Volume 1

Sections 1.00 through 6.00
SECTION 1.00 GENERAL POLICY

1.10 Stanford University Scientific Diving Standards

Purpose

Stanford University formalized a Diving Safety Program with a Diving Safety Officer and Diving Control Board based at Hopkins Marine Station in 1985, and was accepted as an American Academy of Underwater Sciences (AAUS) organizational member in 1987. The AAUS Standards for Scientific Diving (2016) have been used as minimal guidelines for development of Stanford University’s Scientific Diving Standards.

The purpose of these Scientific Diving Standards is to ensure that all Stanford University scientific diving is conducted in a manner that will maximize protection of scientific divers from accidental injury and/or illness while furthering research and safety, and to set forth standards for training and certification that will allow a working reciprocity between Stanford University and other AAUS organizational members.

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.

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):

a) 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.

b) The purpose of the project using scientific diving is the advancement of science; therefore, information and data resulting from the project are non-proprietary.

c) 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.

d) 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.
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 Stanford University’s annual report to the AAUS, any recommendations for modifications of the AAUS standards shall be submitted to the AAUS for consideration.

Liability

By adopting the policies set forth in this manual, Stanford University assumes no liability not otherwise imposed by law. Diving activity under the auspices of Stanford University’s Scientific Diving Program is considered to be voluntary and participation in such activity is not a condition to obtaining any academic degree, nor is it a condition of any employment at the University.

1.20 Operational Control

Stanford University Auspices Defined

For the purposes of these standards the auspices of Stanford University includes any scientific diving operation in which the University 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 Stanford University or employees of auxiliary organizations, where such employees are acting within the scope of their employment, and the operations of students and other persons who are engaged in scientific diving associated with Stanford University research or coursework or are diving as members of a University-recognized organization.

It is Stanford University’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 Stanford University’s Diving Control Board (DCB).

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

Stanford University’s Scientific Diving Standards and Safety Manual

The purpose of the Stanford University Diving Safety Manual is to provide for the development and implementation of policies and procedures that will meet requirements of local environments and conditions as well as to comply with the AAUS scientific diving standards. The Diving Safety Manual shall include, but not be limited to:

1. Scientific diving standards which use those of the AAUS as a set of minimal guidelines. Volume 1, Sections 1.00 through 6.00 and the Appendices are required. Volume 2,
Sections 7.00 through 9.00 are required only when the University conducts that diving activity. Stanford University-specific sections are in Volume 2.

2. Emergency evacuation and medical treatment procedures.
3. Criteria for scientific diver training and certification.
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.

_**Qualifications:**_

1. Shall be appointed by the responsible administrative officer or designee, with the advice and counsel of the Diving Control Board.
2. Shall be trained as a scientific diver.
3. Shall be a full member as defined by AAUS.
4. Shall be an active underwater instructor from an internationally recognized certifying agency.

_Duties and Responsibilities_

1. Shall be responsible, through the DCB, to the responsible administrative officer or designee, for the conduct of the Scientific Diving Program of Stanford 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 membership organization, rests with the Diving Safety Officer.
2. 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.
3. 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.
4. Shall suspend diving operations considered to be unsafe or unwise.

_Diving Control Board_

- The Diving Control Board (DCB) shall consist of a majority of active scientific divers. Voting members shall include the Diving Safety Officer, the responsible administrative officer, or designee, and should include other student, staff, or faculty representatives of the diving program such as qualified divers and members of University laboratories and departments which routinely
conduct scientific diving operations. A chairperson and a secretary may be chosen from the membership of the board according to local procedure.

- Has autonomous and absolute authority over the Scientific Diving Program’s operation.
- Shall approve and monitor diving projects.
- Shall review and revise the Diving Safety Manual.
- Shall assure compliance with the Diving Safety Manual.
- Shall certify the depths to which a diver has been trained.
- Shall take disciplinary action for unsafe practices.
- Shall assure adherence to the buddy system for scuba diving.
- Shall act as Stanford University’s official representative in matters concerning the Scientific Diving Program.
- Shall act as a board of appeal to consider diver-related problems.
- Shall recommend the issue, reissue, or the revocation of diving certifications.
- Shall recommend changes in policy and amendments to AAUS and Stanford University’s Diving Safety Manual as the need arises.
- Shall establish and/or approve training programs through which the applicants for certification can satisfy the requirements of Stanford University’s Diving Safety Manual.
- Shall suspend diving programs that are considered to be unsafe or unwise.
- Shall establish criteria for equipment selection and use.
- Shall recommend new equipment or techniques.
- Shall establish and/or approve facilities for the inspection and maintenance of diving and associated equipment.
- Shall ensure that any University-controlled air station(s) meet air quality standards as described in Section 3.60 of this manual.
- Shall periodically review the Diving Safety Officer’s performance and program.
- Shall sit as a board of investigation to inquire into the nature and cause of diving accidents or violations of Stanford University’s Diving Safety Manual.

Instructional Personnel

Qualifications

All personnel involved in diving instruction under the auspices of Stanford University’s Scientific Diving Program shall be qualified for the type of instruction being given.

Selection

Instructional personnel will be selected by the responsible administrative officer, 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:

- Coordination with other known activities in the vicinity that are likely to interfere with diving operations.
- Ensuring all dive team members possess current certification and are qualified for the type of diving operation.
- Planning dives in accordance with Section 2.20
- Ensuring safety and emergency equipment is in working order and at the dive site.
- 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.
- Suspending diving operations if in their opinion conditions are not safe.
- Reporting to the DSO and DCB any physical problems or adverse physiological effects including symptoms of pressure-related injuries.

Reciprocity and Visiting Scientific Diver

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.

A Scientific Diver from one Organizational Member shall apply for permission to dive under the auspices of another Organizational Member by submitting to the Diving Safety Officer of the host Organizational Member a document containing all the information described in Appendix 6, signed by the Diving Safety Officer or Chairperson of the home Diving Control Board.

A visiting Scientific Diver may be asked to demonstrate their knowledge and skills for the planned dive.

If a host Organizational Member denies a visiting Scientific Diver permission to dive, the host Diving Control Board shall notify the visiting Scientific Diver and their Diving Control Board with an explanation of all reasons for the denial.

Waiver of Requirements

Stanford University’s 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 Stanford University’s scientific Diving Safety Manual may be cause for the revocation or restriction of the diver’s scientific diving certificate by action of the Diving Control Board.
1.40 Consequences of Violation of AAUS Standards

Failure of Stanford University’s Scientific Diving Program to comply with the AAUS Standards for Scientific Diving may be cause for the revocation or restriction of the University’s recognition by AAUS.

1.50 Record Maintenance

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

Availability of Records:

- Medical records shall be available to the attending physician of a diver or former diver when released in writing by the diver.
- Records and documents required by this standard shall be retained for the following period:
  1. Physician’s written reports of medical examinations for dive team members - 5 years.
  3. Records of dive - 1 year, except 5 years where there has been an incident of pressure-related injury.
  4. Pressure-related injury assessment - 5 years.
  5. 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 Stanford University’s Scientific Diving Program unless they hold a current certification issued pursuant to the provisions of this manual.

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 the organizational member, the lead diver for a proposed operation must formulate a dive plan that should include the following:

- Divers’ qualifications, and the type of certificate or certification held by each diver.
- Emergency plan (Appendix 7) with the following information:
  1. Name, telephone number, and relationship of person to be contacted for each diver in the event of an emergency.
  2. Nearest operational decompression chamber.
- Approximate number of proposed dives.
- Location(s) of proposed dives.
- Estimated depth(s) and bottom time(s) anticipated.
- Decompression status and repetitive dive plans, if required.
- Proposed work, equipment, and boats to be employed.
- Any hazardous conditions anticipated.

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, AAUS standards, or Stanford University’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 team 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

1. 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 (two comparably equipped scuba divers in the water in constant communication) 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, AAUS standards, or Stanford University’s Diving Safety Manual.

Termination of the Dive

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.

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

After the completion of a dive, each diver shall report any physical problems, symptoms of
decompression sickness, or equipment malfunctions.

If any dive has been conducted beyond no-decompression limits, the diver(s) should remain awake for at least 1 hour after diving, and in the company of a dive team member who is prepared to activate EMS or transport them to a medical facility for evaluation prior to recompression treatment if necessary.

2.50 Emergency Procedures

All scientific divers and scientific divers-in-training shall follow the emergency procedures described in Appendix 7. Divers conducting scientific diving operations at locations not included in the local dive emergency plan shall note in their Dive Plan the available emergency care facilities and appropriate emergency procedures for each dive location at those sites, including procedures for emergency care, recompression and evacuation.

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 or diver-in-training shall log every dive made under the auspices of Stanford University’s Scientific Diving Program, and is encouraged to log all other dives, according to methods specified by the Diving Safety Officer. Dive logs shall be submitted to the DSO to be placed in the diver’s permanent file. The dive log shall include at least the following:

- Name of diver, buddy, and Lead Diver.
- Date, time, and location.
- Diving modes used.
- General nature of diving activities.
- Approximate surface and underwater conditions.
- Maximum depths, bottom time, and surface interval time.
- Diving tables or computers used.
- Detailed report of any near or actual incidents.
Required Incident Reporting

All diving incidents requiring recompression treatment, or resulting in moderate or serious injury, or death shall be reported to Stanford University’s Diving Control Board and the AAUS. The University’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:

- Occupational injuries and illnesses shall be reported in accordance with requirements of the appropriate Labor Code section.

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

Any incident of pressure-related injury shall be investigated and a report shall be prepared which shall be forwarded to AAUS during the annual reporting cycle. This report must first be reviewed and released by the 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 it 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

- Only those makes and models specifically approved by the Diving Safety Officer and the Diving Control Board shall be used.
- Scuba regulators shall be inspected and tested prior to first use and every 12 months thereafter.
- 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:

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

Scuba Cylinders

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

Backpacks

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

Gauges

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

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

Timing Devices, Depth, and Pressure Gauges

- Each member of the dive team must have an underwater timing device, an approved depth indicator, and a submersible pressure gauge.

Determination of Decompression Status: Dive Tables, Dive Computers

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

3.30 Auxiliary Equipment

Hand held underwater power tools

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

3.40 Support Equipment

First aid supplies

- A first aid kit and emergency oxygen and personnel trained in their use shall be available at every dive site.

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 – Stanford University-Controlled

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

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

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

Compressor Operation and Air Test Records

Gas analyses and air tests shall be performed on each Stanford University-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 and be maintained in a formal log.

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).
CGA Grade E

<table>
<thead>
<tr>
<th>Component</th>
<th>Maximum</th>
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<tr>
<td>Oxygen</td>
<td>20 - 22%/v</td>
</tr>
<tr>
<td>Carbon Monoxide</td>
<td>10 PPM/v</td>
</tr>
<tr>
<td>Carbon Dioxide</td>
<td>1000 PPM/v</td>
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<tr>
<td>Condensed Hydrocarbons</td>
<td>5 mg/m³</td>
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<tr>
<td>Total Hydrocarbons as Methane</td>
<td>25 PPM/v</td>
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<tr>
<td>Water Vapor ppm</td>
<td>(2)</td>
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<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 the standards for entry-level diver training as defined by the WRSTC and/or ISO. The Stanford Scientific Diving Program requires that divers enter the program with at least Advanced Open Water diver certification or equivalent under the auspices and standards of an internationally recognized diver training agency.

4.20 References
“Minimum Course Content for Open Water Diver Certification” - World Recreational Scuba Training Council (WRSTC), www.wrstc.com.

SECTION 5.00  SCIENTIFIC DIVER CERTIFICATION

STANFORD SCIENTIFIC DIVER TRAINING AND CERTIFICATION SEQUENCE SUMMARY

To earn Scientific Diver-In-Training certification:

- Scientist or scientist-in-training with Stanford affiliation
- Minimum of Advanced Open Water Diver or equivalent certification from an internationally recognized training agency
- Apply to Stanford University Scientific Diving Program
- Physician’s clearance to dive and Medical History on current AAUS/Stanford Diving Physical Exam form
- Divers Alert Network diving insurance (or document own diving medical coverage)
- Stanford diving waiver
- Equipment inspection/documentation of service within past 12 months
- Pass swim test
- Confined/open water skills evaluation

To earn Scientific Diver certification:

- Current Stanford DIT
- Emergency care training and current certification (minimum of CPR, First Aid, Emergency Oxygen Provider)
- Rescue Diver certification or equivalent from an internationally recognized training agency
- Successful completion of a minimum of 12 supervised DSO-approved training dives, minimum cumulative bottom time of 6 hours
- Completion of diving theory training, and scientific diver exam. Theoretical and practical training must total a minimum cumulative time of 100 hours
5.10 Prerequisites

Administrative

The applicant/candidate must complete all administrative and legal documentation required by the Stanford University Scientific Diving Program.

Diver Certification

The applicant/candidate must, at minimum, show documented proof of Advanced Open Water diver certification or equivalent from an internationally recognized training agency.

Medical Examination

The applicant/candidate must be medically qualified for diving as described in Section 6.0 of the AAUS Standards for Scientific Diving and this Diving 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.

a) Swim underwater for a distance of 25 yards/meters without surfacing.

b) Swim 400 yards/meters in less than 12 minutes.

c) Tread water for 10 minutes, or 2 minutes without the use of hands.

d) 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

The trainee must demonstrate to the Diving Safety Officer or instructor their ability to perform at least the following in a pool or in sheltered water:

a) Enter water with full equipment.
b) Clear face mask.
c) 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.
d) Demonstrate ability to alternate between snorkel and scuba while kicking.
e) Demonstrate understanding of underwater signs and signals.
f) Demonstrate simulated in-water mouth-to-mouth resuscitation.
g) Rescue and transport, as a diver, a passive simulated victim of an accident.
h) Demonstrate ability to remove and replace equipment while submerged.
i) Demonstrate watermanship ability which is acceptable to the instructor.

Open Water Evaluation

The trainee must demonstrate to the Diving Safety Officer or instructor their ability to perform at least the following in open water:

a) Surface dive to a depth of 10 feet in open water without scuba.
b) Demonstrate proficiency in air sharing as both donor and receiver.
c) Enter and leave open water or surf, or leave and board a diving vessel, while wearing scuba gear.
d) Kick on the surface 400 yards while wearing scuba gear, but not breathing from the scuba unit.
e) Demonstrate judgment adequate for safe diving.
f) Demonstrate, where appropriate, the ability to maneuver efficiently in the environment, at and below the surface.
g) Complete a simulated emergency swimming ascent.
h) Demonstrate clearing of mask and regulator while submerged.
i) Demonstrate ability to achieve and maintain neutral buoyancy while submerged.
j) Demonstrate techniques of self-rescue and buddy rescue.
k) Navigate underwater.
l) 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 DSO 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 active-status Scientific Diver with experience in the type of diving planned, with the knowledge and permission of the DSO.

5.30 Examinations

Written Exams

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

1. Function, care, use, and maintenance of diving equipment.
2. Physics and physiology of diving.
3. Diving regulations and precautions.
5. Dangerous marine animals.
6. Emergency procedures, including buoyant ascent and ascent by air sharing.
7. Currently accepted decompression procedures.
8. Demonstrate the proper use of dive tables.
10. Aspects of freshwater and altitude diving.
11. Hazards of breath-hold diving and ascents.
12. Planning and supervision of diving operations.
14. 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.

15. Suggested topics (from Sec. 5.20) at the DSO’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

Only a person diving under the auspices of Stanford University, which subscribes to the practices of AAUS, is eligible for a Stanford University 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. In Stanford’s Scientific Diving Program this permit signifies that a diver has completed and been certified as at least Advanced Open Water diver or equivalent through an internationally recognized certifying agency, and has the knowledge skills and experience necessary to continue training as a scientific diver under supervision, as approved by the DSO, and that the diver has met other prerequisites to dive under Stanford University auspices as summarized at the beginning of this section.

**Scientific Diver Certification**

This permit signifies a diver has completed all requirements in Section 5.0 and is authorized by Stanford University to engage in scientific diving without supervision, as approved by the DSO. 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 Stanford University scientific diving privileges.

### 5.50 Depth Certifications

**Depth Certifications and Progression to Next Depth Level**

A certified diver diving under the auspices of Stanford University may progress to the next depth level after successfully completing the required dives for the next level. Under these circumstances the diver

25
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.

a) Certification to 60 Foot Depth - Initial permit level, approved upon the successful completion of training listed in Section 4.00 and 5.00.

b) 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.

c) 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.

d) 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.

e) 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.

Re-qualification of Depth Certificate

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 procedures adopted by the DCB.

Medical Examination

All certified scientific divers shall pass a medical examination at the intervals specified in Section 6.0. After each major illness or injury, as described in Section 6.0, a certified scientific diver shall receive clearance to return to diving from a physician before resuming diving activities.

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. 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

- The DSO 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.

- 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.

- 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), the DSO has obtained the results of that examination, and has reviewed and found them satisfactory.

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

The organizational member 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 6.20 shall consist of the following:

1. Applicant agreement for release of medical information to the Diving Safety Officer and the DCB (Appendix 2b).

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)

a) Abnormalities of the tympanic membrane, such as perforation, presence of a monomeric membrane, or inability to auto inflate the middle ears.
b) Hearing loss; Vertigo including Meniere’s Disease.
c) Stapedectomy or middle ear reconstructive surgery.
d) Recent ocular surgery.
e) Psychiatric disorders including claustrophobia, suicidal ideation, psychosis, anxiety states, depression.
f) Substance abuse, including alcohol.
g) Episodic loss of consciousness.
h) History of seizure.
i) History of stroke or a fixed neurological deficit.
j) Recurring neurologic disorders, including transient ischemic attacks.
k) History of intracranial aneurysm, other vascular malformation or intracranial hemorrhage.
l) History of neurological decompression illness with residual deficit.
m) Head injury.
n) Hematologic disorders including coagulopathies.
o) Risk factors or evidence of coronary artery disease.
p) Atrial septal defects.
q) Significant valvular heart disease - isolated mitral valve prolapse is not disqualifying.
r) Significant cardiac rhythm or conduction abnormalities.
s) Implanted cardiac pacemakers and cardiac defibrillators (ICD).
t) Inadequate exercise tolerance.
u) Hypertension.
v) History of pneumothorax.
w) Asthma.
x) Chronic pulmonary disease, including radiographic evidence of pulmonary blebs, bullae or cysts.
y) Diabetes mellitus.
z) Pregnancy.

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 Assessment\(^1\) (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, the DSO 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. In any case other than approval this report will be reviewed by the DCB.

The organizational member shall make a copy of the physician’s written report available to the individual.

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Volume 2

Sections 7.00 and 8.00
SECTION 7.00  NITROX DIVING GUIDELINES

The following guidelines address the use of nitrox by scientific divers under the auspices of an AAUS Organizational Member. 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 a member organization 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.

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 DSO and members of the DCB that they are sufficiently skilled and proficient. The signature of the DSO 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 DSO 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:

1. 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 DSO and DCB (Section 7.30).

2. Examinations
   Each diver should demonstrate proficiency in skills and theory in written, oral, and practical examinations covering:
   - Written examinations covering the information presented in the classroom training session(s) (i.e., gas theory, oxygen toxicity, partial pressure determination, etc.)
   - Practical examinations covering the information presented in the practical training session(s) (i.e., gas analysis, documentation procedures, etc.)
   - 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 5.00).

*Classroom Instruction*

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.

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 5.00), with additional training as follows:

- Oxygen analysis of nitrox mixtures.
- Determination of MOD, oxygen partial pressure exposure, and oxygen toxicity time limits, for various nitrox mixtures at various depths.
- 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.
- 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:

- Function, care, use, and maintenance of equipment cleaned for nitrox use.
- Physical and physiological considerations of nitrox diving (ex.: O₂ and CO₂ toxicity).
- Diving regulations and procedures as related to nitrox diving, either scuba or surface-supplied (depending on intended mode).
- Given the proper information, calculation of:
3. Equivalent air depth (EAD) for a given fO2 and actual depth;
4. pO2 exposure for a given fO2 and depth;
5. Optimal nitrox mixture for a given pO2 exposure limit and planned depth;
6. Maximum operational depth (MOD) for a given mix and pO2 exposure limit;
7. 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.

- Dive table and dive computer selection and usage.
- Nitrox production methods and considerations.
- Oxygen analysis.
- Nitrox operational guidelines (Section 7.40), dive planning, and dive station components.

Open water Dives

A minimum of two supervised open water 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, in-water supervision is required.

Surface-Supplied Training

All training as applied to surface-supplied diving (practical, classroom, and open water) 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

- 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 DSO 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.

- 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 5.50.

- 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 DSO 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 (see Sec. 7.42).
Dive Parameters

Oxygen Exposure Limits

- 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”.
- 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.
- 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.

Bottom Time Limits

- Maximum bottom time should be based on the depth of the dive and the nitrox mixture being used.
- 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.

Dive Tables and Gases

- A set of DCB approved nitrox dive tables should be available at the dive site.
- When using the equivalent air depth (EAD) method, dives should be conducted using air dive tables approved by the DCB.
- 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.
- 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.

Nitrox Dive Computers

- 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.
- 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 DSO or designee.
- 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.
- 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.
Repetitive Diving

- Repetitive dives using nitrox mixtures should be performed in compliance with procedures required of the specific dive tables used.
- 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.
- 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.
- 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.

Oxygen Parameters

- Authorized Mixtures - Mixtures meeting the criteria outlined in Section 7.40 may be used for nitrox diving operations, upon approval of the DCB.
- Purity - Oxygen used for mixing nitrox-breathing gas should meet the purity levels for “Medical Grade” (U.S.P.) or “Aviator Grade” standards.
- In addition to the AAUS Air Purity Guidelines (Section 3.60), the following standard should be met for breathing air that is either:
  a) Placed in contact with oxygen concentrations greater than 40%.
  b) Used in nitrox production by the partial pressure mixing method with gas mixtures containing greater than 40% oxygen as the enriching agent.

<table>
<thead>
<tr>
<th>Air Purity: CGA Grade E (Section 3.60)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Condensed Hydrocarbons</td>
</tr>
<tr>
<td>Hydrocarbon Contaminants</td>
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</tbody>
</table>
Gas Mixing and Analysis for Organizational Members

**Personnel Requirements**

a) Individuals responsible for producing and/or analyzing nitrox mixtures should be knowledgeable and experienced in all aspects of the technique.

b) Only those individuals approved by the DSO and/or DCB should be responsible for mixing and/or analyzing nitrox mixtures.

**Production Methods**

It is the responsibility of the DCB to approve the specific nitrox production method used.

**Analysis Verification by User**

a) 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.

b) 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**

**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.

**Scuba Cylinder Identification Marking**

Scuba cylinders to be used with nitrox mixtures should have the following identification documentation affixed to the cylinder.

a) Cylinders should be marked “NITROX”, or “EANx”, or “Enriched Air”.

b) 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.

c) 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.
d) Other markings, which identify the cylinder as containing gas mixes other than Air, may be used as the approval of the DCB.A contents label should be affixed, to include the current fO₂, date of analysis, and MOD.

e) The cylinder should be labeled to indicate whether the cylinder is prepared for oxygen or nitrox mixtures containing greater than 40% oxygen.

*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.

*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.

*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.

*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.
SECTION 8.00 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 the AAUS. Organizational members using these must have guidelines established by their Diving Control Board. Divers shall comply with all scuba diving procedures in this standard unless specified.

8.10 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).

8.20 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.

8.30 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.

8.40 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.

8.50 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.

8.60 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.
Appendices
Appendix 1 through 9
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 Stanford University’s Scientific Diving Program. 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 the Undersea Hyperbaric and Medical Society or Divers Alert Network. Please contact the Diving Safety Officer ________________ at (831) 655-6245 if you have any questions or concerns about the Stanford University Scientific Diving Program standards. Thank you for your assistance.

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

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

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

______ 3 years (age 40-59)  

______ 5 years (under age 40)  

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

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

____________________________________________________
MD or DO ______________________________
Signature                                                                 Date

Name (Print or Type)_____________________________________________________________________________________________

Address______________________________________________________________________________________________________________

Telephone Number __________________________ E-Mail Address

My familiarity with applicant is: _____This exam only _____Regular physician for _______ years

My familiarity with diving medicine is: __________________________
APPENDIX 2b
AAUS MEDICAL EVALUATION OF FITNESS FOR SCUBA DIVING REPORT

APPLICANT'S RELEASE OF MEDICAL INFORMATION FORM

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

APPENDIX 3
DIVING MEDICAL HISTORY FORM
(To Be Completed By Applicant-Diver)

Name ______________________________________   Sex ____ Age ___  Wt.___ Ht. ___  D.O.B. ___/___/___
__________________________________________ Date ___/___/___
(Sponsor) ____________________________ (Dept./Project/Program/School, etc.) ____________________________
(Mo/Day/Yr) (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.

<table>
<thead>
<tr>
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<th>No</th>
<th>Please indicate whether or not the following apply to you</th>
<th>Comments</th>
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<tbody>
<tr>
<td>1</td>
<td></td>
<td>Convulsions, seizures, or epilepsy</td>
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<td>2</td>
<td></td>
<td>Fainting spells or dizziness</td>
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<td>3</td>
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<td>Been addicted to drugs</td>
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<td>4</td>
<td></td>
<td>Diabetes</td>
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<td>5</td>
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<td>Motion sickness or sea/air sickness</td>
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<td>6</td>
<td></td>
<td>Claustrophobia</td>
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<td>7</td>
<td></td>
<td>Mental disorder or nervous breakdown</td>
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<td>Are you pregnant?</td>
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<td>9</td>
<td></td>
<td>Do you suffer from menstrual problems?</td>
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<td>10</td>
<td></td>
<td>Anxiety spells or hyperventilation</td>
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<td>11</td>
<td></td>
<td>Frequent sour stomachs, nervous stomachs or vomiting spells</td>
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<td>12</td>
<td></td>
<td>Had a major operation</td>
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<td>13</td>
<td></td>
<td>Presently being treated by a physician</td>
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<td>14</td>
<td></td>
<td>Taking any medication regularly (even non-prescription)</td>
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<td>15</td>
<td></td>
<td>Been rejected or restricted from sports</td>
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<td>16</td>
<td></td>
<td>Headaches (frequent and severe)</td>
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<td>17</td>
<td></td>
<td>Wear dental plates</td>
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<td>18</td>
<td></td>
<td>Wear glasses or contact lenses</td>
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<td>19</td>
<td></td>
<td>Bleeding disorders</td>
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<td>20</td>
<td></td>
<td>Alcoholism</td>
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<td>21</td>
<td></td>
<td>Any problems related to diving</td>
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<td>22</td>
<td></td>
<td>Nervous tension or emotional problems</td>
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<td>Yes</td>
<td>No</td>
<td>Please indicate whether or not the following apply to you</td>
<td>Comments</td>
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<tr>
<td>23</td>
<td></td>
<td>Take tranquilizers</td>
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<td>24</td>
<td></td>
<td>Perforated ear drums</td>
<td></td>
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<td>25</td>
<td></td>
<td>Hay fever</td>
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<td>26</td>
<td></td>
<td>Frequent sinus trouble, frequent drainage from the nose, post-nasal drip, or stuffy nose</td>
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<td>27</td>
<td></td>
<td>Frequent earaches</td>
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<td>28</td>
<td></td>
<td>Drainage from the ears</td>
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<td>29</td>
<td></td>
<td>Difficulty with your ears in airplanes or on mountains</td>
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<td>30</td>
<td></td>
<td>Ear surgery</td>
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<td>31</td>
<td></td>
<td>Ringing in your ears</td>
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<td>32</td>
<td></td>
<td>Frequent dizzy spells</td>
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<td></td>
<td>Hearing problems</td>
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<td>34</td>
<td></td>
<td>Trouble equalizing pressure in your ears</td>
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<td>35</td>
<td></td>
<td>Asthma</td>
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<td>36</td>
<td></td>
<td>Wheezing attacks</td>
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<td>37</td>
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<td>Cough (chronic or recurrent)</td>
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<td>38</td>
<td></td>
<td>Frequently raise sputum</td>
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<td>Pleurisy</td>
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<td>Collapsed lung (pneumothorax)</td>
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<td>Lung cysts</td>
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<td>42</td>
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<td>Pneumonia</td>
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<td>43</td>
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<td>Tuberculosis</td>
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<td></td>
<td>Shortness of breath</td>
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<td>Lung problem or abnormality</td>
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<td>46</td>
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<td>Spit blood</td>
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<td>Breathing difficulty after eating particular foods, after exposure to particular pollens or animals</td>
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<td>48</td>
<td></td>
<td>Are you subject to bronchitis</td>
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<td>49</td>
<td></td>
<td>Subcutaneous emphysema (air under the skin)</td>
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<td>Air embolism after diving</td>
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<td>51</td>
<td></td>
<td>Decompression sickness</td>
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<td>52</td>
<td></td>
<td>Rheumatic fever</td>
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<td>53</td>
<td></td>
<td>Scarlet fever</td>
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<td>54</td>
<td></td>
<td>Heart murmur</td>
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<td>55</td>
<td></td>
<td>Large heart</td>
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<td>56</td>
<td></td>
<td>High blood pressure</td>
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<td>Angina (heart pains or pressure in the chest)</td>
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<td>58</td>
<td></td>
<td>Heart attack</td>
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<td>Yes</td>
<td>No</td>
<td>Please indicate whether or not the following apply to you</td>
<td>Comments</td>
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<tr>
<td>59</td>
<td></td>
<td>Low blood pressure</td>
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<td></td>
<td>Recurrent or persistent swelling of the legs</td>
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<td>61</td>
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<td>Pounding, rapid heartbeat or palpitations</td>
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<td>62</td>
<td></td>
<td>Easily fatigued or short of breath</td>
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<td>63</td>
<td></td>
<td>Abnormal EKG</td>
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<td>64</td>
<td></td>
<td>Joint problems, dislocations or arthritis</td>
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<td>65</td>
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<td>Back trouble or back injuries</td>
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<td>66</td>
<td></td>
<td>Ruptured or slipped disk</td>
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<td>67</td>
<td></td>
<td>Limiting physical handicaps</td>
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<td>68</td>
<td></td>
<td>Muscle cramps</td>
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<td>69</td>
<td></td>
<td>Varicose veins</td>
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<td>70</td>
<td></td>
<td>Amputations</td>
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<tr>
<td>71</td>
<td></td>
<td>Head injury causing unconsciousness</td>
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<tr>
<td>72</td>
<td></td>
<td>Paralysis</td>
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<td>73</td>
<td></td>
<td>Have you ever had an adverse reaction to medication?</td>
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<td>74</td>
<td></td>
<td>Do you smoke?</td>
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<td>75</td>
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<td>Have you ever had any other medical problems not listed? If so, please list or describe below;</td>
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<tr>
<td>76</td>
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<td>Is there a family history of high cholesterol?</td>
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<tr>
<td>77</td>
<td></td>
<td>Is there a family history of heart disease or stroke?</td>
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<td>78</td>
<td></td>
<td>Is there a family history of diabetes?</td>
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<td>79</td>
<td></td>
<td>Is there a family history of asthma?</td>
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<tr>
<td>80</td>
<td></td>
<td>Date of last tetanus shot? Vaccination dates?</td>
<td></td>
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</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.

Signature          Date
APPENDIX 4

RECOMMENDED PHYSICIANS WITH EXPERTISE IN DIVING MEDICINE

Medical Doctors that have training and expertise in diving or undersea medicine. Level I graduates of the Undersea Hyperbaric and Medical Society (UHMS) Fitness to Dive courses (approximately 250 physicians) are listed at http://membership.uhms.org/?page=DivingMedical (UHMS website, go to Resources, go to Library, go to Diving Medical Examiners)

Contact Divers Alert Network for Diving Medical Examiners in your area.
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 \( p_{O_2} \) 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.
\( pN_2 \) - Inspired partial pressure of nitrogen, usually expressed in units of atmospheres absolute.

\( pO_2 \) - Inspired partial pressure of oxygen, usually expressed in units of atmospheres absolute.

\( \text{Psi} \) - Unit of pressure, “pounds per square inch.

\( \text{Psig} \) - 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

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

Diver: ___________________________ Date: ________________

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

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

(Date)
_____ Original diving authorization
_____ Written scientific diving examination
_____ Last diving medical examination Medical examination expiration date __________
_____ Most recent checkout dive
_____ Scuba regulator/equipment service/test
_____ CPR training (Agency) CPR Exp. __________
_____ Oxygen administration (Agency) 02 Exp. __________
_____ First aid for diving F.A. Exp. __________
_____ Date of last dive Depth
Number of dives completed within previous 12 months? Depth Certification _______ fsw
Total number of career dives? _______

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

Please indicate any pertinent specialty certifications or training:

Emergency Information:
Name: ___________________________ Relationship: ___________________________
Telephone: ___________________________ (work) ___________________________ (home)
Address: ___________________________

This is to verify that the above individual is currently a certified scientific diver in Stanford University’s Scientific Diving Program

Diving Safety Officer:
______________________________ ___________________________
(Signature) (Date)

(Print)
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
8. Complete and submit Incident Report Form (www.aaus.org) to the DCB and the AAUS (Section 2.70 Required Incident Reporting).

List of Emergency Contact Numbers Appropriate For Dive Location

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<thead>
<tr>
<th>Name</th>
<th>Telephone</th>
<th>Relationship</th>
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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.

10. 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.

11. Multiple deep dives require special consideration.
APPENDIX 9
AAUS STATISTICS COLLECTION CRITERIA AND DEFINITIONS

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

- Dive 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 divers 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:
  ▪ Arterial Gas Embolism.
- DCS symptoms requiring multiple hyperbaric treatment.
- Near drowning.
- Oxygen Toxicity.
- Hypercapnea.
- Spinal injuries.
- Heart attack.
- Fatality.