive equipment shall include:
  o Snorkel is optional at the DCB’s discretion, as determined by the conditions and environment.
  o Diver location devices adequate for the planned diving operations and environment.
  o Compass
• Redundancy in the following components is desirable or required at the discretion of the DCB or the Dive Safety Officer:
  o Decompression Schedules
  o Dive Timing Devices
  o Depth gauges
  o Buoyancy Control Devices
  o Cutting devices
  o Lift bags and line reels

9.30 Minimum Operational Requirements

1. Approval of dive plan applications to conduct required decompression dives shall be on a case-by-case basis.
2. The maximum pO$_2$ to be used for planning required decompression dives is 1.6. It is recommended that a pO$_2$ of less than 1.6 be used during bottom exposure.
3. Diver's gas supplies shall be adequate to meet planned operational requirements and foreseeable emergency situations.
4. Decompression dives may be planned using dive tables, dive computers, and/or PC software approved by the Dive Safety Officer/DCB.
5. Breathing gases used while performing in-water decompression shall contain the same or greater oxygen content as that used during the bottom phase of the dive.
6. The dive team prior to each dive shall review emergency procedures appropriate for the planned dive.
7. If breathing gas mixtures other than air are used for required decompression, their use shall be in accordance with those regulations set forth in the appropriate sections of this standard.
8. The maximum depth for required decompression using air as the bottom gas shall be 190 feet.
9. Use of additional nitrox and/or high-oxygen fraction decompression mixtures as travel and decompression gases to decrease decompression obligations is encouraged.
10. Use of alternate inert gas mixtures to limit narcosis is encouraged for depths greater than 150 feet.
11. If a period of more than 6 months has elapsed since the last decompression dive, a series of progressive workup dives to return the diver(s) to proficiency status prior to the start of project diving operations are recommended.
12. Mission specific workup dives are recommended.
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 certification and authorization (Section 7.00)
2. If the intended use entails required decompression stops, divers will be previously certified and authorized in decompression diving (Section 9.00).
3. Divers shall demonstrate to the DCB’s satisfaction skills, knowledge, and attitude appropriate for training in the safe use of mixed gases.

Classroom training including

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 gases, and the use of multiple decompression gases.
3. Equipment configurations
4. Mixed gas decompression planning
5. Gas management planning
6. Thermal considerations
7. END determination
8. Mission planning and logistics
9. Emergency procedures
10. Mixed gas production methods
11. Methods of gas handling and cylinder filling
12. Oxygen exposure management
13. Gas analysis
14. Mixed gas physics and physiology
Practical Training

1. Confined water session(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 shall 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 depth for initial training dives shall not exceed 260 feet.
6. Diving operations beyond 260 feet requires additional training dives.

10.20 Equipment and Gas Quality Requirements

1. Equipment requirements shall be developed and approved by the DCB, and met by divers, prior to engaging in mixed-gas diving. Equipment shall meet other pertinent requirements set forth elsewhere in this standard.
2. The quality of inert gases used to produce breathing mixtures shall be of an acceptable grade for human consumption.

10.30 Minimum Operational Requirements

1. Approval of dive plan applications to conduct mixed gas dives shall be on a case-by-case basis.
2. All applicable operational requirements for nitrox and decompression diving shall be met.
3. The maximum pO₂ to be used for planning required decompression dives is 1.6. It is recommended that a pO₂ of less than 1.6 be used during bottom exposure.
4. Maximum planned Oxygen Toxicity Units (OTU) will be considered based on mission duration.
5. Divers decompressing on high-oxygen concentration mixtures shall closely monitor one another for signs of acute oxygen toxicity.
6. If a period of more than 6 months has elapsed since the last mixed gas dive, a series of progressive workup dives to return the diver(s) to proficiency status prior to the start of project diving operations are recommended.
SECTION 11.00 OTHER DIVING TECHNOLOGY

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 AAUS. Organizational member’s using these, must have guidelines established by their Diving Control Board. Divers shall comply with all scuba diving procedures in this standard 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: “Guidelines for Conduct of Research Diving”, National Science Foundation, Division of Polar Programs, 1990.

11.30 Overhead Environments

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

11.40 Saturation Diving

If using open circuit compressed air scuba in saturation diving operations, divers shall comply with the saturation diving guidelines of the organizational member.

11.50 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.

11.60 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.
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 the AAUS Standards for Scientific Diving, Volumes 1 and 2.

For rebreather dives that also involve staged decompression and/or mixed gas diving, all requirements for each of the relevant diving modes shall be met. Diving Control Board 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 shall be qualified for the type of instruction to be provided. Training shall be conducted by agencies or instructors approved by DSO and DCB.

12.10 Definitions and General Information

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.

1. Advantages of rebreathers may include increased gas utilization efficiencies that are often independent of depth, extended no-decompression bottom times and greater decompression efficiency, and reduction or elimination of exhaust bubbles that may disturb aquatic life or sensitive environments.

2. Disadvantages of rebreathers include high cost and, in some cases, a high degree of system complexity and reliance on instrumentation for gas composition control and monitoring, which may
fail. The diver is more likely to experience hazardous levels of hypoxia, hyperoxia, or hypercapnia, due to user error or equipment malfunction, conditions which may lead to underwater blackout and drowning. Inadvertent flooding of the breathing loop and wetting of the carbon dioxide absorbent may expose the diver to ingestion of an alkaline slurry ("caustic cocktail").

3. An increased level of discipline and attention to rebreather system status by the diver is required for safe operation, with a greater need for self-reliance. Rebreather system design and operation varies significantly between make and model. For these reasons when evaluating any dive plan incorporating rebreathers, risk-management emphasis should be placed on the individual qualifications of the diver on the specific rebreather make and model to be used, in addition to specific equipment requirements and associated operational protocols.

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 normally limited to a maximum operation depth of 20fsw due to the risk of unsafe hyperoxic exposure.

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 by means which differ between SCR models, but the mechanism usually provides a semi-constant fraction of oxygen (FO₂) in the breathing loop at all depths, similar to open-circuit SCUBA.

Closed-circuit mixed gas rebreathers (CCR) recycle all of the exhaled gas and replace metabolized oxygen via an electronically controlled valve, governed by electronic oxygen sensors. Manual oxygen addition is available as a diver override, in case of electronic system failure. A separate inert gas source (diluent), usually containing primarily air, heliox, or trimix, is used to maintain oxygen levels at safe levels when diving below 20fsw. CCR systems operate to maintain a constant oxygen partial pressure (PPO₂) during the dive, regardless of depth.
12.20 Prerequisites

Specific training requirements for use of each rebreather model shall be defined by DCB on a case-by-case basis. Training shall 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).

Training Prerequisites

1. Active scientific diver status, with depth qualification sufficient for the type, make, and model of rebreather, and planned application.
2. Completion of a minimum of 50 open-water dives on SCUBA.
3. For SCR or CCR, a minimum 100-fsw-depth qualification 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 qualification 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. Training may be provided as part of rebreather training.

Training

Successful completion of the following training program qualifies the diver for rebreather diving using the system on which the diver was trained, in depths of 130fsw and shallower, for dives that do not require decompression stops, using nitrogen/oxygen breathing media.

Satisfactory completion of a rebreather training program authorized or recommended by the manufacturer of the rebreather to be used, or other training approved by the DCB. 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.

Classroom training shall include: A review of those topics of diving physics and physiology, decompression management, and dive planning included in prior scientific diver, nitrox, staged decompression and/or mixed gas training, as they pertain to the safe operation of the selected rebreather system and planned diving application.
1. In particular, causes, signs and symptoms, first aid, treatment and prevention of the following must be covered:
   - Hyperoxia (CNS and Pulmonary Oxygen Toxicity)
   - Middle Ear Oxygen Absorption Syndrome (oxygen ear)
   - Hyperoxia-induced myopia
   - Hypoxia
   - Hypercapnia
   - Inert gas narcosis
   - Decompression sickness

2. Rebreather-specific information required for the safe and effective operation of the system to be used, including:
   - System design and operation, including:
     - Counterlung(s)
     - CO₂ scrubber
     - CO₂ absorbent material types, activity characteristics, storage, handling and disposal
     - Oxygen control system design, automatic and manual
     - Diluent control system, automatic and manual (if any)
     - Pre-dive set-up and testing
     - Post-dive break-down and maintenance
     - Oxygen exposure management
     - Decompression management and applicable decompression tracking methods
     - Dive operations planning
     - Problem recognition and management, including system failures leading to hypoxia, hyperoxia, hypercapnia, flooded loop, and caustic cocktail
     - Emergency protocols and bailout procedures
Practical Training (with model of rebreather to be used)

- A minimum number of hours of underwater time.

<table>
<thead>
<tr>
<th>Type</th>
<th>Pool/Confined Water</th>
<th>O/W Training</th>
<th>O/W Supervised</th>
</tr>
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<tbody>
<tr>
<td>Oxygen Rebreather</td>
<td>1 dive, 90 min</td>
<td>4 dives, 120 min.*</td>
<td>2 dives, 60 min</td>
</tr>
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<td>1 dive, 90-120 min</td>
<td>4 dives, 120 min.**</td>
<td>4 dives, 120 min</td>
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<tr>
<td>Closed-Circuit</td>
<td>1 dive, 90-120 min</td>
<td>8 dives, 380 min.***</td>
<td>4 dives, 240 min</td>
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</table>

* Dives should not exceed 20 fsw.
** First two dives should not exceed 60 fsw. Subsequent dives should be at progressively greater depths, with at least one dive in the 80 to 100 fsw range.
*** Total underwater time (pool and open water) of approximately 500 minutes. First two open water dives should not exceed 60 fsw. Subsequent dives should be at progressively greater depths, with at least 2 dives in the 100 to 130 fsw range.

- Amount of required in-water time should increase proportionally to the complexity of rebreather system used.
- Training shall be in accordance with the manufacturer's recommendations.

Practical Evaluations

Upon completion of practical training, the diver must demonstrate to the DCB or its designee proficiency in pre-dive, dive, and post-dive operational procedures for the particular model of rebreather to be used. Skills shall include, at a minimum:

- Oxygen control system calibration and operation checks
- Carbon dioxide absorbent canister packing
- Supply gas cylinder analysis and pressure check
- Test of one-way valves
- System assembly and breathing loop leak testing
- Pre-dive breathing to test system operation, In-water leak checks
- Buoyancy control during descent, bottom operations, and ascent
- System monitoring and control during descent, bottom operations, and ascent
• Proper interpretation and operation of system instrumentation (PO2 displays, dive computers, gas supply pressure gauges, alarms, etc, as applicable)
• Unit removal and replacement on the surface.
• Bailout and emergency procedures for self and buddy, including:
  o System malfunction recognition and solution
  o Manual system control
  o Flooded breathing loop recovery (if possible)
  o Absorbent canister failure
  o Alternate bailout options
  o Symptom recognition and emergency procedures for hyperoxia, hypoxia, and hypercapnia
  o Proper system maintenance, including:
    ▪ Full breathing loop disassembly and cleaning (mouthpiece, check-valves, hoses, counterlung, absorbent canister, etc.)
    ▪ Oxygen sensor replacement (for SCR and CCR)
    ▪ Other tasks required by specific rebreather models

Written Evaluation

A written evaluation approved by the DCB with a pre-determined passing score, covering concepts of both classroom and practical training, is required.

Supervised Rebreather Dives

Upon successful completion of open water training dives, the diver is authorized to conduct a series of supervised rebreather dives, during which the diver gains additional experience and proficiency.

Supervisor for these dives should be the DSO or designee, and should be an active scientific diver experienced in diving with the make/model of rebreather being used.

Dives at this level may be targeted to activities associated with the planned science diving application. See the following table for number and cumulative water time for different rebreather types.
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* Dives should not exceed 20 fsw.
** First two dives should not exceed 60 fsw. Subsequent dives should be at progressively greater depths, with at least one dive in the 80 to 100 fsw range.
*** Total underwater time (pool and open water) of approximately 500 minutes. First two open water dives should not exceed 60 fsw. Subsequent dives should be at progressively greater depths, with at least 2 dives in the 100 to 130 fsw range.

Maximum ratio of divers per designated dive supervisor is 4:1. The supervisor may dive as part of the planned operations.

Extended Range, Required Decompression and Helium-Based Inert Gas

Rebreather dives involving operational depths in excess of 130 fsw, requiring staged decompression, or using diluents containing inert gases other than nitrogen are subject to additional training requirements, as determined by DCB on a case-by-case basis. Prior experience with required decompression and mixed gas diving using open-circuit SCUBA is desirable, but is not sufficient for transfer to dives using rebreathers without additional training.

- As a prerequisite for training in staged decompression using rebreathers, the diver shall have logged a minimum of 25 hours of underwater time on the rebreather system to be used, with at least 10 rebreather dives in the 100 fsw to 130 fsw range.
- As a prerequisite for training for use of rebreathers with gas mixtures containing inert gas other than nitrogen, the diver shall have logged a minimum of 50 hours of underwater time on the rebreather system to be used and shall have completed training in stage decompression methods using rebreathers. The diver shall have completed at least 12 dives requiring staged decompression on the rebreather model to be used, with at least 4 dives near 130 fsw.

Training shall be in accordance with standards for required-decompression and mixed gas diving, as applicable to rebreather systems, starting at the 130 fsw level.
Maintenance of Proficiency

To maintain authorization to dive with rebreathers, an authorized diver shall make at least one dive using a rebreather every 8 weeks. For divers authorized for the conduct of extended range, stage decompression or mixed-gas diving, at least one dive per month should be made to a depth near 130 fsw, practicing decompression protocols.

For a diver in arrears, the DCB shall approve a program of remedial knowledge and skill tune-up training and a course of dives required to return the diver to full authorization. The extent of this program should be directly related to the complexity of the planned rebreather diving operations.

12.30 Equipment Requirements

General Requirements

Only those models of rebreathers specifically approved by DCB shall be used.

Rebreathers should be manufactured according to acceptable Quality Control/Quality Assurance protocols, as evidenced by compliance with the essential elements of ISO 9004. Manufacturers should be able to provide to the DCB supporting documentation to this effect.

Unit performance specifications should be within acceptable levels as defined by standards of a recognized authority (CE, US Navy, Royal Navy, NOAA, etc...).

Prior to approval, the manufacturer should supply the DCB with supporting documentation detailing the methods of specification determination by a recognized third-party testing agency, including unmanned and manned testing. Test data should be from a recognized, independent test facility.

The following documentation for each rebreather model to be used should be available as a set of manufacturer's specifications. These should include:

- Operational depth range
- Operational temperature range
- Breathing gas mixtures that may be used
• Maximum exercise level which can be supported as a function of breathing gas and depth
• Breathing gas supply durations as a function of exercise level and depth
• CO₂ absorbent durations, as a function of depth, exercise level, breathing gas, and water temperature
• Method, range and precision of inspired PPO₂ control, as a function of depth, exercise level, breathing gas, and temperature
• Likely failure modes and backup or redundant systems designed to protect the diver if such failures occur
• Accuracy and precision of all readouts and sensors
• Battery duration as a function of depth and temperature
• Mean time between failures of each subsystem and method of determination

A complete instruction manual is required, fully describing the operation of all rebreather components and subsystems as well as maintenance procedures.

A maintenance log is required. The unit maintenance shall be up-to-date based upon manufacturer’s recommendations.

Minimum Equipment

1. A surface/dive valve in the mouthpiece assembly, allowing sealing of the breathing loop from the external environment when not in use.
2. An automatic gas addition valve, so that manual volumetric compensation during descent is unnecessary.
3. Manual gas addition valves, so that manual volumetric compensation during descent and manual oxygen addition at all times during the dive are possible.
4. The diver shall carry alternate life support capability (open-circuit bail-out or redundant rebreather) sufficient to allow the solution of minor problems and allow reliable access to a pre-planned alternate life support system.

Oxygen Rebreathers

• Oxygen rebreathers shall be equipped with manual and automatic gas addition valves.
Semi-Closed Circuit Rebreathers.

- SCR's shall be equipped with at least one manufacturer-approved oxygen sensor sufficient to warn the diver of impending hypoxia. Sensor redundancy is desirable, but not required.

Closed Circuit Mixed-gas Rebreathers.

- CCR shall incorporate a minimum of three independent oxygen sensors.
- A minimum of two independent displays of oxygen sensor readings shall be available to the diver.
- Two independent power supplies in the rebreather design are desirable. If only one is present, a secondary system to monitor oxygen levels without power from the primary battery must be incorporated.
- CCR shall be equipped with manual diluent and oxygen addition valves, to enable the diver to maintain safe oxygen levels in the event of failure of the primary power supply or automatic gas addition systems.
- Redundancies in onboard electronics, power supplies, and life support systems are highly desirable.

12.40 Operational Requirements

General Requirements

- All dives involving rebreathers must comply with applicable operational requirements for open-circuit SCUBA dives to equivalent depths.
- No rebreather system should be used in situations beyond the manufacturer's stated design limits (dive depth, duration, water temperature, etc).
- Modifications to rebreather systems shall be in compliance with manufacturer's recommendations.
- Rebreather maintenance is to be in compliance with manufacturer's recommendations including sanitizing, replacement of consumables (sensors, CO₂ absorbent, gas, batteries, etc) and periodic maintenance.
Dive Plan

In addition to standard dive plan components stipulated in AAUS Section 2.0, all dive plans that include the use of rebreathers must include, at minimum, the following details:

- Information about the specific rebreather model to be used
- Make, model, and type of rebreather system
- Type of CO₂ absorbent material
- Composition and volume(s) of supply gases
- Complete description of alternate bailout procedures to be employed, including manual rebreather operation and open-circuit procedures
- Other specific details as requested by DCB

Buddy Qualifications

A diver whose buddy is diving with a rebreather shall be trained in basic rebreather operation, hazard identification, and assist/rescue procedures for a rebreather diver.

If the buddy of a rebreather diver is using open-circuit scuba, the rebreather diver must be equipped with a means to provide the open-circuit scuba diver with a sufficient supply of open-circuit breathing gas to allow both divers to return safely to the surface.

Oxygen Exposures

- Planned oxygen partial pressure in the breathing gas shall not exceed 1.4 atmospheres at depths greater than 30 feet.
- Planned oxygen partial pressure set point for CCR shall not exceed 1.4 ata. Set point at depth should be reduced to manage oxygen toxicity according to the NOAA Oxygen Exposure Limits.
- Oxygen exposures should not exceed the NOAA oxygen single and daily exposure limits. Both CNS and pulmonary (whole-body) oxygen exposure indices should be tracked for each diver.
Decompression Management

DCB shall review and approve the method of decompression management selected for a given diving application and project.

Decompression management can be safely achieved by a variety of methods, depending on the type and model of rebreather to be used. Following is a general list of methods for different rebreather types:

1. Oxygen rebreathers: Not applicable.
2. SCR (presumed constant FO\(_2\)):
   - Use of any method approved for open-circuit scuba diving breathing air, above the maximum operational depth of the supply gas.
   - Use of open-circuit nitrox dive tables based upon expected inspired FO\(_2\). In this case, contingency air dive tables may be necessary for active-addition SCR's in the event that exertion level is higher than expected.
   - Equivalent air depth correction to open-circuit air dive tables, based upon expected inspired FO\(_2\) for planned exertion level, gas supply rate, and gas composition. In this case, contingency air dive tables may be necessary for active-addition SCR's in the event that exertion level is higher than expected.
3. CCR (constant PPO\(_2\)):
   - Integrated constant PPO\(_2\) dive computer.
   - Non-integrated constant PPO\(_2\) dive computer.
   - Constant PPO\(_2\) dive tables.
   - Open-circuit (constant FO\(_2\)) nitrox dive computer, set to inspired FO\(_2\) predicted using PPO\(_2\) set point at the maximum planned dive depth.
   - Equivalent air depth (EAD) correction to standard open-circuit air dive tables, based on the inspired FO\(_2\) predicted using the PPO\(_2\) set point at the maximum planned dive depth.
   - Air dive computer, or air dive tables used above the maximum operating depth (MOD) of air for the PPO\(_2\) setpoint selected.

Maintenance Logs, CO2 Scrubber Logs, Battery Logs, and Pre-And Post-Dive Checklists

Logs and checklists will be developed for the rebreather used, and will be used before and after every dive. Diver shall indicate by initialing that checklists have been completed before and after each dive.
Such documents shall be filed and maintained as permanent project records. No rebreather shall be dived which has failed any portion of the pre-dive check, or is found to not be operating in accordance with manufacturer's specifications. Pre-dive checks shall include:

- Gas supply cylinders full
- Composition of all supply and bail-out gases analyzed and documented
- Oxygen sensors calibrated
- Carbon dioxide canister properly packed
- Remaining duration of canister life verified
- Breathing loop assembled
- Positive and negative pressure leak checks
- Automatic volume addition system working
- Automatic oxygen addition systems working
- Pre-breathe system for 3 minutes (5 minutes in cold water) to ensure proper oxygen addition and carbon dioxide removal (be alert for signs of hypoxia or hypercapnia)
- Other procedures specific to the model of rebreather used
- Documentation of ALL components assembled
- Complete pre-dive system check performed
- Final operational verification immediately before to entering the water:
  - PO\textsubscript{2} in the rebreather is not hypoxic
  - Oxygen addition system is functioning;
  - Volumetric addition is functioning
  - Bail-out life support is functioning

Alternate Life Support System

The diver shall have reliable access to an alternate life support system designed to safely return the diver to the surface at normal ascent rates, including any required decompression in the event of primary rebreather failure. The complexity and extent of such systems are directly related to the depth/time profiles of the mission. Examples of such systems include, but are not limited to:

1. Open-circuit bailout cylinders or sets of cylinders, either carried or pre-positioned
2. Redundant rebreather
3. Pre-positioned life support equipment with topside support
CO₂ Absorbent Material

- CO₂ absorption canister shall be filled in accordance with the manufacturer's specifications.
- CO₂ absorbent material shall be used in accordance with the manufacturer's specifications for expected duration.
- If CO₂ absorbent canister is not exhausted and storage between dives is planned, the canister should be removed from the unit and stored sealed and protected from ambient air, to ensure the absorbent retains its activity for subsequent dives.
- Long-term storage of carbon dioxide absorbents shall be in a cool, dry location in a sealed container. Field storage must be adequate to maintain viability of material until use.

Consumables (e.g., batteries, oxygen sensors, etc.)

Other consumables (e.g., batteries, oxygen sensors, etc.) shall be maintained, tested, and replaced in accordance with the manufacturer's specifications.

Unit Disinfections

The entire breathing loop, including mouthpiece, hoses, counterlungs, and CO₂ canister, should be disinfected periodically according to manufacturer's specifications. The loop must be disinfected between each use of the same rebreather by different divers.

12.50 Oxygen Rebreathers

Oxygen rebreathers shall not be used at depths greater than 20 feet.

Breathing loop and diver's lungs must be adequately flushed with pure oxygen prior to entering the water on each dive. Once done, the diver must breathe continuously and solely from the intact loop, or re-flushing is required.

Breathing loop shall be flushed with fresh oxygen prior to ascending to avoid hypoxia due to inert gas in the loop.
12.60 Semi-Closed Circuit Rebreathers

The composition of the injection gas supply of a semi-closed rebreather shall be chosen such that the partial pressure of oxygen in the breathing loop will not drop below 0.2 ata, even at maximum exertion at the surface.

The gas addition rate of active addition SCR (e.g., Draeger Dolphin and similar units) shall be checked before every dive, to ensure it is balanced against expected workload and supply gas FO$_2$.

The intermediate pressure of supply gas delivery in active-addition SCR shall be checked periodically, in compliance with manufacturer's recommendations.

Maximum operating depth shall be based upon the FO$_2$ in the active supply cylinder.

Prior to ascent to the surface the diver shall flush the breathing loop with fresh gas or switch to an open-circuit system to avoid hypoxia. The flush should be at a depth of approximately 30 fsw during ascent on dives deeper than 30 fsw, and at bottom depth on dives 30 fsw and shallower.

12.70 Closed-Circuit Rebreathers

The FO$_2$ of each diluent gas supply used shall be chosen so that, if breathed directly while in the depth range for which its use is intended, it will produce an inspired PPO$_2$ greater than 0.20 ata but no greater than 1.4 ata.

Maximum operating depth shall be based on the FO$_2$ of the diluent in use during each phase of the dive, so as not to exceed a PO$_2$ limit of 1.4 ata.

Divers shall monitor both primary and secondary oxygen display systems at regular intervals throughout the dive, to verify that readings are within limits, that redundant displays are providing similar values, and whether readings are dynamic or static (as an indicator of sensor failure).

The PPO$_2$ set point shall not be lower than 0.4 ata or higher than 1.4 ata.
14.10 General

The University of Southern California recognizes that the majority of diving done under its auspices is conducted at the Wrigley Institute for Environmental Studies (WIES). As such this manual contains some regulations particular to the Institute. All diving done at WIES shall follow the provisions outlined in this manual.

14.20 Emergency Procedures

Due to the proximity of the Catalina Hyperbaric Chamber, diving emergency procedures differ somewhat at WIES. At WIES: Immediately contact Baywatch Isthmus (911 or 510-0341 or VHF channel 16), do not break contact until told to do so. Either they will or you will be instructed to contact a Catalina Hyperbaric Chamber Crew member (510-1053 or 6-4027). The red emergency phone on the pier will automatically ring the chamber emergency line when the receiver is picked up. State that you have a diving emergency, and do not hang up until told to do so. (see Appendix 7)

Any accident or incident occurring under University of Southern California auspices must be reported. (see section 2.70)

14.30 On-site Oxygen Requirements

The on-site oxygen requirement (see section 3.40) is met by the Catalina Hyperbaric Chamber when diving is conducted within the small boat boundaries (see Boating Safety Manual).

14.40 Small Boat Use

The USC Wrigley Institute for Environmental Studies has several small boats available for use on a reservation basis. All boat operators must complete the qualification requirements established by the Boating Safety Officer (BSO) to be qualified to operate any of the WIES boats. Small boat operations will be conducted within the small boat boundaries unless the BSO has authorized vessel use outside these boundaries. Vessels may not be operated by anyone who has not been certified by the BSO as a small boat operator.
14.50 Game Taking

The possession of any algae, plant or animal is prohibited in the WIES Marine Life Refuge. The boundaries of the refuge extend from Chalk Cliffs seaward past Big Fisherman Cove and around the north headland to Blue Cavern Point. Anyone who holds valid Fish and Game permits for scientific collection and is approved by the Director of the WIES Marine Life Refuge may collect marine life in the refuge area.

Any violation of this restriction will result in a written reprimand and suspension from the diving program.
SECTION 15.00 USC SCIENTIFIC DIVER CERTIFICATION FOR EXPERIENCED DIVERS

Divers certified as scuba divers through a nationally recognized training agency with a minimum of 50 logged dives may forego taking a USC Scientific Diver Certification Class with the approval of the Diving Safety Officer. All paperwork must be completed, including a written examination. Divers who wish to forego taking a USC Scientific Diver Certification Class must demonstrate proficiency in the following skills during checkout dives or during training evaluation dives with the Diving Safety Officer or designee:

15.10 Knowledge:

- Pass written exam covering theoretical aspects of scientific diving. Topics include diving physics, physiology, medicine, rescue, first aid, recompression, air tables, waves, currents, navigation, physical fitness, environment, subtidal marine life, research methods, life support equipment, and USC requirements and procedures.

15.20 General Skills:

- Site evaluation
- Proper gear check
- Proper entry and exit

15.30 CONFINED WATER (at the discretion of the DSO):

- Surface swim without swim aids (400 yds. < 10 min.)
- Underwater swim without swim aids (25 yds. w/o surfacing)
- Tread water without swim aids (10 min.)
- Surface dive to a depth of 10 ft., recover a victim from the bottom, and transport the victim without swim aids (50 yds.)
- Snorkeling gear ditch and recovery
15.40 OPEN WATER:

Snorkeling Gear only:

____ Demonstrate proper surface dives/ascents
____ Surface dive demonstrating mask clears
____ Remove and replace weight belt
____ Tired diver assists (surface)
____ Rescue of non-breathing, unconscious diver including transport and exit to shore
____ Surface swim with full snorkeling gear (880 yds.)

Full Scuba Gear:

General Knowledge/Skills:

____ Pre-dive planning, briefing, site orientation, and buddy check
____ Proper use of decompression model (tables/computer)
____ Equipment familiarity
____ Full scuba rescue
____ Underwater signs and signals
____ Proper entry and exit
____ Monitor cylinder pressure, depth, and bottom time
____ Calculate air consumption (expressed as SAC rate in cubic feet)
____ Proper buddy contact
____ Surface swim with full gear, not breathing from scuba (400 yds.)

Under Water:

____ Remove and replace equipment on surface
____ Proper ascent/decent
____ Mask flood and clear
____ Regulator ditch and recovery
____ Out of air situation (both donor and recipient)
____ Simulated controlled emergency swimming ascent
____ Remove and replace weight belt at depth
____ Remove and replace power inflator hose
____ Neutral buoyancy (using manual and power inflation of the BC)
____ Underwater navigation
____ Simulate proper safety stop
____ properly plan another repetitive dive using decompression model
  (dive need not be executed, only planned)
____ Other, as discussed with the Diving Safety Officer
16.10 General

The USC Catalina Hyperbaric Chamber Crew is composed of a group of dedicated volunteers essential to the continual operation of the Chamber. The Chamber provides a safety net for Scientific Diving from the lab in its ongoing mission to treat underwater diving casualties and promote diving safety. The Chamber Crew’s primary mission is support and operation of the Chamber during the treatment of diving casualties. The Chamber Crew members are responsible for maintaining their knowledge of and operational proficiency with the chamber facility, which includes frequent participation in training sessions and individual practice.

16.20 Prerequisites and Chamber Diver Authorization Procedures

USC Catalina Hyperbaric Chamber Crew members with Rescue Diver, or equivalent scuba certification from a nationally recognized scuba certification agency and 25 logged dives are allowed an opportunity to explore the Cove and the surrounding underwater environment as a benefit for their dedicated service to the dive community. Only active crew members, as determined by the Chamber Director, are approved to conduct recreational dives under the auspices of the USC Scientific Diving Program. Approval as a Chamber Diver may only be authorized by the Dive Safety Officer. Chamber Diver status can be revoked at any time by the Chamber Director, the Dive Safety Officer or the Chamber Supervisor. Chamber Divers are not allowed to conduct scientific or commercial dive operations. Chamber divers are expected to as closely adhere to the USC Dive Safety Manual as possible, this includes but is not limited to Sections 2.0 – Diving Regulations for Scuba, 3.0 – Diving Equipment, 5.0 – Scientific Diver Certification, 6.0 – Medical Standards and Appendix 7 – Diving Emergency Management Procedures. Chamber divers may only dive with other approved Chamber divers or active scientific divers within the USC dive program to a maximum depth of 40fsw. Chamber divers, with the knowledge and permission of the Dive Safety Officer and the Chamber Director, may have an opportunity to increase their depth rating following the depth authorization procedures listed in Section 5.0 of the USC Dive Safety Manual. The maximum depth rating for Chamber Divers will be 100fsw. Chamber divers, under the auspices of USC, are not allowed to dive outside the Small Boating boundaries. Chamber divers diving from small boats must demonstrate proficiency in small boat rescue techniques and diver extractions to the satisfaction of the Dive Safety Officer or designee. All boat operators must complete the qualification requirements established by the Boating Safety Officer to be qualified to operate any of the WIES boats. All dive plans that include the use of a boat must be submitted to the Dive Safety Officer for final approval at least 24 hours prior to dive operations.
If the diver is a member of a scientific or public safety dive team program then they need to follow these steps:

1. Obtain approval from Chamber Director
2. Submit a LOR or VOC from their organization’s Diving Officer

If the diver is not a member of a scientific or public safety dive team then they need to follow these steps:

1. Obtain approval from Chamber Director
3. Pass a WMSC diving regulations and safety protocol exam
4. Complete a Chamber Diver Request Form and attach the following:
   a. Copy of Rescue Diver, or equivalent Diver Certification Card
   b. Log of last 25 dives
   c. Approved AAUS Medical
   d. Copies of current CPR, AED, FA & O2 Certification Cards
   e. Proof of current DAN, or other, Diving Medical Insurance
   f. Proof of Regulator and BCD Service within the previous 12 months
5. Schedule a check-out dive. Chamber Diver must satisfy the DSO or designee, of their ability to perform the following:
   a. Demonstrate clearing of mask and regulator while submerged
   b. Demonstrate proficiency in air sharing as both donor and receiver
   c. Demonstrate techniques of self-rescue and buddy rescue
   d. Demonstrate judgment adequate for safe diving
   e. Demonstrate understanding of underwater signs and signals
   f. Demonstrate the ability to maneuver efficiently in the environment, at and below the surface.
   g. Navigate underwater
SECTION 17.00 GUEST DIVER

17.10 General

The Wrigley Marine Science Center on Catalina Island is an ideal location for underwater activities and offers convenient access to nearshore open water environments. The University of Southern California recognizes a benefit to the facility to offer an opportunity for approved Guest Divers to explore the Cove and surrounding underwater environments.

This protocol is not intended as a means to offer an open door policy or access to the facility and scuba diving activities. This protocol is also not intended to be a Temporary Scientific Diver Permit.

17.20 Authorization Policies and Procedures

All Guest Divers must be approved by the WIES Director. The Dive Safety Officer, the Marine Operations Manager, the Boating Safety Officer and the Assistant Director may revoke Guest Diving privileges at any time.

- Guest divers may only dive with the Dive Safety Officer or DSO designee.
- Guest diver(s) may utilize USC WIES owned scuba equipment with the approval of the Dive Safety Officer.
- Guest Divers may only dive to a maximum depth of 40fsw.
- Guest Diver to USC Diver ratio must be 1:1. A 2:1 ratio maybe authorized by the Dive Safety Officer.
- All dive requests for locations outside the Cove, from a small boat will require a topside tender/boat operator in addition to the Dive Safety Officer or DSO designee.
- The Dive Safety Officer will establish, file and approve all dive plans.
- The Dive Safety Officer, or DSO designee will conduct the pre-dive briefing.

To be considered as a Guest Diver the applicant/candidate must provide the following:

1. Complete diver waiver and medical questioner as required by Scuba Diving International (SDI).
2. Proof of at least entry level scuba diving certification
Appendices

Appendix 1 through 9

Required For All Organizational Members
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 University of Southern California. 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 University of Southern California Scientific Dive standards. Thank you for your assistance.

NOT A VALID MEDICAL FORM

_________________________________________  _____________________________
Diving Safety Officer                      Date

_________________________________________  _____________________________
Printed Name                                Phone Number

Scuba and other modes of compressed-gas diving can be strenuous and hazardous. A special risk is present if the middle ear, sinuses, or lung segments do not readily equalize air pressure changes. The most common cause of distress is 82ntologicai 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]
4. Recent ocular surgery. [15, 18, 19]
5. Psychiatric disorders including claustrophobia, suicidal ideation, psychosis, anxiety states, untreated depression. [20 – 23]
6. Substance abuse, including alcohol. [24 – 25]
7. Episodic loss of consciousness. [1, 26, 27]
8. History of seizure. [27, 28]
9. History of stroke or a fixed neurological deficit. [29, 30]
10. Recurring neurologic disorders, including transient ischemic attacks. [29, 30]
11. History of intracranial aneurysm, other vascular malformation or intracranial hemorrhage. [31]
12. History of neurological decompression illness with residual deficit. [29, 30]
13. Head injury with sequelae. [26, 27]
14. Hematologic disorders including coagulopathies. [41, 42]
15. Evidence of coronary artery disease or high risk for coronary artery disease. [33 – 35]
16. Atrial septal defects. [39]
17. Significant valvular heart disease – isolated mitral valve prolapse is not disqualifying. [38]
18. Significant cardiac rhythm or conduction abnormalities. [36 – 37]
19. Implanted cardiac pacemakers and cardiac defibrillators (ICD). [39, 40]
20. Inadequate exercise tolerance. [34]
21. Severe hypertension. [35]
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

APPENDIX 2
AAUS MEDICAL EVALUATION OF FITNESS FOR SCUBA DIVING REPORT

Name of Applicant (Print or Type) ____________________________ Date of Medical Evaluation (Month/Day/Year)

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

TESTS: THE FOLLOWING TESTS ARE REQUIRED:

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

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

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

• Chest x-ray (Required only during first exam over age 40)
• Resting EKG
• Assessment of coronary artery disease using Multiple-Risk-Factor Assessment† (age, lipid profile, blood pressure, diabetic screening, smoking)
  Note: Exercise stress testing may be indicated based on Multiple-Risk-Factor Assessment‡

PHYSICIAN’S STATEMENT:

01 Diver IS medically qualified to dive for: 2 years (over age 60)

01 Diver IS medically qualified to dive for: 3 years (age 40-59)

01 Diver IS medically qualified to dive for: 5 years (under age 40)

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

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

Signature ____________________________ MD or DO ____________________________ Date ____________________________

Name (Print or Type)

________________________________________________________

Address

Telephone Number ____________________________ E-Mail Address ____________________________

My familiarity with applicant is: This exam only

My familiarity with diving medicine is:

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APPENDIX 2b

AAUS MEDICAL EVALUATION OF FITNESS FOR SCUBA DIVING REPORT

APPLICANT’S RELEASE OF MEDICAL INFORMATION FORM

Name of Applicant (Print or Type)

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

Signature of Applicant __________________________________________
                   ______________________

Date

REFERENCES

1 Grundy et al. Assessment of Cardiovascular Risk by Use of Multiple-Risk-Factor Assessment Equations. AHA/ACC Scientific

2 Gibbons RJ, et al. ACC/AHA Guidelines for exercise testing. A report of the American College of Cardiology/American Heart
APPENDIX 3
DIVING MEDICAL HISTORY FORM
(To Be Completed By Applicant-Diver)

Name ____________________________________________ Sex _____ Age _____ Wt. _____ Ht. _____

Sponsor ____________________________ Date ____/____/____ (Dept./Project/Program/School, etc.)
(Dept./Project/Program/School, e t c.) (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 shall be kept confidential by the examining physician. If you believe any question amounts to invasion of your privacy, you may elect to omit an answer, provided that you shall subsequently discuss that matter with your own physician who must then indicate, in writing, that you have done so and that no health hazard exists.

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

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<th>Please indicate whether or not the following apply to you</th>
<th>Comments</th>
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<td>Convulsions, seizures, or epilepsy</td>
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<td>Fainting spells or dizziness</td>
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<td>Been addicted to drugs</td>
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<td>Motion sickness or sea/air sickness</td>
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<td>Mental disorder or nervous breakdown</td>
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<td>Anxiety spells or hyperventilation</td>
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<td>Frequent sour stomachs, nervous stomachs or vomiting spells</td>
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<td>Question</td>
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<td>Had a major operation</td>
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<td>Presently being treated by a physician</td>
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<td>Taking any medication regularly (even non-prescription)</td>
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<td>Been rejected or restricted from sports</td>
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<td>Headaches (frequent and severe)</td>
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<td>Wear glasses or contact lenses</td>
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<td>20</td>
<td>Alcoholism</td>
<td></td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>Any problems related to diving</td>
<td></td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>Nervous tension or emotional problems</td>
<td></td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>Take tranquilizers</td>
<td></td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>Perforated ear drums</td>
<td></td>
<td></td>
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<tr>
<td>25</td>
<td>Hay fever</td>
<td></td>
<td></td>
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<tr>
<td>26</td>
<td>Frequent sinus trouble, frequent drainage from the nose, post-nasal</td>
<td></td>
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<tr>
<td>27</td>
<td>Frequent earaches</td>
<td></td>
<td></td>
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<tr>
<td>28</td>
<td>Drainage from the ears</td>
<td></td>
<td></td>
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<tr>
<td>29</td>
<td>Difficulty with your ears in airplanes or on mountains</td>
<td></td>
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<tr>
<td>30</td>
<td>Ear surgery</td>
<td></td>
<td></td>
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<tr>
<td>31</td>
<td>Ringing in your ears</td>
<td></td>
<td></td>
</tr>
<tr>
<td>32</td>
<td>Frequent dizzy spells</td>
<td></td>
<td></td>
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<tr>
<td>33</td>
<td>Hearing problems</td>
<td></td>
<td></td>
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<tr>
<td>34</td>
<td>Trouble equalizing pressure in your ears</td>
<td></td>
<td></td>
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<tr>
<td>35</td>
<td>Asthma</td>
<td></td>
<td></td>
</tr>
<tr>
<td>36</td>
<td>Wheezing attacks</td>
<td></td>
<td></td>
</tr>
<tr>
<td>37</td>
<td>Cough (chronic or recurrent)</td>
<td></td>
<td></td>
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<tr>
<td>38</td>
<td>Frequently raise sputum</td>
<td></td>
<td></td>
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<tr>
<td>39</td>
<td>Pleurisy</td>
<td></td>
<td></td>
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<tr>
<td>40</td>
<td>Collapsed lung (pneumothorax)</td>
<td></td>
<td></td>
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<tr>
<td>41</td>
<td>Lung cysts</td>
<td></td>
<td></td>
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<tr>
<td>42</td>
<td>Pneumonia</td>
<td></td>
<td></td>
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<tr>
<td>43</td>
<td>Tuberculosis</td>
<td></td>
<td></td>
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<tr>
<td>44</td>
<td>Shortness of breath</td>
<td></td>
<td></td>
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<td>45</td>
<td>Lung problem or abnormality</td>
<td></td>
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<td>46</td>
<td>Spit blood</td>
<td></td>
<td></td>
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<tr>
<td>47</td>
<td>Breathing difficulty after eating particular foods, after exposure to</td>
<td></td>
<td></td>
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<tr>
<td>48</td>
<td>Are you subject to bronchitis</td>
<td></td>
<td></td>
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<tr>
<td>49</td>
<td>Subcutaneous emphysema (air under the skin)</td>
<td></td>
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<tr>
<td>50</td>
<td>Air embolism after diving</td>
<td></td>
<td></td>
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<tr>
<td>51</td>
<td>Decompression sickness</td>
<td></td>
<td></td>
</tr>
<tr>
<td>52</td>
<td>Rheumatic fever</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>No</td>
<td>Please indicate whether or not the following apply to you</td>
<td>Comments</td>
</tr>
<tr>
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<td>----------------------------------------------------------</td>
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</tr>
<tr>
<td>53</td>
<td></td>
<td>Scarlet fever</td>
<td></td>
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<tr>
<td>54</td>
<td></td>
<td>Heart murmur</td>
<td></td>
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<tr>
<td>55</td>
<td></td>
<td>Large heart</td>
<td></td>
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<tr>
<td>56</td>
<td></td>
<td>High blood pressure</td>
<td></td>
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<tr>
<td>57</td>
<td></td>
<td>Angina (heart pains or pressure in the chest)</td>
<td></td>
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<tr>
<td>58</td>
<td></td>
<td>Heart attack</td>
<td></td>
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<tr>
<td>59</td>
<td></td>
<td>Low blood pressure</td>
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<tr>
<td>60</td>
<td></td>
<td>Recurrent or persistent swelling of the legs</td>
<td></td>
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<tr>
<td>61</td>
<td></td>
<td>Pounding, rapid heartbeat or palpitations</td>
<td></td>
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<tr>
<td>62</td>
<td></td>
<td>Easily fatigued or short of breath</td>
<td></td>
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<tr>
<td>63</td>
<td></td>
<td>Abnormal EKG</td>
<td></td>
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<td>64</td>
<td></td>
<td>Joint problems, dislocations or arthritis</td>
<td></td>
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<tr>
<td>65</td>
<td></td>
<td>Back trouble or back injuries</td>
<td></td>
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<td>66</td>
<td></td>
<td>Ruptured or slipped disk</td>
<td></td>
</tr>
<tr>
<td>67</td>
<td></td>
<td>Limiting physical handicaps</td>
<td></td>
</tr>
<tr>
<td>68</td>
<td></td>
<td>Muscle cramps</td>
<td></td>
</tr>
<tr>
<td>69</td>
<td></td>
<td>Varicose veins</td>
<td></td>
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<tr>
<td>70</td>
<td></td>
<td>Amputations</td>
<td></td>
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<tr>
<td>71</td>
<td></td>
<td>Head injury causing unconsciousness</td>
<td></td>
</tr>
<tr>
<td>72</td>
<td></td>
<td>Paralysis</td>
<td></td>
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<tr>
<td>73</td>
<td></td>
<td>Have you ever had an adverse reaction to medication?</td>
<td></td>
</tr>
<tr>
<td>74</td>
<td></td>
<td>Do you smoke?</td>
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<tr>
<td>75</td>
<td></td>
<td>Have you ever had any other medical problems not listed?</td>
<td></td>
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<tr>
<td>76</td>
<td></td>
<td>If so,</td>
<td></td>
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<tr>
<td>77</td>
<td></td>
<td>Is there a family history of high cholesterol?</td>
<td></td>
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<tr>
<td>78</td>
<td></td>
<td>Is there a family history of heart disease or stroke?</td>
<td></td>
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<tr>
<td>79</td>
<td></td>
<td>Is there a family history of diabetes?</td>
<td></td>
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<tr>
<td>80</td>
<td></td>
<td>Date of last tetanus shot?  Vaccination dates?</td>
<td></td>
</tr>
</tbody>
</table>

Please explain any “yes” answers to the above questions.

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

I certify that the above answers and information represent an accurate and complete description of my medical history.
List of local Medical Doctors that have training and expertise in diving or undersea medicine:

1. Name:  
   Address:  
   Telephone:  

2. Name:  
   Address:  
   Telephone:  

3. Name:  
   Address:  
   Telephone:  

4. Name:  
   Address:  
   Telephone:  

5. Name:  
   Address:  
   Telephone:  

APPENDIX 5
DEFINITION OF TERMS

Air sharing – Sharing of an air supply between divers.

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

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 in constant communication.

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).

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

\( f_{N_2} \) – Fraction of nitrogen in a gas mixture, expressed as either a decimal or percentage, by volume.

\( f_{O_2} \) – 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 pO₂ 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.


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.

pN₂ – Inspired partial pressure of nitrogen, usually expressed in units of atmospheres absolute.

pO₂ – Inspired partial pressure of oxygen, usually expressed in units of atmospheres absolute.

Psi – Unit of pressure, “pounds per square inch.

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 6
UNIVERSITY OF SOUTHERN CALIFORNIA REQUEST FOR DIVING RECIPROCITY FORM
VERIFICATION OF DIVER TRAINING AND EXPERIENCE

Diver: __________________________________________

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 as established by the University of Southern California (USC) Diving Safety Manual, and has demonstrated competency in the indicated areas. USC is an American Academy of Underwater Sciences (AAUS) Organizational Member and meets or exceeds all AAUS training requirements.

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

_____ Original Diving Authorization
_____ Written Scientific Diving Examination Requesting Institution: _____________
_____ Most Recent Checkout Dive DAN Insurance Expiration: ________________
_____ Last Diving Medical Examination Medical Examination Expiration: ________________
_____ Scuba Regulator Service Expiration:
_____ Buoyance Control Device (BCD) Service Expiration:
_____ CPR Training (Agency) _____________ CPR Exp. ________________
_____ Oxygen Administration (Agency) _____________ 02 Exp. ________________
_____ First Aid for Diving (Agency) _____________ F.A. Exp. ________________
_____ Last Dive

Number of Dives Completed Within Previous 12 months? ____________ Depth Certification ______ fsw

Any Restrictions? (Y/N) ___________. If yes, explain:

Please indicate any pertinent specialty certifications or training:

_____ Nitox
_____ Night
_____ Dry Suit
_____ Rescue
_____ Cavern
_____ Blue Water
_____ EMT
_____ Instructor
_____ Asst. Instructor
_____ Divemaster
_____ USC Staff
_____ Chamber Crew
Other: __________________________________________

Emergency Information:

Name: _________________________________ Relationship: _________________________________

Best Phone: ______________________________ Alternative Phone: ______________________________

This is to verify that the above individual is currently a certified Scientific Diver at USC.

Please Contact me if you have any questions or concerns.

Signature: _____________________________________ Date: ________________________________
UNIVERSITY OF SOUTHERN CALIFORNIA
VERIFICATION OF CERTIFICATION

Diver: ________________________________

This document may not be used for the purpose of reciprocity and the University of Southern California (USC) takes no responsibility or liability for this diver while he/she is diving under the auspices of the host organization. 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 as established by the USC Diving Safety Manual, and has demonstrated competency in the indicated areas. USC is an American Academy of Underwater Sciences (AAUS) Organizational Member and meets or exceeds all AAUS training requirements.

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

______ Original Diving Authorization
______ Written Scientific Diving Examination Requesting Institution: _____________
______ Most Recent Checkout Dive DAN Insurance Expiration: ________________
______ Last Diving Medical Examination Medical Examination Expiration: ____________
______ Scuba Regulator Service Expiration
______ Buoyance Control Device (BCD) Service Expiration
______ CPR Training (Agency) __________________ CPR Exp. ________________
______ Oxygen Administration (Agency) __________________ 02 Exp. ________________
______ First Aid for Diving (Agency) __________________ F.A. Exp. ________________
______ Date of Last Dive

Number of Dives Completed Within Previous 12 months? ______ Depth Certification ______ fsw

Any Restrictions? (Y/N) ______. If yes, explain:

Please indicate any pertinent specialty certifications or training:

____ Nitrox ______ Night ______ Dry Suit ______ Rescue ______ Cavern

____ Blue Water ______ EMT ______ Instructor ______ Asst. Instructor ______ Divemaster

____ USC Staff ______ Chamber Crew ______ Other: ________________________________

Emergency Information:

Name: ________________________________ Relationship: ________________________________

Best Phone: __________________________ Alternative Phone: __________________________

This is to verify the above individual was trained as an AAUS Scientific Diver at USC.

Please Contact me if you have any questions or concerns.

Signature: ________________________________ Date: ________________________________
APPENDIX 7
DIVING EMERGENCY MANAGEMENT PROCEDURES

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

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

1. Make appropriate contact with victim or rescue as required.
2. Establish (A)irway, (B)reathing, (C)irculation as required.
3. Stabilize the victim
4. Administer 100% oxygen, if appropriate (in cases of Decompression Illness, or Near Drowning).
5. Call local Emergency Medical System (EMS) for transport to nearest medical treatment facility. Explain the circumstances of the dive incident to the evacuation teams, medics and physicians. Do not assume that they understand why 100% oxygen may be required for the diving accident victim or that recompression treatment may be necessary.
6. Call appropriate Diving Accident Coordinator for contact with diving physician and decompression chamber. Etc.
7. Notify DSO or designee according to the Emergency Action Plan of the organizational member.
8. Complete and submit Incident Report Form (www.aaus.org) to the DCB of the organization and the AAUS (Section 2.70 Required Incident Reporting).

List of Emergency Contact Numbers Appropriate For Dive Location

Available Procedures
- Emergency care
- Recompression
- Evacuation

Emergency Plan Content
- Name, telephone number, and relationship of person to be contacted for each diver in the event of an emergency.
- Nearest operational decompression chamber.
- Nearest accessible hospital.
- Available means of transport.
APPENDIX 8
DIVE COMPUTER GUIDELINES

1. Only those makes and models of dive computers specifically approved by the Diving Control Board may be used.

2. Any diver desiring the approval to use a dive computer as a means of determining decompression status must apply to the Diving Control Board, complete an appropriate practical training session and pass a written examination.

3. Each diver relying on a dive computer to plan dives and indicate or determine decompression status must have his/her own unit.

4. On any given dive, both divers in the buddy pair must follow the most conservative dive computer.

5. If the dive computer fails at any time during the dive, the dive must be terminated and appropriate surfacing procedures should be initiated immediately.

6. A diver should not dive for 18 hours before activating a dive computer to use it to control their diving.

7. Once the dive computer is in use, it must not be switched off until it indicates complete out gassing has occurred or 18 hours have elapsed, whichever comes first.

8. When using a dive computer, non emergency ascents are to be at a rate specified for the make and model of dive computer being used.

9. Whenever practical, divers using a dive computer should make a stop between 10 and 30 feet for 5 minutes, especially for dives below 60 fsw.

10. Multiple deep dives require special consideration.
COLLECTION CRITERIA:

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

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

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 into water, an underwater diving activity utilizing compressed gas, an ascent/return to the surface, and a surface interval of greater than 10 minutes.

Dives will not be differentiated as openwater or confined water dives. But openwater 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) occurring during the collection cycle. Only incidents occurring during, or resulting from, a dive where the diver is breathing a compressed gas will be submitted to AAUS.
DEFINITIONS:

Dive Classification:

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

Breathing Gas:

- Air: Dives where the bottom gas used for the dive is air.
- Nitrox: Dives where the bottom gas used for the dive is a combination of nitrogen and oxygen other than air.
- Mixed Gas: Dives where the bottom gas used for the dive is a combination of oxygen, nitrogen, and helium (or other “exotic” gas), or any other breathing gas combination not classified as air or nitrox.

Diving Mode:

- Open Circuit Scuba: Dives where the breathing gas is inhaled from a self-contained underwater breathing apparatus and all of the exhaled gas leaves the breathing loop.
- Surface Supplied: Dives where the breathing gas is supplied from the surface by means of a pressurized umbilical hose. The umbilical generally consists of a gas supply hose, strength member, pneumofathometer hose, and communication line. The umbilical supplies a helmet or full-face mask. The diver may rely on the tender at the surface to keep up with 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 the monitoring his/her own depth, time, and diving profile.
- Rebreathers: Dives where the breathing gas is repeatedly recycled in the 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, and 191->. Depths are in feet seawater. A dive is logged to the maximum depth reached during the dive. Note: Only “The Number of Dives Logged” and “The Number of Divers Logging Dives” will be collected for this category.

Specialized Environments:

- Required Decompression: Any dive where the diver exceeds the no-decompression limit of the decompression planning method being employed.
- Overhead Environments: Any dive where the diver does not have direct access to the surface due to a physical obstruction.
- Blue Water Diving: Openwater diving where the bottom is generally greater than 200 feet deep and requiring 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 shall not be logged by AAUS.
- Aquarium: An aquarium is a shallow, confined body of water, which is operated by or under the control of an institution and is used for the purposes of specimen exhibit, education, husbandry, or research. (Not a swimming pool)

Incident Types:

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

**Incident Classification Rating Scale:**

- **Minor:** Injuries that the OM considers being minor in nature. Examples of this classification of incident would include, but not be limited to:
  - Mask squeeze that produced discoloration of the eyes.
  - Lacerations requiring medical attention but not involving moderate or severe bleeding.
  - Other injuries that would not be expected to produce long term adverse effects on the diver’s health or diving status.

- **Moderate:** Injuries that the OM considers being moderate in nature. Examples of this classification would include, but not be limited to:
  - DCS symptoms that resolved with the administration of oxygen, hyperbaric treatment given as a precaution.
  - DCS symptoms resolved with the first hyperbaric treatment.
  - Broken bones.
  - Torn ligaments or cartilage.
  - Concussion.
  - Ear barotrauma requiring surgical repair.
• Serious: Injuries that the OM considers being serious in nature. Examples of this classification would include, but not be limited to:

  o Arterial Gas Embolism.
  o DCS symptoms requiring multiple hyperbaric treatment.
  o Near drowning.
  o Oxygen Toxicity.
  o Hypercapnea.
  o Spinal injuries.
  o Heart attack.
  o Fatality.
APPENDIX 10
RELEASE FROM LIABILITY
(University of Southern California)

I, the undersigned, acknowledge and agree that in consideration for permission to participate in the Activities (defined below), I, my spouse, assigns, heirs, guardians, and legal representatives hereby voluntarily indemnify, release from liability, agree to defend, and hold harmless the University of Southern California, The USC Wrigley Institute for Environmental Studies and any organization affiliated therewith, including all of their respective agents, employees, administrators, representatives, officers, trustees, students and assigns (collectively “USC”), for any accident, injury, illness, death, loss, theft, damage to person or property, or other consequences arising or resulting directly or indirectly from any activities which I may engage in, on, about or by access through any property owned, operated or managed by USC (whether permitted or not permitted by USC), including, without limitation, activities such as swimming, diving, snorkeling, scuba diving, wading, or boating (collectively, the “Activities”), including but not limited to claims arising from or related to USC’s negligence and/or products liability, including strict products liability. In the event that I am injured, I agree to assume any financial obligation, either through my health insurance, or through some other means, for any medical costs that I incur. USC assumes no responsibility for any medical expenses, injury or damage suffered by me in connection with my participation in the Activities.

IT IS MY INTENTION BY SIGNING BELOW TO EXPRESSLY ASSUME ALL RISK OF PERSONAL INJURY, DEATH, OR PROPERTY DAMAGE UPON MYSELF, TO THE EXCLUSION OF USC, AND TO EXEMPT AND RELEIVE USC FROM LIABILITY FOR PERSONAL INJURY, PROPERTY DAMAGE OR WRONGFUL DEATH.

By signing this agreement, I waive my right to bring any legal action now or at any time in the future to recover compensation or obtain any other remedy for any injury to myself or my property or for my death, however caused, arising out of my participation in the Activities. I further agree that I, my spouse, assigns, heirs, guardians, and legal representatives will not make any claim against, sue or attach the property of USC for any loss or damage resulting from my participation in the Activities. I understand that none of the Activities are endorsed, sanctioned, guaranteed, supervised or monitored by USC.

I acknowledge and affirm that I am not required to participate in any of the Activities as a condition to obtaining any academic degrees. I further acknowledge and affirm that I am not to be considered and employee of USC and that no benefits customarily afforded to employees of USC will be extended to me by virtue of my participation in the Activities. As an individual who actually IS employed by USC in a capacity unrelated to the Activities, I acknowledge that participating in the Activities is not a condition of my employment.

I HAVE CAREFULLY READ THIS AGREEMENT AND FULLY UNDERSTAND ITS CONTENTS. I AM AWARE OF THE POTENTIAL DANGERS INCIDENTAL TO THE ACTIVITIES, THAT THIS IS A RELEASE OF LIABILITY, A WAIVER OF MY LEGAL RIGHT TO COLLECT DAMAGES IN THE EVENT OF INJURY, DEATH, OR PROPERTY DAMAGE AND A CONTRACT BETWEEN MYSELF AND USC AND SIGN IT OF MY OWN FREE WILL.

I EXPRESSLY AGREE THAT THIS RELEASE IS INTENDED TO BE AS BROAD AND INCLUSIVE AS THE STATE OF CALIFORNIA WILL ALLOW AND THAT IF ANY PORTION IS HELD INVALID, I AGREE THAT THE BALANCE SHALL, NOT WITHSTANDING, CONTINUE IN FULL LEGAL FORCE AND EFFECT.

SIGNATURE ____________________________ Date _________________
NAME (PRINT)________________________________________ Age _________________
WITNESSED BY (PRINT)____________________________________
WITNESS SIGNATURE _______________________________________

If participant is a minor:
Parent/Legal Guardian Signature: __________________________ Name (print): __________________________
Anticipated Project start date __________________________  End date __________________________

Name (Project Director): ________________________________________________________________

Contact information: Phone FAX e-mail: ___________________________________________________

University Status (circle one): Faculty Staff Graduate Undergraduate Visiting Researcher

Name (lead diver) ___________________________________________________ Certification depth: ____________________

University Status (circle one): Faculty Staff Graduate Undergraduate Visiting Researcher

Faculty or University affiliated sponsor (if appropriate): ______________________________________

Name(s) dive buddies: USCG certification depth or Other Institution affiliation
_________________________________________ ______________________
_________________________________________ ______________________
_________________________________________ ______________________
_________________________________________ ______________________

Please outline your research project, focusing on the diving aspect of the research.

Include the following:

Breathing gas supply and mode. Air/Nitrox/Other Scuba/Surface Supply/Other

Decompression status indicator used. Tables / Computer (List make) __________________________

Diver thermal protection. Wetsuit/Drysuit/Other

Emergency procedures you will follow (see Appendix 7 of the Diving Safety Manual)

Include emergency evacuation plans and names and numbers of persons to contact in the event of an emergency. ____________________________________________________________

Dive profiles expected, including diving depths, bottom times and number of repetitive dives expected per day.

____________________________________________________________________________________

Appropriate out-of-air protocol to be used (dives deeper than 100 feet may require a redundant air source)

____________________________________________________________________________________

Diving conditions expected (visibility, wave exposure, wall diving etc., contaminants, currents).

Please detail any potentially hazardous conditions. __________________________________________

Boat use and/or beach access plan. ______________________________________________________
Specialty equipment use (ie. Scooters {DPVs}, lift bags, cameras, dredges, drills, cores, blue water rigs, etc.)

Sampling methods to be used (ie. Transects/quadrats, collecting {explain collecting methods}, etc.)

Comments:

Diving Safety Officer Approval __________________________ DCB chairperson approval __________________________
APPENDIX 12

USC TEMPORARY DIVING PERMIT APPLICATION

Name: ___________________________________________________ Date:__________________

Period this application is to cover: ______________________________________________________

Proposed Dive Buddy: (must be an active scientific diver):___________________

Purpose for diving: ___________________________________________________________________

Certification:
Agency _______________ Level _______________ (attach copy of C card)

Diving Experience: (fill in number of dives in the following categories)
0-30 ______ 31-60 ______ 61-100 ______ 130+ ______

Total number of dives in the last 12 months: ____________

Medical: Attach a completed copy of the USC Medical History Form Attach a copy of the medical clearance for scuba diving signed by a licensed medical doctor and dated within one year of this request. (see Appendices B and C of the Diving Safety Manual)

USC Waiver: Submit with this Request a signed and witnessed USC Waiver/Release Form. (see Appendix D of the Diving Safety Manual) I understand that when this temporary diving permit is approved that I am authorized to dive within the USC Diving Program for the period stated on this request. I also understand that I am allowed only two dives a day to a maximum depth of 40 feet during day light hours unless otherwise authorized by the Diving Safety Officer. I agree to comply with all USC Diving Program Regulations. I have read and understand the USC Diving Safety Manual.

_______________________  ____________________
DIVER’S SIGNATURE     DATE

_______________________  ____________________
DIVING SAFETY OFFICER APPROVAL     DATE

_______________________  ____________________
DIVING CONTROL BOARD APPROVAL     DATE

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