

CALIFORNIA STATE UNIVERSITY  
**OCEAN STUDIES INSTITUTE**  
**DIVE SAFETY MANUAL**  
**Revised January 2009**

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## 1.00 OCEAN STUDIES INSTITUTE SCIENTIFIC DIVING PROGRAM

The Ocean Studies Institute (OSI) is a consortium of participating California State University System (CSU) campuses. The mission of OSI is to facilitate research in the marine sciences. OSI is funded through the CSU Office of the Chancellor and run by a board of directors composed of marine scientists and/or administrators from member campuses. OSI maintains a fleet of research vessels staffed by marine science professionals, each linked to the host campus, California State University, Long Beach (CSULB). Maintenance of a Scientific Diving Program, open to participants from member campuses, is an important role of OSI. This OSI Diving Safety Manual is a key element of the scientific diving program in support of marine research.

### 1.10 THE SCIENTIFIC DIVING STANDARDS

#### 1.11 Scientific Diving Standards - Overview

The purpose of these diving standards are to ensure that all diving under the auspices of California State University's Ocean Studies Institute is conducted in a manner that will maximize protection of divers from accidental injury and/or illness, and to set forth standards for training and certification which will allow a working reciprocity with other scientific diving programs.

This manual has been developed and written with the assistance of the American Academy of Underwater Sciences, which is the premier diving safety entity in the United States. AAUS shares a common heritage with the diving program at the Scripps Institution of Oceanography (SIO). SIO standards have a proven record of safety and effectiveness dating back to 1954.

#### 1.12 Regulatory References for Scientific Diving Programs

"Scientific diving" gives the researcher much more regulatory flexibility for complex tasks than "commercial" divers. OSI dive operations shall only be of the scientific type. Commercial or industrial type diving such as salvage, maintenance or repair may not be performed under the auspices of the OSI. Scientific diving is defined in Cal/OSHA regulations in Title 8 of the California Code of Regulations (8CCR) in section 6051 et. seq. The parallel Federal OSHA reference is 29 CFR 1910.402.

### 1.13 Scientific Diving Exemption

Federal and Cal/OSHA have granted an exemption from the rigid commercial diving standard/regulations, for scientific diving. This exemption is allowed ONLY if the diving operations are performed solely as a necessary part of a scientific, research, or educational activity by employees and students whose sole purpose for diving is to perform scientific research tasks. In addition to this mandate, the following elements of a scientific diving program must be established and maintained to qualify as a scientific diving program:

1.13.1 A Diving Control 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 an appropriate buddy system for scuba diving.

1.13.2 A mechanism to monitor the tasks of program divers to confirm that they are restricted to observation and data acquisition, conducted by scientists or scientists-in-training. Commercial-type construction or trouble-shooting shall not be conducted.

1.13.3 A Diving Safety Manual which includes as a minimum: Procedures covering all diving operations specific to the program; procedures for emergency care, recompression and evacuation; criteria for diver training and certification; program administration. The manual shall provide for the development and implementation of policies and procedures to ensure that the program meets the requirements of local environments and conditions as well as to comply with current AAUS scientific diving standards and Cal/OSHA regulations. Safety procedures and equipment use/maintenance shall also be addressed therein.

### 1.1.20 OPERATIONAL CONTROL OF DIVING

#### 1.23 A Diving Safety Officer

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

research related diving.

#### 1.23.1 Qualifications

- 1.23.1.1 Shall be appointed with the approval of the OSI Board of Directors, with the advice and counsel of the Diving Control Board.
- 1.23.1.2 Shall be trained as a scientific diver.
- 1.23.1.3 Shall be a member of the AAUS.
- 1.23.1.4 Shall be certified as a scuba diving instructor or have equivalent diving supervisory experience.

#### 1.23.2 Duties and Responsibilities

- 1.23.2.1 Shall be responsible, through the Diving Control Board, and to the Director, OSI, for the conduct of the OSI scientific diving program. 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 manual and all relevant regulations of the OSI, rests with the Diving Safety Officer.
- 1.23.2.2 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.
- 1.23.2.3 Shall be guided in the performance of the required duties by the advice of the Diving Control Board, but operational responsibility for the conduct of the local diving program will be retained by the Diving Safety Officer.
- 1.23.2.4 Shall suspend diving operations which he/she considers to be unsafe or unwise.

#### 1.24 The Diving Control Board

- 1.24.1 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 his/her designee. Other voting members shall be chosen from among

active divers in the OSI diving program. OSI DCB membership divers and members selected by the DCB and approved by the OSI Board of Directors. A chairperson and a secretary may be chosen from the membership of the DCB.

- 1.24.2 Has autonomous and absolute authority over the diving program's operation.
- 1.24.3 Shall approve and monitor diving projects.
- 1.24.4 Shall review and revise the diving safety manual.
- 1.24.5 Shall assure compliance with the manual.
- 1.24.6 Shall certify the depths to which a diver has been trained.
- 1.24.7 Shall take disciplinary action for unsafe practices.
- 1.24.8 Shall assure adherence to the buddy system for scuba diving.
- 1.24.9 Shall act as the official representative of the OSI DCB in matters concerning the diving program.
- 1.24.10 Shall act as a board of appeal to consider diver-related problems.
- 1.24.11 Shall recommend the issue, reissue, or the revocation of diving certifications.
- 1.24.12 Shall recommend major changes in policy to the CSULB Office of Safety and Risk Management or the Office of the Chancellor as appropriate concerning the OSI diving program.
- 1.24.13 Shall establish and/or approve training programs through which the applicants for certification can satisfy the requirements of the OSI Diving Safety Manual.
- 1.24.14 Shall suspend diving programs which it considers to be unsafe or unwise.
- 1.24.15 Shall establish criteria for equipment selection and use.
- 1.24.16 Shall recommend new equipment or techniques.
- 1.24.17 Shall establish and/or approve facilities for the inspection and

maintenance of diving and associated equipment.

- 1.24.18 Shall ensure that any station(s) employed meet air quality standards as described in this manual.
- 1.24.19 Shall periodically review the Diving Safety Officer's performance and program.
- 1.24.20 Shall sit as a board of investigation to inquire into the nature and cause of diving accidents or violations of OSI protocols.

## 1.25 Instructional Personnel

### 1.25.1 Qualifications

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

### 1.25.2 Selection

Instructional personnel will be selected by the OSI Board of Directors or their designee, who will solicit the advice of the Diving Control Board in conducting preliminary screening of applicants for instructional positions.

## 1.26 Lead Diver

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

- 1.26.1 Coordination with other known activities in the vicinity, which are likely to interfere with diving operations.
- 1.26.2 Ensuring all dive team members possess current certification and are qualified for the type of diving operation.
- 1.26.3 Planning dives in accordance with section 2.21
- 1.26.4 Ensuring safety and emergency equipment is in working order and at the dive site.
- 1.26.5 Briefing the dive team members on:
  - 1.26.5.1 Dive objectives.

1.26.5.2 Unusual hazards or environmental conditions likely to affect the safety of the diving operation.

1.26.5.3 Modifications to diving or emergency procedures necessitated by the specific diving operation.

1.26.6 Suspending diving operations if in his/her opinion conditions are not safe.

1.26.7 Reporting to the DSO and Diving Control Board any physical problems or adverse physiological effects, including symptoms of pressure-related injuries (Decompression Sickness or DCS).

## 1.27 Reciprocity and Visiting Divers

1.27.1 Two or more organizations 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.

1.27.2 A diver from any other organization shall apply for permission to dive under the auspices of OSI in writing. An acceptable "letter of reciprocity" from the applicant-diver's Diving Safety Officer or Chair of the home Diving Control Board shall be forwarded to the OSI DSO.

1.27.3 A visiting diver may be asked to demonstrate his/her knowledge and skills for the planned diving. An example of items to be demonstrated is presented in the Appendix (see "checkout dive").

1.27.4 If the OSI DCB denies a visiting diver permission to dive, the reason for denial shall be declared to the visiting diver and his/her Diving Control Board.

## 1.28 Waiver of Requirements

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

## 1.29 Consequence of Violation of Regulations by OSI Divers

Failure to comply with the regulations of this diving manual may be cause for

the revocation or restriction of the diver's certificate by action of the Diving Control Board. The DSO will notify the appropriate administrator(s)/supervisor at the home campus of the revocation and/or other disciplinary action. scientific data collected out of compliance with OSI dive regulations may be declared unacceptable by the faculty supervisor for academic purposes.

### 1.30 CONSEQUENCES OF VIOLATION OF REGULATIONS

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

### 1.40 RECORD MAINTENANCE - DIVE PROGRAM

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

#### 1.40.1 Availability of Records:

1.40.1.1 Medical records shall be available to the attending physician of a diver or former diver when released in writing by the diver.

1.40.1.2 Records and documents required by this standard shall be retained by the OSI and/or the appropriate CSU campus for the following period:

1.40.1.2.1 Physician's written reports of medical examinations for divers - 5 years.

1.40.1.2.2 Manual for diving safety - A copy of the current OSI Diving Safety Manual shall be kept available at all times.

1.40.1.2.3 Records of dive - 1 year, except 5 years where there has been an incident of pressure-related injury.

1.40.1.2.4 Pressure-related injury assessment from the attending physician(s) - 5 years.

1.40.1.2.5 Equipment inspection and testing records - current documentation until equipment is withdrawn from service.



## 1.500 Liability and Insurance

In adopting the policies set forth in this manual, the OSI assumes no liability not otherwise imposed by law. Outside of those University employees diving in the course of their employment (through Workman's Compensation Insurance), each diver is considered to be voluntarily performing activities for which he/she assumes all risks, consequences and potential liability and is not protected by any health or medical policy or program (other than the limited Student Health Services for enrolled students through their respective campus).

Diver insurance (DAN, PADI, ETC) is required. Personal health insurance is strongly recommended. OSI and the host campus provides no coverage beyond their Student Health Center for student divers.

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## 2.10 INTRODUCTION

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

## 2.20 PRE-DIVE PROCEDURES

### 2.21 Dive Plans

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

2.21.1 Divers' qualifications, and the type of certificate or certification held by each diver.

2.21.2 Emergency Plan (see Appendix) with the following information:

2.21.2.1 Name, telephone number, and relationship of person to be contacted for each diver in the event of an emergency.

2.21.2.2 Nearest operational recompression chamber.

2.21.2.3 Nearest accessible hospital.

2.21.2.4 Available means of transport.

2.21.3 Approximate number of proposed dives.

2.21.4 Location(s) of proposed dives.

2.21.5 Estimated depth(s) and bottom time(s) anticipated.

2.21.6 Decompression status and repetitive dive plans, if required.

2.21.7 Proposed work, equipment, and boats to be employed.

2.21.8 Any hazardous conditions anticipated.

## 2.22 Pre-dive Safety Checks

### 2.22.1 Diver's Responsibility:

2.22.1.1 Each scientific diver shall conduct a functional check of his/her diving equipment in the presence of the diving buddy or tender.

2.22.1.2 It is the diver's responsibility and duty to refuse to dive if, in his/her judgement, conditions are unfavorable, or if he/she would be violating the precepts of his/her training, or this manual.

2.22.1.3 No dive team member shall be required to be exposed to hyperbaric conditions against his/her will, except when necessary to prevent or treat a pressure-related injury.

2.22.1.4 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.

### 2.22.2 Equipment Evaluations

2.22.2.1 Each diver shall insure that his/her equipment is in proper working order and that the equipment is suitable for the type of diving operation.

2.22.2.2 Each diver shall have the capability of achieving and

maintaining positive buoyancy.

### 2.22.3 Site Evaluation

The environmental conditions at the site will be evaluated by the dive team members.

## 2.30 DIVING PROCEDURES

### 2.31 Buddy System and Solo Diving Prohibition

All diving activities shall assure adherence to the buddy system (pairs of 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. For OSI auspice dives, the buddy must also be a current participant in the OSI program.

### 2.32 Refusal to Dive

2.32.1 The decision to dive is that of the diver. A diver may refuse to dive, without fear of reprisal, whenever he/she feels it is unsafe for them to make the dive.

2.32.2 The ultimate responsibility for safety rests with the individual diver. It is the diver's responsibility and duty to refuse to dive if, in his/her judgment, conditions are unsafe or unfavorable, or if he/she would be violating the precepts of his/her training or the regulations in this manual.

### 2.33 Termination of the Dive

2.33.1 It is the responsibility of the diver to terminate the dive, without fear of reprisal, whenever he/she feels it is unsafe to continue the dive, unless it compromises the safety of another diver already in the water.

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

### 2.34 Emergencies and Deviations from Regulations

Any diver may deviate from the requirements of this manual to the extent

necessary to prevent or minimize a situation, which is likely to cause death, serious physical harm, or major environmental damage. A written report of such actions must be submitted to the Diving Control Board explaining the circumstances and justifications.

## 2.40 POST-DIVE PROCEDURES

### 2.41 Post-Dive Safety Checks

2.41.1 After the completion of a dive, each diver shall report any physical problems, symptoms of decompression illness, or equipment malfunctions. Symptoms that appear later shall be reported to the DSO or other appropriate campus authorities. Any physician consulted shall be apprised of the possibility of a pressure injury.

2.41.2 When diving outside the no-decompression limits, the divers should remain awake for at least one hour after diving, and in the company of a dive team member who is prepared to transport him/her to a hyperbaric chamber, if necessary.

## 2.50 EMERGENCY PROCEDURES

OSI emergency procedures are indicated in Appendix 9 on page 61 of this manual. Procedures shall be developed as appropriate for each dive/location/condition. The procedure shall be immediately available in written form to all divers and dive support personnel. The procedure shall also be reviewed at the dive site during the pre-dive briefing.

## 2.60 ASCENDING TO ALTITUDE AFTER DIVING

### 2.61 Flying After Diving

Divers should have a minimum surface interval of 12 hours before ascending to altitude. Considerations should be given to extending this interval to a minimum of 24 hours following repetitive or decompression diving during the last dive day.

### 2.62 Driving To Altitude

Divers driving to altitudes greater than 2000 feet above sea level must consider the effects of the elevation and plan a surface interval sufficient enough to avoid decompression injury.

## 2.70 RECORDKEEPING AND REQUIREMENTS - INDIVIDUAL DIVERS

### 2.71 Personal Diving Log

Each diver shall log every dive made under the auspices of the OSI program, and is encouraged to log all other dives. Use the standard form available from the DSO, or the OSI web page. Dive Log sheets shall be submitted to the Diving Safety Officer for review and filing. OSI encourages all divers to submit dive logs on a monthly basis. At a minimum, quarterly submission of the logs is required. OSI diving logs shall, at a minimum, contain the following information:

2.71.1 Name of diver, partner, and Lead Diver.

2.71.2 Date, time, and location.

2.71.3 Diving modes used.

2.71.4 General nature of diving activities.

2.71.5 Approximate surface and underwater conditions.

2.71.6 Maximum depths, bottom time and surface interval time.

2.71.7 Diving tables or computers used.

2.71.8 Detailed report of any near or actual incidents.

### 2.72 Other mandatory diver records

2.72.1 Physicians release

2.72.2 Equipment maintainance

2.72.2 CPR evidence of training

2.72.4 First Aid evidence of training

2.72.5 Oxygen First Aid evidence of training

### 2.73 Required Incident Reporting

All diving incidents requiring recompression treatment, or resulting in moderate or serious injury, or death shall be reported to the Diving

Control Board, the appropriate authority at the applicable CSU campus (Worker's Comp. administrator or Student Health Center as appropriate), The Office of Safety and Risk Management for the applicable CSU Campus, and to the AAUS. AAUS reporting criteria shall be used. The report will specify the circumstances of the incident and the extent of any injuries or illnesses. Information that must be relayed includes a description of the incident and the following information:

2.73.2 If pressure-related injuries are suspected, or if symptoms are evident, the following additional information shall be recorded and retained by the OSI DSO and by any applicable campus personnel, with the record of the dive, for a period of 5 years:

2.73.2.1 Complete AAUS Incident Report Form at <http://www.aaus.org>

2.73.2.2 Written descriptive report to include:

2.73.2.2.1 Name, address, phone numbers of the principal parties involved.

2.73.2.2.2 Summary of experience of divers involved.

2.73.2.2.3 Location, description of dive site and description of conditions that led up to incident.

2.73.2.2.4 Description of symptoms, including depth and time of onset.

2.73.2.2.5 Description and results of treatment.

2.73.2.2.6 Disposition of case.

2.73.2.2.7 Recommendations to avoid repetition of incident.

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### 3.10 GENERAL POLICY

3.10.1 All equipment shall meet standards as determined by the Diving Safety Officer and the Diving Control Board. Equipment that is subjected to extreme usage under adverse conditions should

require more frequent testing and maintenance.

3.10.2 All equipment shall be regularly examined by the person using it.

## 3.20 EQUIPMENT

### 3.21 Regulators

3.21.1 Approval. Only those makes and models specifically approved by the Diving Safety Officer and the Diving Control Board shall be used.

3.21.2 Inspection and testing. Scuba regulators shall be inspected and tested prior to first use and every twelve months thereafter.

3.21.3 Regulators will consist of a primary second stage and an alternate air source (such as an octopus second stage or redundant air supply).

### 3.22 Breathing Masks and Helmets

Breathing masks and helmets shall have:

3.22.1 A non-return valve at the attachment point between helmet or mask hose, which shall close readily and positively.

3.22.2 An exhaust valve.

3.22.3 A minimum ventilation rate capable of maintaining the diver at the depth to which he/she is diving.

### 3.23 Scuba Cylinders

3.23.1 Scuba cylinders shall be designed, constructed, and maintained in accordance with the applicable provisions of the Unfired Pressure Vessel Safety Orders.

3.23.2 Scuba cylinders must be hydrostatically tested in accordance with DOT standards.

3.23.3 Scuba cylinders must have an internal inspection at intervals not to exceed twelve months.

3.23.4 Scuba cylinder valves shall be functionally tested at intervals

not to exceed twelve months.

### 3.24 Backpacks and harnesses

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.

### 3.25 Gauges

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

### 3.26 Flotation Devices

3.26.1 Each diver shall have the capability of achieving and maintaining positive buoyancy.

3.26.2 Personal flotation systems, buoyancy compensators, dry suits, or other variable volume buoyancy compensation devices shall be equipped with an exhaust valve.

3.26.3 These devices shall be functionally inspected and tested at intervals not to exceed twelve months.

### 3.27 Timing Devices, Depth and Pressure Gauges

Each diver must have an underwater timing device, an approved depth indicator, and a submersible pressure gauge.

### 3.28 Determination of Decompression Status: Dive Tables and Computers

3.28.1 A set of diving tables, approved by the Diving Control Board, must be available at the dive location.

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..... . AAUS recommendations on dive computers are available at <http://www.aaus.org>

## 3.30 AUXILIARY EQUIPMENT

### 3.31 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

#### 3.41 First Aid Supplies

A first aid kit and emergency oxygen shall be available.

#### 3.42 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.

#### 3.43 OSI Controlled Compressor Systems

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

3.43.1 Low pressure compressors used to supply air to the diver if equipped with a volume tank shall have a check valve on the inlet side, a relief valve, and a drain valve.

3.43.2 Compressed air systems over 500 psig shall have slow-opening shut-off valves.

3.43.3 All air compressor intakes shall be located away from areas containing exhaust or other contaminants.

#### 3.44 Oxygen Systems

3.44.1 Equipment used with oxygen or mixtures containing over forty percent (40%) by volume oxygen shall be designed and maintained for oxygen service.

3.44.2 Components exposed to oxygen or mixtures containing over forty percent (40%) by volume oxygen shall be cleaned of flammable materials before being placed into service.

3.44.3 Oxygen systems over 125 psig shall have slow-opening shut-off

valves.

### 3.50 EQUIPMENT MAINTENANCE

#### 3.51 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:

- 3.51.1 Regulators
- 3.51.2 Submersible pressure gauges
- 3.51.3 Depth gauges
- 3.51.4 Scuba cylinders
- 3.51.5 Cylinder valves
- 3.51.6 Diving helmets
- 3.51.7 Submersible breathing masks
- 3.51.8 Compressors
- 3.51.9 Gas control panels
- 3.51.10 Air storage cylinders
- 3.51.11 Air filtration systems
- 3.51.12 Analytical instruments
- 3.51.13 Buoyancy control devices
- 3.51.14 Dry suits

#### 3.52 Compressor Operation and Air Test Records

- 3.52.1 Gas analyses and air tests shall be performed on any OSI-controlled breathing air compressor at regular intervals of no more than 100 hours of operation or six months, whichever

occurs first. The results of these tests shall be entered in a formal log.

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

### 3.60 AIR QUALITY STANDARDS

Breathing air for scuba shall meet the following specifications as set forth by the Compressed Gas Association (CGA Pamphlet G-7.1) and referenced in OSHA 29 CFR 1910.134.

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<u>Component</u>	<u>Maximum</u>
Oxygen	20 - 22%/v
Carbon Monoxide	10 PPM/v
Carbon Dioxide	1000 PPM/v
Condensed Hydrocarbons	5 mg/m <sup>3</sup>
Water Vapor	NS
Objectionable Odors	None

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This section describes training for the non diving applicant previously not certified for diving, and equivalency for the certified diver.

### 4.10 EVALUATION

#### 4.11 Medical Examination

The applicant for training shall be approved by a licensed physician to be medically qualified for diving before proceeding with the training as designated in Sec. 4.20 (see Sec. 6.00 and Appendices 1 through 6).

#### 4.12 Swimming Evaluation

The applicant for training shall successfully perform the following tests, or their equivalent, in the presence of the Diving Safety Officer, or an examiner approved by the Diving Safety Officer.

- 4.12.1 Swim underwater without swim aids for a distance of 25 yards without surfacing.
- 4.12.2 Swim 400 yards in less than 12 minutes without swim aids.
- 4.12.3 Tread water for 10 minutes, or 2 minutes without the use of hands, without swim aids.
- 4.12.4 Without the use of swim aids, transport another person of equal size a distance of 25 yards in the water.

#### 4.20 SCUBA TRAINING

##### 4.21 Practical Training

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

- 4.21.1 Assemble, adjust and don scuba equipment and complete pre-dive equipment check for self and buddy
- 4.21.2 Enter water with full equipment.
- 4.21.3 Clear face mask.
- 4.21.4 Demonstrate air sharing, including both buddy breathing and the use of alternate air source, as both donor and recipient, with and without a face mask.
- 4.21.5 Demonstrate ability to alternate between snorkel and scuba while kicking.
- 4.21.6 Demonstrate understanding of underwater signs and signals.
- 4.21.7 Demonstrate simulated in-water mouth-to-mouth

resuscitation.

- 4.21.8 As a diver, demonstrate the rescue, from the bottom, of a diver simulating unconsciousness and transport of the victim to safety.
- 4.21.9 Demonstrate ability to remove and replace equipment at the surface and while submerged.
- 4.21.10 Demonstrate proper weighting and competency in the use of the buoyancy system at the surface and the ability to achieve and maintain neutral buoyancy while submerged.
- 4.21.11 Demonstrate watermanship ability, which is acceptable to the instructor.

#### 4.22 Written Examination

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

- 4.22.1 Function, care, use, and maintenance of diving equipment.
- 4.22.2 Physics and physiology of diving.
- 4.22.3 Diving regulations and precautions.
- 4.22.4 Near-shore currents and waves.
- 4.22.5 Dangerous marine animals.
- 4.22.6 Emergency procedures, including buoyant ascent and ascent by air sharing.
- 4.22.7 Currently accepted decompression procedures.
- 4.22.8 Demonstrate the proper use of dive tables.
- 4.22.9 Underwater communications.
- 4.22.10 Aspects of freshwater and altitude diving.
- 4.22.11 Hazards of breath-hold diving.

- 4.22.12 Planning and supervision of diving operations.
- 4.22.13 Diving hazards.
- 4.22.14 Cause, symptoms, treatment, and prevention of the following: near drowning, air embolism and related injuries, carbon dioxide excess, carbon monoxide, squeezes and blocks, oxygen poisoning, nitrogen narcosis, exhaustion and panic, respiratory fatigue, motion sickness, decompression sickness, hypothermia, hyperthermia, hypoxia/anoxia, and other diving maladies.

#### 4.23 Open Water Evaluation

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

- 4.23.1 Demonstrate effective pre-dive dive site orientation and dive planning including the recognition of potential hazards and discussion of emergency procedures.
- 4.23.2 Assemble, adjust and don scuba equipment and complete pre-dive equipment check for self and buddy.
- 4.23.3 Surface dive to a depth of 10 feet in open water without scuba.
- 4.23.4 Demonstrate proficiency in air sharing, including ascents, utilizing both buddy breathing and an alternate air source, as both donor and receiver.
- 4.23.5 Enter and leave open water or surf, or leave and board a diving vessel, while wearing scuba gear.
- 4.23.6 Kick on the surface 400 yards while wearing scuba gear, but not breathing from the scuba unit.
- 4.23.7 Demonstrate skill and judgment adequate for safe diving.
- 4.23.8 Demonstrate, where appropriate, the ability to maneuver efficiently in the environment, at and below the surface.
- 4.23.9 Complete a simulated emergency swimming ascent.
- 4.23.10 Demonstrate clearing of mask and regulator while submerged.

- 4.23.11 Demonstrate proper weighting and competency in the use of the buoyancy system at the surface and the ability to achieve and maintain neutral buoyancy while submerged.
- 4.23.12 Demonstrate techniques of self-rescue and buddy rescue.
- 4.23.13 As a diver, demonstrate the rescue, from the bottom, of a diver simulating unconsciousness and transport of the victim to safety.
- 4.23.14 Demonstrate ability to remove and replace equipment at the surface and while submerged.
- 4.23.15 Demonstrate understanding of underwater signs and signals.
- 4.23.16 Demonstrate proper ascent including a safety stop.
- 4.23.17 Navigate underwater.
- 4.23.18 Plan and execute a dive.
- 4.23.19 Successfully complete 7 open water dives, of which 6 must be scuba, for a minimum total in-water time of 4 hours, of which 2 hours cumulative bottom time must be on scuba. No more than 3 training dives shall be made in any one day.

#### 4.30 DIVER-IN-TRAINING PERMIT LEVEL

This permit signifies that a diver has completed a minimum of 40 hours of training with at least 7 ocean or open water dives, and possesses a nationally recognized diving certificate.

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#### 5.10 CERTIFICATION TYPES

##### 5.10.1 OSI Scientific Diver Certification.

This is a permit to dive, usable only while it is current and for the purpose intended.

### 5.10.2 OSI Diver-In-Training Permit

This permit signifies that a diver has completed and been certified as at least an open water diver through a nationally or internationally recognized certifying agency, scientific diving program, or its equivalent. This diver may participate in further scientific diver training and, at the discretion of the Diving Safety Officer, may serve a diving buddy on dives shallower than 30 feet for the purpose of gaining additional experience and logging additional dives leading toward the minimums for OSI Scientific Diver Certification.

### 5.10.3 OSI Temporary Diver Permit.

This permit constitutes a waiver of the requirements of Sec. 5.00 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 manual.

Requirements of Sec. 5.31 and 5.32 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 manual, including medical requirements.

## 5.20 GENERAL POLICY

The OSI requires that no person shall engage in scientific diving unless that person is authorized pursuant to the provisions of this manual. The following are considered minimal standards for a scientific diver certification.

### 5.21 Prerequisites

Diver-In-Training Permit (Section 4.00).

### 5.22 Eligibility

Only a person diving under the auspices of an organization that subscribes to the practices of the AAUS is eligible for a scientific diver certification.



### 5.23 Application

Application for certification shall be made to the Diving Safety Officer on the prescribed form.

### 5.24 Medical Examination

Each applicant for diver certification shall submit a statement from a licensed physician, based on an approved medical examination, attesting to the applicant's fitness for diving (see Sec. 6.00 and Appendices 1-6).

## 5.30 REQUIREMENTS FOR OSI SCIENTIFIC DIVER CERTIFICATION

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 Diving Control Board that he/she is 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 his/her partner, may be denied OSI diving privileges. Minimum documentation and examinations required are as follows:

### 5.31 Documents

5.31.1 Application for certification.

5.31.2 Medical approval.

5.31.3 Proof of diver-in-training permit level or its equivalent.

5.31.4 Emergency Care Training.

The trainee must provide proof of current training in the following:

a. cardiopulmonary resuscitation (CPR).

b. emergency oxygen administration.

c. first aid for diving accidents.

### 5.32 Training

The diver must complete additional 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.

a) **Required Topics (include, but not limited to):**

Diving Emergency Care Training

- Cardiopulmonary Resuscitation (CPR)
- Standard or Basic First Aid
- Recognition of DCS and AGE
- Accident Management
- Field Neurological Exam
- Oxygen Administration

Dive Rescue

Dive Physics

Dive Physiology

Dive Environments

Decompression Theory and its Application

AAUS Scientific Diving Regulations and History

- Scientific Dive Planning
- Coordination with other Agencies
- Appropriate Governmental Regulations

Scientific Method

Data Gathering Techniques (Only Items specific to area of study are required)

- 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 (include, but not limited to):**

Specific Dive Modes (methods of gas delivery)

- Open Circuit
- Hooka

- Surface Supplied diving

#### Small Boat Operation

#### Rebreathers

- Closed
- Semi-closed

#### Specialized Breathing Gas

- Nitrox
- Mixed Gas

#### 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

#### Specialized Diving Equipment

- Full face mask
- Dry Suit
- Communications

Practical training must include a checkout dive, with evaluation of the skills listed in Section 4.20 (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 Scientific Diver with experience in the type of diving planned, with the knowledge and permission of the DSO.

### 5.33 Examinations

- 5.33.1 Written examination for scientific diver certification that covers all required topics from section 5.32.

Also, suggested topics from section 5.32 as determined by the DSO.

- 5.33.2 Examination of equipment.

- 5.33.3 Open water check-out dives to appropriate depths with

evaluation of the skills in Sec 4.23 and Appendix 9.

#### 5.34 Experienced Diver Certification

A diver holding a nationally recognized Scuba Certification, with a minimum of 50 logged dives, who feels their training and experience has prepared them for Scientific Diver Certification may forego taking a university research diver class with the approval of the DSO. All required paperwork must be completed and evaluation of the diver's skills using the guidelines in section 5.33, will be conducted by the DSO or an appropriate designee.

#### 5.40 OSI DEPTH CERTIFICATIONS

OSI diving is not permitted beyond a depth of 190 feet.

##### 5.41 Depth Certification Levels

###### 5.41.1 Certification to 30 Foot Depth

This is the initial permit level, approved upon the successful completion of training listed in Sections 5.20 and 5.30.

###### 5.41.2 Certification to 60 Foot Depth

A diver holding a 30 foot certificate may be certified to a depth of 60 feet after successfully completing, under supervision, 12 logged training dives to depths between 31 and 60 feet, for a minimum total time of 4 hours.

###### 5.41.3 Certification to 100 foot depth.

A diver holding a 60 foot certificate may be certified to a depth of 100 feet after successfully completing 4 dives to depths between 61 and 100 feet. The diver shall also demonstrate proficiency in the use of the appropriate Dive Tables.

###### 5.41.4 Certification to 130 foot depth.

A diver holding a 100 foot certificate may be certified to a depth of 130 feet after successfully completing 4 dives to depths between 100 and 130 feet. The diver shall also demonstrate proficiency in the use of the appropriate Dive Tables.

#### 5.41.5 Certification to Depths Over 130 Feet

A diver holding a 130 foot certification may be certified to depths of 150 and then 190 feet after the completion of four dives near each depth. Dives shall be planned and executed under close supervision of a diver certified to this depth. 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.

#### 5.42 Exceeding Depth Limits and Progression To Next Depth Level

5.42.1 A certified diver, diving under the auspices of the OSI program, may exceed his/her depth certification by one step only if accompanied by a diver certified to a greater depth. Under these circumstances the diver may exceed his/her depth limit by one step.

5.42.2 A certified diver diving under the auspices of the OSI program may exceed his/her depth certification by more than one step only when accompanied by the Diving Safety Officer, or a person designated by the Diving Safety Officer, either of whom must be certified to the greater depth.

#### 5.50 CONTINUATION OF CERTIFICATE

##### 5.51 Minimum Activity to Maintain OSI Certification

During any 12 month period, each OSI-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.

##### 5.52 Requalification of Depth Certificate

Once the initial certification requirements of Sec. 5.31 - 5.34 are met, divers whose depth certification has lapsed due to lack of activity may be re-qualified by procedures adopted by the Diving Safety Officer or the OSI Diving Control Board.

##### 5.53 Medical Examination

All OSI-certified scientific divers shall pass a medical examination at the intervals specified in Section 6.12. After each major illness or injury, as described in Sec. 6.12, a certified scientific diver shall receive clearance to return to diving from a physician before resuming diving activities.

#### 5.60 REVOCATION OF OSI CERTIFICATION

An OSI diving certificate may be revoked or restricted for cause by the Diving Safety Officer or the Diving Control Board. Violations of regulations set forth in this manual, or of other governmental agencies (CA DFG, Cal/OSHA, Cal/EPA, Animal Welfare, etc.), may be considered cause. The Diving Safety Officer shall inform the diver in writing of the reason(s) for revocation. The diver will be given the opportunity to present his/her 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.

#### 5.70 RECERTIFICATION

If a diver's OSI certificate expires or is revoked, he/she may be re-certified after complying with such conditions as the Diving Safety Officer or the Diving Control Board may impose. The diver shall be given an opportunity to present his/her case to the Diving Control Board before conditions for re-certification are stipulated.

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### 6.10 MEDICAL REQUIREMENTS

#### 6.11 General

- 6.11.1 The OSI DCB requires that each OSI diver obtain a specific diving physical examination and be declared by the examining physician fit to engage in diving activities. The declaration must be current per DCB policy.
- 6.11.2 All OSI diving medical evaluations 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.
- 6.11.3 The diver should be free of any chronic disabling disease and be free of any conditions contained in the list of conditions for which restrictions from

diving are generally recommended. (Appendix 1)

- 6.11.4 All cost of the medical examinations shall be the responsibility of the applicant for certification, except in the case of an employee who is required to dive as a regular part of his/her employment.

## 6.12 Frequency of Medical Evaluations

Medical evaluation shall be completed:

- 6.12.1 Before a diver may begin diving, unless an equivalent initial medical evaluation has been given within the preceding 5 years (3 years if the diver is over age 40, 2 years if over age 60), the DSO has obtained the results of that examination, and those results have been reviewed and found satisfactory by the Diving Safety Officer
- 6.12.2 Thereafter, at five year intervals up to age 40, every three years after the age of 40., and every two years after the age of sixty.
- 6.12.3 After any major injury or illness, or any condition requiring hospital care or chronic medication, or after any diving accident requiring treatment in a hyperbaric chamber, a physician's clearance is required to return to diving. If the injury or illness is pressure related, then the clearance to return to diving must come from a physician trained in diving medicine.

## 6.13 Information Provided Examining Physician

The OSI DSO shall provide a copy of the OSI medical evaluation requirements of this standard to the examining physician. (Appendices 1, 2, and 3).

## 6.14 Content of Medical Evaluations

Medical examinations conducted initially and at the intervals specified in section 6.12 shall consist of the following:

- 6.14.1 Applicant agreement for release of medical information to the Diving Safety Officer and the Diving Control Board (see Appendix 2).
- 6.14.2 Medical history (see Appendix 3)
- 6.14.3 Diving physical examination (see Section 6.15 and Appendix 2).
- 6.14.4 Laboratory Requirements for the diving medical examination as described

in section 6.16

6.15 Conditions which may disqualify candidates from diving (adapted from bove, 1998) .

1. Abnormalities of the tympanic membrane, such as perforation, presence of a monomeric membrane, or inability to autoinflate the middle ears. [5,7,8,9]
2. Vertigo including Meniere's Disease. [13]
3. Stapedectomy or middle ear reconstructive surgery.
4. Recent ocular surgery.. [11 [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. [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. Hypertension. [35]
22. History of pneumothorax. [45] 2/01 41
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]

6.16 Laboratory requirements for diving medical evaluation and intervals.

6.16.1 Initial examination under age 40:

- \* Medical history



- \* Complete physical exam, emphasis on neurological and otological components
- \* Urinalysis
- \* Any further tests deemed necessary by the physician.

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

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

6.16.3 Initial exam over age 40:

- \* Medical history
  - \* Complete physical exam, emphasis on neurological and otological components
  - \* Detailed assessment of coronary artery disease using multiple-risk-factor assessment<sub>1</sub>(age, family history, lipid profile, blood pressure, diabetic screening, smoking history)
  - \* Resting ekg
  - \* Chest x-ray
  - \* Urinalysis
  - \* Any further tests deemed necessary by the physician
  - \* Exercise stress testing may be indicated based on risk factor assessment<sub>2</sub>
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6.16.4 Periodic re-examination over age 40 (every 3 years); over age 60 (every two years):

- \* Medical history
- \* Complete physical exam, emphasis on neurological and otological components
- \* Detailed assessment of coronary artery disease using multiple-risk-factor assessment<sub>1</sub> (age, family history, lipid profile, blood pressure, diabetic screening, smoking history)
- \* Resting ekg
- \* Urinalysis
- \* Any further tests deemed necessary by the physician
- \* Exercise stress testing may be indicated based on risk factor assessment.<sub>2</sub>

6.17 Physician's written report.

6.17.1 After any medical examination relating to the individual's fitness to dive, the organizational member shall obtain a written report prepared by the examining physician, which shall contain the examining physician's opinion of

the individual's fitness to dive, including any recommended restrictions or limitations. This will be reviewed by the DCB.

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

1 "assessment of cardiovascular risk by use of multiple-risk-factor assessment equations." Grundy et. al. 1999. aha/acc scientific statement. <http://www.acc.org/clinical/consensus/risk/risk1999.pdf>  
2 Gibbons RJ, et al. ACC/AHA Guidelines for Exercise Testing. A Report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines (Committee on Exercise Testing). Journal of the American College of Cardiology. 30:260-311, 1997. <http://www.acc.org/clinical/guidelines/exercise/exercise.pdf>

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Certain types of diving, some of which are listed below, require equipment or procedures, which require additional training. Supplementary guidelines for these technologies are in development by the AAUS. The OSI, when using these, will have guidelines established by their Diving Control Board. OSI divers shall comply with all scuba diving procedures in this manual unless specified.

### ..... **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 5.40.

#### **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:

### **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).

### **Examinations**

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

- b) **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 5.30).

### **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 4.00), with additional training as follows:

**c) 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:

**d) Function, care, use, and maintenance of equipment cleaned for nitrox use.**

**Physical and physiological considerations of nitrox diving (ex.: O<sub>2</sub> and CO<sub>2</sub> 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:**

Equivalent air depth (EAD) for a given fO<sub>2</sub> and actual depth;

pO<sub>2</sub> exposure for a given fO<sub>2</sub> and depth;

Optimal nitrox mixture for a given pO<sub>2</sub> exposure limit and planned depth;

Maximum operational depth (MOD) for a given mix and pO<sub>2</sub> exposure limit;

For nitrox production purposes, percentages/psi of oxygen present in a given mixture, and psi of each gas required to produce a fO<sub>2</sub> 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.**

**Openwater Dives**

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

**Surface-Supplied Training**

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

**7.40 Scientific Nitrox Diving Regulations**

**Dive Personnel Requirements**

- e) 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. 5.40.**

**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:

As part of the dive planning process, verify that all divers using nitrox on a dive are properly qualified and authorized;

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.

The Lead Diver should also reduce the maximum allowable  $pO_2$  exposure limit for the dive team if on-site conditions so indicate (see Sec. 7.42.).

## Dive Parameters

### f) 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 pO<sub>2</sub> 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 should not be exceeded.

Dive computers capable of pO<sub>2</sub> limit and fO<sub>2</sub> adjustment should be checked by the diver prior to the start 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.

Air Purity:	CGA Grade E (Section 3.60)
Condensed Hydrocarbons	5mg/m <sup>3</sup>
Hydrocarbon Contaminants	No greater than 0.1 mg/m <sup>3</sup>



## **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:  $fO_2$ , MOD, cylinder pressure, date of analysis, and user's name.

b. Individual dive log reporting forms should report  $fO_2$  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**

#### **g) Requirement for Oxygen Service**

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.

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.

Cylinders should be marked "NITROX", or "EANx", or "Enriched Air".

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. 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.

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  $fO_2$ , date of analysis, and MOD.

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

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.

All diver and support equipment should be suitable for the  $fO_2$  being used.

### Compressor system

Compressor/filtration system must produce oil-free air.

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.**

## 7.60 STAGED DECOMPRESSION DIVING

No OSI diver shall plan or conduct staged decompression dives without prior approval of the Diving Control Board.

## 7.70 SATURATION DIVING

If using open circuit compressed air scuba in saturation diving operations, divers shall, AT A MINIMUM, comply with THE STANDARDS SET FORTH IN THE NOAA DIVING MANUAL, FOURTH EDITION, CHAPTER 17.

## 7.80 HOOKAH

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

## 7.90 SURFACE SUPPLIED DIVING

Surface supplied divers shall comply with all scuba diving procedures in this manual (except Section 2.31). Surface supplied diving shall not be conducted at depths greater than 190 fsw (58 msw).

- 7.90.1 OSI divers using the surface supplied mode shall be equipped with a diver-carried independent reserve breathing gas supply.
- 7.90.2 Each surface supplied diver shall be hose tended by a separate dive team member while in the water.
- 7.90.3 Divers using the surface supplied mode shall maintain voice communication with the surface tender.
- 7.90.4 The surface supplied breathing gas supply shall be sufficient to support all surface supplied divers in the water for the duration of the planned dive, including decompression.
- 7.90.5 During surface supplied diving operations when only one diver is in the water, there must be a standby diver in attendance at the dive location.

## 8.00 CLOSED AND SEMI-CLOSED CIRCUIT SCUBA (REBREATHERS)

Closed and semi-closed circuit scuba (rebreathers) used under the auspices of OSI shall meet the following requirements:

- 8.01.1 Oxygen partial pressure in the breathing gas shall not exceed values

approved by the OSI Diving Control Board. This accepted maximum value is 1.5 atmospheres ppO<sub>2</sub> at depths greater than 25 fsw (7.6 msw).

- 8.01.2 Chemicals used for the absorption of carbon dioxide shall be kept in a cool, dry location in a sealed container until required for use.
- 8.01.3 The designated person-in-charge shall determine that the carbon dioxide absorption canister is used in accordance with the manufacturer's instructions.
- 8.01.4 Closed and semi-closed diving equipment will not be used at a depth greater than that recommended by the manufacturer of the equipment.

## 8.10 MIXED GAS DIVING

- 8.10.1 OSI divers planning to use gas mixes other than NITROX (EAN) must show adequate training/proficiency to satisfy the DCB.

## 8.20 BLUE WATER DIVING

Blue water diving is defined as diving in open water where the bottom is generally >200 feet deep. It requires special training and the use of multiple-tethered diving techniques. Specific guidelines that should be followed are outlined in "Blue Water Diving Guidelines" (California Sea Grant Publ. No. T-CSGCP-014).

## 8.30 ICE AND POLAR DIVING

OSI 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.

## 8.40 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.

APPENDICIES  
APPENDIX 1

**DIVING MEDICAL EXAM OVERVIEW FOR THE EXAMINING PHYSICIAN TO THE EXAMINING PHYSICIAN:**

This person, \_\_\_\_\_, requires a medical examination to assess his/her fitness for certification as a Scientific Diver for the (Organizational Member) \_\_\_\_\_ . His /her answers on the Diving Medical History Form (attached), may indicate potential health or safety risks as noted. Your evaluation is requested on the attached scuba Diving Fitness Medical Evaluation Report. If you have questions about diving medicine, you may wish to consult one of the references on the attached list or contact one of the physicians with expertise in diving medicine whose names and phone numbers appear on an attached list. Please contact the undersigned Diving Safety Officer if you have any questions or concerns about diving medicine or the \_\_\_\_\_ standards. Thank you for your assistance.

Organizational Member

\_\_\_\_\_  
Diving Safety Officer Date

\_\_\_\_\_  
Printed Name Phone Number

Scuba and other modes of compressed-gas diving can be strenuous and hazardous. A special risk is present if the middle ear, sinuses or lung segments do not readily equalize air pressure changes. The most common cause of distress is eustachian insufficiency. Most fatalities involve deficiencies in prudence, judgment, emotional stability or physical fitness. Please consult the following list of conditions, which usually restrict candidates from diving.

(Adapted from Bove, 1998: 61 -63, bracketed numbers are pages in Bove)

**CONDITIONS WHICH MAY DISQUALIFY CANDIDATES FROM DIVING**

1. Abnormalities of the tympanic membrane, such as perforation, presence of a monomeric membrane, or inability to autoinflate the middle ears. [5,7,8,9]
2. Vertigo including Meniere's Disease. [13]
3. Stapedectomy or middle ear reconstructive surgery. [11]
4. Recent ocular surgery. [15,18,19]
5. Psychiatric disorders including claustrophobia, suicidal ideation, psychosis, anxiety states, untreated depression. [20-23]
6. Substance abuse, including alcohol. [24-25]
7. Episodic loss of consciousness. [1,26,27]
8. History of seizure. [27,28]
9. History of stroke or a fixed neurological deficit. [29,30]
10. Recurring neurologic disorders, including transient ischemic attacks. [29,30]
11. History of intracranial aneurysm, other vascular malformation or intracranial hemorrhage. [31]
12. History of neurological decompression illness with residual deficit. [29,30]
13. Head injury with sequelae. [26,27]
14. Hematologic disorders including coagulopathies. [41,42]
15. Evidence of coronary artery disease or high risk for coronary artery disease<sub>1</sub> [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] 2/01 41
23. Asthma<sup>2</sup>. [42-44]
24. Chronic pulmonary disease, including radiographic evidence of pulmonary blebs, bullae or cysts.[45,46]
25. Diabetes mellitus. [46-47]
26. Pregnancy<sup>1</sup>. [56]

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“Assessment of Cardiovascular Risk by Use of Multiple-Risk-Factor Assessment Equations.” Grundy et. al. 1999. AHA/ACC Scientific Statement.  
<http://www.acc.org/clinical/consensus/risk/risk1999.pdf><sup>2</sup>

“Are Asthmatics Fit to Dive? ” Elliott DH, ed. 1996 Undersea and Hyperbaric Medical Society, Kensington, MD.

### **SELECTED REFERENCES IN DIVING MEDICINE**

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

- Elliott, D.H. ed. 1996. *Are Asthmatics Fit to Dive?* Kensington, MD: Undersea and Hyperbaric Medical Society.
- Bove, A.A. 2011. The cardiovascular system and diving risk. *Undersea and Hyperbaric Medicine* 38(4): 261-269.
- Thompson, P.D. 2011. The cardiovascular risks of diving. *Undersea and Hyperbaric Medicine* 38(4): 271-277.
- Douglas, P.S. 2011. Cardiovascular screening in asymptomatic adults: Lessons for the diving world. *Undersea and Hyperbaric Medicine* 38(4): 279-287.
- Mitchell, S.J., and A.A. Bove. 2011. Medical screening of recreational divers for cardiovascular disease: Consensus discussion at the Divers Alert Network Fatality Workshop. *Undersea and Hyperbaric Medicine* 38(4): 289-296.
- Grundy, S.M., Pasternak, R., Greenland, P., Smith, S., and Fuster, V. 1999. Assessment of Cardiovascular Risk by Use of Multiple-Risk-Factor Assessment Equations. AHA/ACC Scientific Statement. *Journal of the American College of Cardiology*, 34: 1348-1359.  
<http://content.onlinejacc.org/cgi/content/short/34/4/1348>
- Bove, A.A. and Davis, J. 2003. DIVING MEDICINE, Fourth Edition. Philadelphia: W.B. Saunders Company.
- Edmonds, C., Lowry, C., Pennefather, J. and Walker, R. 2002. DIVING AND SUBAQUATIC MEDICINE, Fourth Edition. London: Hodder Arnold Publishers.
- Bove, A.A. ed. 1998. MEDICAL EXAMINATION OF SPORT SCUBA DIVERS, San Antonio, TX: Medical Seminars, Inc.
- NOAA DIVING MANUAL, NOAA. Superintendent of Documents. Washington, DC: U.S. Government Printing Office.
- U.S. NAVY DIVING MANUAL. Superintendent of Documents, Washington, DC: U.S. Government Printing Office, Washington, D.C.

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

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

\_\_\_\_\_  
Date of Medical Evaluation (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<sup>1</sup> (age, lipid profile, blood pressure, diabetic screening, smoking)  
Note: Exercise stress testing may be indicated based on Multiple-Risk-Factor Assessment<sup>2</sup>

**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

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Name (Print or Type)

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Address

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Telephone Number

E-Mail Address

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

My familiarity with diving medicine is:

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

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

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

Signature of Applicant \_\_\_\_\_

Date \_\_\_\_\_

---

**REFERENCES**

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

### APPENDIX 3 DIVING MEDICAL HISTORY FORM

(To Be Completed By Applicant-Diver)

Name \_\_\_\_\_ Sex \_\_\_\_ Age \_\_\_\_ Wt. \_\_\_\_ Ht. \_\_\_\_

Sponsor \_\_\_\_\_ Date \_\_\_\_/\_\_\_\_/\_\_\_\_  
(Dept./Project/Program/School, etc.) (Mo/Day/Yr)

**TO THE APPLICANT:**

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

	Yes	No	Please indicate whether or not the following apply to you	Comments
1			Convulsions, seizures, or epilepsy	
2			Fainting spells or dizziness	
3			Been addicted to drugs	
4			Diabetes	
5			Motion sickness or sea/air sickness	
6			Claustrophobia	
7			Mental disorder or nervous breakdown	
8			Are you pregnant?	
9			Do you suffer from menstrual problems?	
10			Anxiety spells or hyperventilation	
11			Frequent sour stomachs, nervous stomachs or vomiting spells	
12			Had a major operation	
13			Presently being treated by a physician	
14			Taking any medication regularly (even non-prescription)	
15			Been rejected or restricted from sports	

16			Headaches (frequent and severe)	
17			Wear dental plates	

	Yes	No	Please indicate whether or not the following apply to you	Comments
18			Wear glasses or contact lenses	
19			Bleeding disorders	
20			Alcoholism	
21			Any problems related to diving	
22			Nervous tension or emotional problems	
23			Take tranquilizers	
24			Perforated ear drums	
25			Hay fever	
26			Frequent sinus trouble, frequent drainage from the nose, post-nasal drip, or stuffy nose	
27			Frequent earaches	
28			Drainage from the ears	
29			Difficulty with your ears in airplanes or on mountains	
30			Ear surgery	
31			ringing in your ears	
32			Frequent dizzy spells	
33			Hearing problems	
34			Trouble equalizing pressure in your ears	
35			Asthma	
36			Wheezing attacks	
37			Cough (chronic or recurrent)	
38			Frequently raise sputum	
39			Pleurisy	
40			Collapsed lung (pneumothorax)	
41			Lung cysts	
42			Pneumonia	
43			Tuberculosis	

	Yes	No	Please indicate whether or not the following apply to you	Comments
44			Shortness of breath	
45			Lung problem or abnormality	
46			Spit blood	
47			Breathing difficulty after eating particular foods, after exposure to particular pollens or animals	
48			Are you subject to bronchitis	
49			Subcutaneous emphysema (air under the skin)	
50			Air embolism after diving	
51			Decompression sickness	
52			Rheumatic fever	
53			Scarlet fever	
54			Heart murmur	
55			Large heart	
56			High blood pressure	
57			Angina (heart pains or pressure in the chest)	
58			Heart attack	
59			Low blood pressure	
60			Recurrent or persistent swelling of the legs	
61			Pounding, rapid heartbeat or palpitations	
62			Easily fatigued or short of breath	
63			Abnormal EKG	
64			Joint problems, dislocations or arthritis	
65			Back trouble or back injuries	
66			Ruptured or slipped disk	
67			Limiting physical handicaps	
68			Muscle cramps	
69			Varicose veins	

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

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

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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**

List of local Medical Doctors that have training and expertise in diving or undersea medicine:

1. \_\_\_\_\_  
Name

\_\_\_\_\_  
Address

\_\_\_\_\_

\_\_\_\_\_

Telephone \_\_\_\_\_

2. \_\_\_\_\_  
Name

\_\_\_\_\_  
Address

\_\_\_\_\_

\_\_\_\_\_

Telephone \_\_\_\_\_

3. \_\_\_\_\_  
Name

\_\_\_\_\_  
Address

\_\_\_\_\_

\_\_\_\_\_

Telephone \_\_\_\_\_

4. \_\_\_\_\_  
Name

---

Address

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Telephone

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## **APPENDIX 5**

### **SELECTED REFERENCES IN DIVING MEDICINE**

DIVING MEDICINE, 1990. A. Bove and J. Davis. W.B. Saunders Company, Philadelphia.

DIVING AND SUBAQUATIC MEDICINE, Third Edition, 1992. C. Edmonds, C. Lowery and J. Pennefather. Butterworth-Heinemann Ltd. Oxford. (Available from Best Publishing Company, P.O. Box 30100, Flagstaff, AZ 86003-0100)

MEDICAL EXAMINATION OF SPORT SCUBA DIVERS, Jefferson Davis, M.D. (ed.). Best Publishing Company, P.O. Box 30100, Flagstaff, AZ 86003-0100.

NOAA DIVING MANUAL, NOAA. Superintendent of Documents, U.S. Government Printing Office, Washington, D.C.

SCUBA DIVING IN SAFETY AND HEALTH, C.W. Deuker. Madison Publishing Associates, Diving Safety Digest, P.O. Box 2735, Menlo Park, CA 94026

THE PHYSICIAN'S GUIDE TO DIVING MEDICINE, C.W. Shilling, C.B. Carlston and R.A. Mathias. Plenum Press, New York, NY (Available through the Undersea and Hyperbaric Medical Association, Bethesda, MD)

U.S. NAVY DIVING MANUAL. Superintendent of Documents, U.S. Government Printing Office, Washington, D.C.



## **APPENDIX 6**

### **DEFINITION OF TERMS**

Air sharing - The 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.

Altitude Diving - Diving conducted in excess of 1,000 feet above sea level.

Bottom Time/Dive Time - The total time underwater.

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

Buddy Breathing - The 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 - The pressure at which a pressure containment device would fail structurally.

Certified Diver - A diver who holds a recognized valid certification from OSI, a sister CSU campus, an AAUS organizational member, or other 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 recompression chamber.

Decompression Sickness (DCS or Pressure Injury) - A condition with a variety of symptoms, which may result from gas and bubbles in the tissues of divers after pressure reduction.

Decompression 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. (Also called dive tables.)

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 - The 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 (Diving Control Board). The group of individuals who act as the official representative of the member-campus' in matters concerning the scientific diving program (see Section 1.24).

Diving Safety Officer (DSO) - The individual responsible for the safe conduct of an institution's scientific diving program (see Section 1.23).

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.

$fN_2$  - Fraction of nitrogen in a gas mixture, expressed as either a decimal or percentage, by volume.

$fO_2$  - Fraction of oxygen in a gas mixture, expressed as either a decimal or percentage, by volume.

FFW – Feet of freshwater, or equivalent static head.

FSW - Feet of seawater, or equivalent static head.

Hookah Diving - A type of shallow water surface-supplied diving where there is no voice communication with the surface.

Hyperbaric Chamber - See decompression chamber.

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

Lead Diver - The certified 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.

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

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

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

MSW - Meters of seawater or equivalent static head.

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

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

No-Decompression Limits - The depth-time limits of the "no-decompression limits and repetitive dive group designations table for no-decompression air dives" at a rate specified by the tables or computers used.

Normal Ascent - An ascent made with an adequate air supply at a rate specified by the table or computer being used by the diver.

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.

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 – OUT

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.

$pN_2$  - 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.

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.

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

Psig - pounds per square inch gauge.

Recompression Chamber - see decompression chamber.

Scientific Diving - Scientific diving is defined (8CCR 6050 and CFR 1910.402) 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 - A diving mode in which the diver in the water is supplied from the dive location with compressed gas for breathing.

Swimming Ascent - An ascent, which can be done under normal or emergency conditions

accomplished by simply swimming to the surface.

**Umbilical** - The 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 7**  
**OCEAN STUDIES INSTITUTE (OSI) REQUEST FOR DIVING RECIPROCITY FORM**  
**\* VERIFICATION OF DIVER TRAINING AND EXPERIENCE \***

The OSI Dive Safety Committee has the right to approve or deny this request and may require, at a minimum, a checkout dive with the OSI Diving Safety Officer (DSO) or designee. If the request is denied, OSI will notify the DSO of the visiting diver the reason for the denial. The DSO for the visiting scientific diver must confirm the following information:

(Date) \_\_\_\_\_  
 \_\_\_\_\_ Written scientific diving examination  
 \_\_\_\_\_ Last diving medical examination  
 \_\_\_\_\_ Most recent checkout dive  
 \_\_\_\_\_ Scuba regulator/equipment service/test  
 \_\_\_\_\_ CPR training (Agency) \_\_\_\_\_  
 \_\_\_\_\_ Oxygen administration (Agency) \_\_\_\_\_  
 \_\_\_\_\_ First aid for diving (Agency) \_\_\_\_\_  
 \_\_\_\_\_ Date of last dive  
 Number of dives completed within previous 12 months? \_\_\_\_\_  
 Depth certification \_\_\_\_\_ Ft.  
 Any restrictions? (Y/N) \_\_\_\_\_ if yes, explain:

Please check any pertinent specialty certifications:

_____ Dry suit	_____ Rescue	_____ Blue water
_____ Dive Computer	_____ Divemaster	_____ Altitude
_____ Nitrox	_____ Instructor	_____ Ice/Polar
_____ Mixed gas	_____ EMT	_____ Cave
_____ Closed circuit	_____ Dive Accident Management	_____ Night
_____ Saturation	_____ Chamber operator	Other _____
_____ Decompression	_____ Lifesaving	

Name of diver: \_\_\_\_\_  
 Emergency Information: (To notify in an emergency)  
 Name: \_\_\_\_\_  
 Relationship: \_\_\_\_\_  
 Telephone: (work) \_\_\_\_\_ (home) \_\_\_\_\_  
 Address: \_\_\_\_\_

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

\_\_\_\_\_  
 (Name of AAUS Organizational Member)  
 Diving Safety Officer: \_\_\_\_\_  
(Signature) (Date)

\_\_\_\_\_  
 (Print Name) Telephone FAX

E-mail Other

## APPENDIX 8 CHECKOUT DIVE AND TRAINING EVALUATION

Certified divers and Divers-In-Training should be able to demonstrate proficiency in the following skills during checkout dives or training evaluation dives with the Dive Safety Officer or designee:

- Knowledge of OSI SCIENTIFIC diving standards and regulations
- Pre-dive planning, briefing, site orientation, and buddy check
- Use of dive tables and/or dive computer
- Equipment familiarity
- Underwater signs and signals
- Proper buddy contact
- Monitor cylinder pressure, depth, bottom time
- Swim skills:
  - Surface dive to 10 ft. without scuba gear
  - Demonstrate general water skills and snorkel skills
  - Surface swim without swim aids (400 yd. <12min)
  - Underwater swim without swim aids (25 yd. without surfacing)
  - Tread water without swim aids (10 min.), or without use of hands (2 min.)
  - Transport another swimmer without swim aids (25yd)
- Entry and exit (pool, boat, shore)
- Mask removal and clearing
- Regulator removal and clearing
- Surface swim with scuba; alternate between snorkel and regulator (400 yd.)
- Neutral buoyancy (hover motionless in midwater)
- Proper descent and ascent with B.C.
- Remove and replace weight belt while submerged
- Remove and replace scuba cylinder while submerged
- Alternate air source breathing with and without mask (donor/receiver)
- Buddy breathing with and without mask (donor/receiver)
- Simulated emergency swimming ascent
- Compass and underwater navigation
- Simulated decompression and safety stop
- Rescue:
  - Self rescue techniques
  - Tows of conscious and unconscious victim
  - Simulated in-water rescue breathing
  - Rescue of submerged non-breathing diver (including equipment removal, simulated rescue breathing, towing, and recovery to boat or shore)
  - Use of emergency oxygen on breathing and non-breathing victim
  - Accident management and evacuation procedures

Additional Training (optional)

- Compressor/ Fill station orientation and usage

\_\_\_ Small boat handling



**APPENDIX 9**  
**DIVING EMERGENCY MANAGEMENT PROCEDURES**  
Introduction

A diving accident victim could be any person who has been breathing compressed gas underwater regardless of depth. It is essential that emergency procedures are pre-planned and that medical treatment is initiated as soon as possible. In conformance with AAUS guidelines, the OSI dive program has developed procedures for diving emergencies including evacuation and medical treatment for each dive location. This information is immediately available to dive team members.

General Emergency Procedures

Depending on and according to the nature of the diving accident, stabilize the patient, administer 100% oxygen, contact local Emergency Medical System (EMS) for transport to medical facility, contact diving accident coordinator, as appropriate. 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.

- 1. Make appropriate contact with victim or rescue as required.**
- 2. Establish (A)irway, (B)reathing, (C)irculation as required.**
- 3. Administer 100% oxygen, if appropriate (in cases of Decompression Illness, or Near Drowning).**
- 4. Call local Emergency Medical System (EMS) for transport to nearest medical treatment facility.**
- 5. Call appropriate Diving Accident Coordinator for contact with diving physician and recompression chamber. etc.**
- 6. Notify DSO or designee according to the OSI Diving Emergency Action Plan.**
- 7. Complete and submit Incident Report Form(Appendix 11) to the OSI Diving Control Board, appropriate personnel for any other institution involved, and to the the AAUS (As required in Section 2.72).**
- 8. List of Emergency Contact Numbers Appropriate For Dive Location:**

**SEE THE COMPLETED STANDARD OSI FORM PREPARED FOR EACH DIVE.**

## APPENDIX 10

### Cal/OSHA Scientific Diving Exemption

Subchapter 7. General Industry Safety Orders, Group 26. Diving Operations, Article 152. Diving Operations, Section §6050.

General.

(a) Scope.

(1) This standard applies to all diving operations: commercial, scientific, technical and agricultural which are conducted within the boundaries of the State as defined in Government Code Section 170 except in areas of exclusive Federal jurisdiction and the exceptions listed below. In addition, any diver involved in commercial diving operations shall comply with the requirements of Sections 6059 thru 6063 of these orders.

EXCEPTION: This standard does not apply to the following diving operations:

(A) Commercial diving operations under the jurisdiction of the U.S. Coast Guard, which includes all commercial diving operations taking place offshore and from all vessels required to have a certificate of inspection issued by the Coast Guard.

(B) Diving operations performed solely for search, rescue, or related public safety purposes under the control of and performed by employees of a state or local governmental agency.

(C) Diving operations performed solely for instruction purposes, using open-circuit, compressed-air SCUBA and breathhold diving conducted within the no-decompression limits.

(D) Diving operations governed by 45 CFR Part 46 (Protection of Human Subjects, U.S. Department of Health, Education and Welfare), or equivalent rules or regulations established by another Federal agency, which regulate research, development, or related purposes involving human subjects.

(E) Scientific diving operations under the direction and control of a diving program containing at least the following elements:

1. Diving safety manual, which includes at a minimum: procedures covering all diving operations specific to the program; procedures for emergency care, including recompression and evacuation; and criteria for diver training and certification.

2. Diving control (safety) board, with the majority of its members being active divers, which 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.

(2) Deviations from this Standard.

(A) An employer may deviate from the requirements of this standard to the extent necessary to prevent or minimize a situation which is likely to cause death, serious physical harm, or major environmental damage, provided that the person-in-charge:

1. Notifies the Division within 48 hours of the onset of the emergency situation indicating the nature of the emergency and extent of the deviation from the prescribed regulations; and
2. Upon request from the Division, submits such information in writing.

NOTE: Authority cited: Section 142.3 Labor Code. Reference: Section 142.3, Labor Code.

**APPENDIX 11**

**OCEAN STUDIES INSTITUTE  
DIVE PLAN**

**Lead diver for the Project** \_\_\_\_\_

**It is the responsibility of the lead diver to ensure that all divers and equipment used is approved.**

**Name and Description of Project** \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**Project Location and Duration** \_\_\_\_\_

**Estimated maximum depths and bottom times anticipated** \_\_\_\_\_

\_\_\_\_\_

**Estimated number of dives required to complete project** \_\_\_\_\_

**List any special equipment, diving conditions, or boats to be used** \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**Type of gas (air, nitrox, mixed).** \_\_\_\_\_

**Other divers (and affiliation, if other than OSI) involved with the project:**

**Name** \_\_\_\_\_ **Certification Depth** \_\_\_\_\_

**Emergency Contact** \_\_\_\_\_ **Emergency phone #** \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**On the reverse side, list the emergency information (i.e. nearest chamber, hospital or medical facility, phone #'s, evacuation plans, oxygen availability, etc.) for the dive location.**

**Faculty Advisor Approval** \_\_\_\_\_ **Date** \_\_\_\_\_

**Diving Officer Approval** \_\_\_\_\_ **Date** \_\_\_\_\_

## APPENDIX 12

### OSI Diving Incident Flow Chart

IN THE CASE OF AN OSI DIVING INCIDENT, THE FOLLOWING NOTIFICATIONS SHALL BE MADE

BY THE INVOLVED DIVER OR LEAD DIVER ON SITE, THE APPROPRIATE EMS AND ACCIDENT MANAGEMENT PERSONNEL AS OUTLINED IN THE DIVE PLAN.

1. A phone call to the diving safety officer (DSO) as soon as possible
2. AAUS diving Injury Incident report (form) to the DSO

BY THE DSO OR DESIGNEE, reports forwarded to the:

1. The office of safety and risk management for the appropriate campus.
2. The office of safety and risk management for the CSU.
3. The director, OSI
4. The appropriate Dean
5. The appropriate department chairmen
6. The faculty advisor (If a student)
7. In the event of the diver(s) are employees of the CSU, and diving under the auspices of the CSU, the appropriate workman's compensation administrator

Phone numbers of Office of Safety and Risk Management at various campuses:

CSU DOMINGUEZ HILLS 310-243-2895  
CSU FULLERTON 714-278-3844  
CSU LONG BEACH 562-985-8260  
CSU LOS ANGELES 323-343-3531  
CSU NORTHRIDGE 818-677-2079  
CSU POMONA 909-869-4846  
CSU SAN MARCOS 760-750-4502-  
CSU OFFICE OF THE CHANCELLOR 562-951-4580