



Scientific Divers Safety Manual

6th Edition

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1.10 SCIENTIFIC DIVING

1.11 Purpose

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

This manual sets minimal standards for the establishment of Florida International University (FIU) recognized scientific diving programs, the organization for the conduct of these programs, and the basic regulations and procedures for safety in scientific diving operations. It also establishes a framework for reciprocity with other American Academy of Underwater Science (AAUS) organizational members which adhere to these minimum standards.

This manual was developed and written by FIU's Dive Safety Officer based on the policies of AAUS. AAUS compiled the policies set forth in the diving manuals of several universities, private, and governmental scientific diving programs. These programs share a common heritage with the scientific diving program at the Scripps Institution of Oceanography (SIO). Adherence to the SIO standards has proven both feasible and effective in protecting the health and safety of scientific divers since 1954.

In 1982, OSHA exempted scientific diving from commercial diving regulations (29 CFR Part 1910, Subpart T) under certain conditions, which are outlined bellow. The final guidelines for the exemption became effective in 1985 (Federal Register, Vol 50, No.6, p.1046) The AAUS is recognized by OSHA as the scientific diving standard setting organization.

1.12 Scientific Diving Definition

Scientific diving is defined (29 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. Scientific diving does not include performing any tasks usually associated with commercial diving such as: Placing or removing heavy objects underwater; inspection of pipelines and similar objects; construction; demolition; cutting or welding; or the use of explosives."

1.13 Scientific Diving Exemption

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

1.13.1 The Diving Control Board consists of a majority of active scientific divers and has autonomous and absolute authority over the scientific diving program's operation.

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

1.13.3 The tasks of a scientific diver are those of an observer and data gatherer. Construction and trouble-shooting tasks traditionally associated with commercial diving are not included within scientific diving.

1.13.4 Scientific divers, based on the nature of their activities, must use scientific expertise in studying the underwater environment and therefore, are scientists or scientists-in-training.

1.13.5 In addition, the scientific diving program shall contain at least the following elements:

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

1.13.5.2 Diving Control Board, with its members being active scientific divers and FIU administration which oversee university research or safety compliance, 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.

1.14 Representations, Warranties, Assumption of the Risk, Release, Hold Harmless and Indemnification of FIU

1.14.1. Each diver represents and warrants to FIU that he/she has thoroughly reviewed the appropriateness of these standards and policies set forth in this document for his/her own program and purposes, that each diver has made a professionally informed, independent decision that the FIU standards and policies are in every instance and every detail suitable for the intended use by that individual, and that each diver freely and voluntarily makes an informed choice to assume all risks associated with the application and use of these standards and policies in any diving or diving related activities.

1.14.2. Each diver represents and agrees that he/she has made a professionally informed decision to release FIU, and thereby does release FIU, from any and all losses, costs, injuries, death or damages, including attorneys' fees, caused in whole or in part by, or resulting in whole or part from, the implementation, use or

application of these standards and policies to any diving or diving-related activities, or caused in whole or in part by, or resulting in whole or in part from, acts or omissions of FIU, its officers, directors, employees, students, volunteers or invitees whether caused by its/their negligence or not.

1.14.3. Each diver represents and warrants that he/she has made a professionally informed decision to hold harmless and indemnify FIU, and thereby does hold harmless and indemnify FIU, from and against any and all losses, costs, injuries, death or damages, including attorneys' fees, caused in whole or in part by, or resulting in whole or in part from, the implementation, use or application of these standards and policies to any diving or diving-related activities, or caused in whole or in part by, or resulting in whole or in part from, acts or omissions of FIU, its officers, directors, employees, students, volunteers or invitees whether caused by its/their negligence or not.

1.15 Review of Standards

As part of each organizational member's annual report, any recommendations for modifications of these standards shall be submitted to AAUS for consideration.

1.20 OPERATIONAL CONTROL

1.21 Florida International University Auspices Defined

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

It is FIU's responsibility to adhere to the AAUS Standards for Scientific Diving Certification and Operation of the Scientific Diving Programs. The administration of the local diving program will reside with FIU's Diving Control Board (DCB).

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

1.22 FIU's Scientific Diving Standards and Safety Manual

The purpose of the FIU Scientific Diving Standards is to provide for the development and implementation of policies and procedures that will enable the FIU Scientific Diving Program to meet requirements of local environments and conditions as well as to comply with AAUS scientific diving standards. The FIU scientific diving standards shall include but are not limited to:

- 1.22.1 Emergency evacuation and medical treatment procedures.
- 1.22.2 The criteria for diver training and certification.
- 1.22.3 Standards written or adopted by reference for each diving mode utilized which include the following:
 - 1.22.4.1 Safety procedures for the diving operation.
 - 1.22.4.2 Responsibilities of the dive team members.
 - 1.22.4.3 Equipment use and maintenance procedures.
 - 1.22.4.4 Emergency procedures.

1.23 The Diving Safety Officer

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

1.23.1 Qualifications

1.23.1.1 Shall be appointed by the responsible administrative officer or his/her designee, with the advice and counsel of the diving control board.

1.23.1.2 Shall be certified as a scuba diving instructor and have diving supervisory experience.

1.23.1.3 Shall qualify as a Full Voting Member of AAUS as defined by AAUS Bylaws:

- “(a) Holds a diving certification from a recognized national certifying agency or equivalent, and
- (b) Has engaged in sustained or successive scientific diving activities during the past two years, or
- (c) Has completed a course in scientific diving that meets the requirements as specified by the most current edition of the AAUS Standards for Scientific Diving.”

1.23.1.4 Shall attend an AAUS DSO Orientation within one year of accepting a position DSO, unless he / she has served as a DSO for another current AAUS Organizational Member within the last year.

1.23.2 Duties and Responsibilities

1.23.2.1 Shall be responsible, through the DCB, to the responsible administrative officer or his/her designee, for the conduct of the scientific diving program of FIU in accordance with the Scientific Dive Safety Manual and policies of the Diving Control Board.

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 FIU, 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 Operational responsibility for the conduct of the local diving program resides with the Diving Safety Officer. The Dive Safety Officer will have autonomous and absolute authority over the scientific diving program's operation. The DSO shall approve and monitor all dive plans.

1.23.2.4 In conjunction with the FIU DCB, shall certify the depths to which a diver has been trained.

1.23.2.5 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) has autonomous and absolute authority over the FIU scientific diving program's operation and shall consist of active scientific divers and FIU administrative personnel which manage university research or university safety standards compliance. Voting members shall include the Diving Safety Officer, the responsible administrative officer, or his/her designee, and should include other representatives of the diving program such as qualified divers and members selected by procedures established by FIU. A chairperson and a secretary may be chosen from the membership of the board according to local procedure.

1.24.2 Shall establish standards, protocols, and operational procedures beyond the AAUS minimums, review and revise the diving safety manual.

1.24.3 Shall assure compliance with the manual.

1.24.4 Shall take disciplinary action for unsafe practices.

1.24.5 Shall assure adherence to the buddy system for scuba diving.

1.24.6 Shall act as the official representative of FIU in matters concerning the scientific diving program.

1.24.7 Shall act as a board of appeal to consider diver-related problems.

1.24.8 Shall recommend changes in policy and amendments to AAUS and FIU's scientific diving safety manual as the need arises.

1.24.9 Shall establish and/or approve training programs through which the applicants for certification can satisfy the requirements of FIU's diving safety manual.

1.24.10 Shall suspend diving programs that it considers being unsafe or unwise.

1.24.11 Shall establish criteria for equipment selection and use.

1.24.12 Shall recommend new equipment or techniques.

1.24.13 Shall establish and/or approve facilities for the inspection and maintenance of diving and associated equipment.

1.24.14 Shall ensure that the FIU's air station(s) meet air quality standards as described in Sec. 3.60 of this manual.

1.24.15 Shall periodically review the Diving Safety Officer's performance and program.

1.24.16 Shall sit as a board of investigation to inquire into the nature and cause of diving accidents or violations of FIU's diving manual

1.24.17 Shall approve the depth to which a diver has been authorized to dive.

1.24.18 Shall recommend the issue, reissue, or revocation of diving authorizations.

1.24.19 May deligate operational oversight for portions of the program to the DSO; However, the DCB may not abdicate responsibility for the safe conduct of the scientific diving program.

1.25 Instructional Personnel

1.25.1 Qualifications: All personnel involved in diving instruction under the auspices of FIU shall be qualified for the type of instruction being given.

1.25.2 Selection: Instructional personnel will be selected by the responsible administrative officer or his/her designee, who will solicit the advice of the DCB in conducting preliminary screening of applicants for instructional positions.

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 DCB any physical problems or adverse physiological effects, include symptoms of pressure-related injuries.

1.27 Reciprocity and Visiting Diver

1.27.1 If FIU and another AAUS organization engaged jointly in diving activities, or engaged jointly in the use of diving resources, one of the participating Diving Control Boards shall be designated to govern the joint dive project.

1.27.2 A scientific diver from FIU shall apply for permission to dive under the auspices of another AAUS Member by submitting to the Diving Safety Officer of the host AAUS Member a document containing all the information described in Appendix 6 (Verification of Diver Training and Experience / Letter of Reciprocity) signed by the Diving Safety Officer or Chairperson of the home Diving Control Board.

1.27.3 A visiting scientific 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 Appendix 7 (FIU/AAUS Checkout Dive and Training Evaluation)

1.27.4 If FIU denies a visiting scientific diver permission to dive, the FIU Diving Control Board shall notify the visiting scientific diver and his/her Diving Control Board with an explanation of all reasons for the denial.

1.28 Waiver of Requirements

FIU's Diving Control Board may grant a waiver for specific requirements of training, examinations, depth certification, and minimum activity to maintain certification. Documentation of such waivers shall be entered into the subject diver's personnel file.

1.29 Consequence of Violation of Regulations by Scientific Divers

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

1.30 CONSEQUENCES OF VIOLATION OF REGULATIONS BY ORGANIZATIONAL MEMBERS

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

1.40 RECORD MAINTENANCE

The Diving Safety Officer or his/her designee shall maintain permanent records for each individual scientific diver certified. The file shall include evidence of certification level, log sheets, results of current physical examination, waiver, reports of disciplinary actions by FIU's 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 organizational member for the following period:

1.40.1.2.1 Physician's written reports of medical examinations, for dive team members 5 years.

1.40.1.2.2 Manual for diving safety - current document only.

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- 5 years.

1.40.1.2.5 Equipment inspection and testing records - all logs will be kept until equipment is withdrawn from service.

DIVING REGULATIONS FOR SCUBA (OPEN CIRCUIT, COMPRESSED AIR)

2.10 INTRODUCTION

No person shall engage in scientific diving operations under the auspices of FIU scientific diving program unless he/she holds a current certification 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 FIU, the diving supervisor for a proposed operation must formulate a dive plan which 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 8) 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.

2.0 DIVING REGULATIONS FOR SCUBA

2.22 Pre-Dive Briefings and Pre-dive Safety Checks

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

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

2.22.2 Diver's Responsibility:

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

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

2.22.2.3 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.

2.22.2.4 No dive team member shall be permitted to dive for the duration of any known condition which is likely to adversely affect the safety and health of the diver or other dive members. Each dive team member has the responsibility to inform the lead diver of such conditions prior to commencing operations or as soon as such conditions should occur.

2.22.3 Equipment Evaluations

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

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

2.22.4 Site Evaluation: The environmental conditions at the site will be evaluated by the lead diver.

2.22.5 Site Evaluation: The environmental conditions at the site will be evaluated by the lead diver.

2.0 DIVING REGULATIONS FOR SCUBA

2.30 DIVING PROCEDURES

2.31 Solo Diving Prohibition

All diving activities shall assure adherence to the buddy system. (Two comparably equipped scuba divers in the water in constant communication) for scuba diving. This buddy system is based upon mutual assistance, especially in the case of an emergency.

2.32 Decompression Management

2.32.1 On any given dive, both divers in the buddy pair must follow the most conservative dive profile

2.32.2 A safety stop performed during the ascent phase of the dive should be conducted on any dive that exceeds 30 feet (9.14m).

2.33 Refusal to Dive

2.33.1 The decision to dive is that of the diver. A diver may refuse to dive, without fear of penalty, whenever he/she feels it is unsafe for them to make the dive (see Sec. 2.22 # 1.).

2.33.2 Safety - The ultimate responsibility for safety rests with the individual diver. It is the diver's responsibility and duty to refuse to dive if, in 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

2.34 Termination of the Dive

2.34.1 It is the responsibility of the diver to terminate the dive, without fear of penalty, whenever he/she feels it is unsafe to continue the dive, unless it compromises the safety of another diver already in the water (see Sec. 2.22 #1.).

2.34.2 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.

2.35 Emergencies and Deviations from Regulations

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

2.0 DIVING REGULATIONS FOR SCUBA

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 sickness, or equipment malfunctions.

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

Emergency procedures (Appendix 8) must be strictly followed in case of an accident or injury. All FIU scientific diving staff will receive annual training in CPR, First Aid and the ability to provide oxygen.

2.60 FLYING AFTER DIVING

Divers should have minimum surface interval of 24 hours before ascending to altitude.

2.70 RECORDKEEPING AND REQUIREMENTS

2.71 Personal Diving Log

Each certified scientific diver shall log every dive made under the auspices of FIU's program, and is encouraged to log all other dives. Standard forms will be provided by FIU. Log sheets shall be submitted to the Diving Safety Officer to be placed in the diver's permanent file.

Details of the submission procedures are left to the discretion of the Diving Safety Officer. The diving log shall be in a form specified by FIU and shall include at least the following:

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 Required Incident Reporting

All diving incidents or accidents shall be reported to the FIU's Dive Safety Officer and after an investigation

2.0 DIVING REGULATIONS FOR SCUBA

FIU's Diving Control Board and AAUS will be notified as necessary. FIU's regular procedures for incident reporting, including those required by the AAUS shall be followed. The report will specify the circumstances of the incident and the extent of any injuries or illnesses.

Additional information must meet the following reporting requirements:

2.72.1 The FIU scientific diver shall record and report occupational injuries and illnesses in accordance with requirements of the appropriate Labor Code section.

2.72.2 If pressure-related injuries are suspected or if symptoms are evident, the following additional information shall be recorded and retained by FIU, with the record of the dive, for a period of 5 years:

2.72.2.1 Complete AAUS Incident Report Form (Appendix 13).

2.72.2.2 Written descriptive report to include:

2.72.2.2.1 Name, address, and phone numbers of the principal parties involved.

2.72.2.2.2 Summary of experience of divers involved.

2.72.2.2.3 Location, description of dive sites and description of conditions that led up to incident.

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

2.72.2.2.5 Description and results of treatment.

2.72.2.2.6 Disposition of case.

2.72.2.2.7 Recommendations to avoid repetition of incident.

2.72.3 FIU shall investigate and document any incident of pressure-related injury and prepare a report that is to be forwarded to the AAUS during the annual reporting cycle. This report must first be reviewed and released by the FIU's Diving Control Board.

DIVING EQUIPMENT

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 them.

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 Minimum ventilation rates 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.

3.0 DIVING EQUIPMENT

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 tested at intervals not to exceed twelve months.

3.24 Backpacks

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

3.25 Gauges

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

3.26 Buoyancy Control Devices

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

3.26.2 Personal flotation systems, buoyancy compensator, 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

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

3.28 Determination of Decompression Status: Dive Tables, Dive Computers

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

3.28.2 Dive computers may be utilized in place of diving tables, and must be approved by the Diving Control Board.

3.28.3 See Appendix 10 for AAUS recommendations on dive computers.

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 should 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. Both the "Code Alpha" flag as well as the traditional diver's flag should be displayed.
- 3.43 Compressor Systems - FIU Controlled
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 psi 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 psi 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 FIU controlled breaking 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 and be maintained.

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 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

CGA Grade E

Component	Maximum
Oxygen	20 - 22%/v
Carbon Monoxide	10 PPM/v
Carbon Dioxide	500 PPM/v
Condensed Hydrocarbons	5 mg/m ³
Water Vapor	NS
Objectionable Odors	None

Remote Operations:

For remote site operations using gas sources not controlled by FIU or where adherence to CGA standards cannot be confirmed, every effort should be made to verify breathing gas meets the requirements of this standard. If CGA Grade E gas is not verifiable, the DCB must develop a protocol to mitigate risk to the diver.

4.0 ENTRY-LEVEL TRAINING REQUIREMENTS

ENTRY-LEVEL TRAINING REQUIREMENTS

This section describes training for the non-diver applicant, previously not certified for diving. Training and certification as an entry-level diver is a prerequisite to AAUS Scientific Diver training. In lieu of writing/promulgating AAUS specific standards for entry-level divers, AAUS references the standards for entry-level diver training as defined by the WRSTC and/or ISO. AAUS programs who wish to train entry-level divers may do so using one of the following options:

- a) Under the auspices and standards of an internationally recognized diver training agency
- b) Under the auspices of AAUS using the minimum guidelines presented by the most current version of the RSTC/WRSTC and/or ISO entry-level diver standards.

REFERENCES:

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

“Safety related minimum requirements for the training of recreational SCUBA divers – Part 2: Level 2- “Autonomous diver”. ISO 24801-2:2007 – International Organization for Standardization (ISO) – www.iso.org

4.10 EVALUATION

4.11 Medical Examination

The applicant for training shall be certified 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 4).

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.

4.0 ENTRY-LEVEL TRAINING REQUIREMENTS

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 Enter water with full equipment.

4.21.2 Clear face mask.

4.21.3 Demonstrate air sharing, including both buddy breathing and the use of alternate air source, as both donor and recipient, with and without a face mask.

4.21.4 Demonstrate ability to alternate between snorkel and scuba while kicking.

4.21.5 Demonstrate understanding of underwater signs and signals.

4.21.6 Demonstrate simulated in-water mouth-to-mouth resuscitation.

4.21.7 Rescue and transport, as a diver, a passive simulated victim of an accident.

4.21.8 Demonstrate ability to remove and replace equipment while submerged.

4.21.9 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.

4.0 ENTRY-LEVEL TRAINING REQUIREMENTS

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 and ascents.

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, carbon dioxide excess, squeezes, oxygen poisoning, nitrogen narcosis, exhaustion and panic, respiratory fatigue, motion sickness, decompression sickness, hypothermia, and hypoxia/anoxia.

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 Surface dive to a depth of 10 feet in open water without scuba.

4.23.2 Demonstrate proficiency in air sharing, including both buddy breathing and the use of alternate air source, as both donor and receiver.

4.23.3 Enter and leave open water or surf, or leave and board a diving vessel, while wearing scuba gear.

4.23.4 Kick on the surface 400 yards while wearing scuba gear, but not breathing from the scuba unit.

4.23.5 Demonstrate judgment adequate for safe diving.

4.23.6 Demonstrate, where appropriate, the ability to maneuver efficiently in the environment, at and below the surface.

4.23.7 Complete a simulated emergency swimming ascent.

4.23.8 Demonstrate clearing of mask and regulator while submerged.

4.0 ENTRY-LEVEL TRAINING REQUIREMENTS

4.23.9 Demonstrate ability to achieve and maintain neutral buoyancy while submerged.

4.23.10 Demonstrate techniques of self-rescue and buddy rescue.

4.23.11 Navigate underwater.

4.23.12 Plan and execute a dive.

4.23.13 Successfully complete 5 open water dives for a minimum total time of 3 hours, of which 1-1/2 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 AUTHORIZATION

4.30.1 This permit signifies that a diver has completed a minimum of 40 hours of training with at least 5 ocean or open water dives, and possesses a nationally recognized diving certificate. The permit shall be granted upon completion of requirements listed in Sections 4.10 and 4.20.

4.30.2 If the diver's entry-level training was not under the control of FIU, the DSO or his/her designee shall evaluate the diver and verify that he/she possesses skills and knowledge substantially similar to those stated in Sections 4.10 and 4.2.

5.0 SCIENTIFIC DIVER CERTIFICATION

SCIENTIFIC DIVER CERTIFICATION

5.10 CERTIFICATION and AUTHORIZATION TYPES

5.10.1 Scientific Diver Certification - this is a permit to dive, usable only while it is current and for the purpose intended.

5.10.2 Temporary Diver Authorization - 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

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

5.21 Diver-In-Training Authorization

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 (Section 4.00).

5.22 Eligibility

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

5.23 Application

Application for authorization to dive shall be made to the Diving Safety Officer on the form prescribed by FIU.

5.24 Medical Examination

Each applicant for diver authorization 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 1-4).

5.0 SCIENTIFIC DIVER CERTIFICATION

5.30 REQUIREMENTS FOR 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 DCB that he/she is sufficiently skilled and proficient. 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 FIU scientific 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 diver or diver-in-training must provide proof of current training in the following:

- a. cardiopulmonary resuscitation (CPR)
- b. standard or basic first aid (details on training and curriculum are found in OSHA CPL 2-2.53 CFR1910.151)
- c. emergency oxygen administration

5.32 Training

The candidate must complete additional theoretical aspects and practical training beyond the diver-in-training permit level for a minimum cumulative time of 100 hours. Formats for meeting the 100 hour training requirement include formalized training course, or a combination of formalized and on the job training.

When a diver's resume provides clear evidence of significant scientific diving experience, the diver can be given credit for meeting portions of the 100 hour course requirements. The DCB will identify specific overlap between on-the-job training, previous scientific diving training/experience and course requirements, and then determine how potential deficiencies will be resolved. However, FIU cannot "test-out" divers, regardless of experience, when they have no previous experience in scientific diving.

5.0 SCIENTIFIC DIVER CERTIFICATION

Theoretical Training / Knowledge Development		Practical Training / Skill Development	
Required Topics:	Suggested Topics:		
Diving Emergency Care Training <ul style="list-style-type: none"> • Cardiopulmonary Resuscitation (CPR) • AED • Standard or Basic First Aid • Recognition of DCS and AGE • Accident Management • Field Neurological Exam • Oxygen Administration 	Specific Dive Modes (methods of gas delivery) <ul style="list-style-type: none"> • Open Circuit • Hookah • Surface Supplied diving • Rebreathers (closed and/or semi-closed) 	Confined Water	At the completion of training, the trainee must satisfy the DSO or DCB-approved designee of their ability to perform the following, as a minimum, in a pool or in sheltered water: <ul style="list-style-type: none"> • Enter water fully equipped for diving • Clear fully flooded face mask • Demonstrate air sharing and ascent using an alternate air source, as both donor and recipient, with and without a face mask • Demonstrate buddy breathing as both donor and recipient, with and without a face mask • Demonstrate understanding of underwater signs and signals • Demonstrate ability to remove and replace equipment while submerged • Demonstrate acceptable watermanship skills for anticipated scientific diving conditions
Dive Rescue <ul style="list-style-type: none"> • To include procedures relevant to OM specific protocols. (See water skills below) 	Specialized Breathing Gas <ul style="list-style-type: none"> • Nitrox • Mixed Gas 		
Scientific Method	Small Boat Operation		
Data Gathering Techniques (Only items specific to area of study required) <ul style="list-style-type: none"> • Transects and Quadrats • Mapping • Coring • Photography • Tagging • Collecting • Animal Handling • Archaeology • Common Biota • Organism Identification • Behavior • Ecology • Site Selection, Location, and Re-location 	Specialized Environments and Conditions <ul style="list-style-type: none"> • Blue Water Diving • Altitude • Ice and Polar Diving (Cold Water Diving) • Zero Visibility Diving • Polluted Water Diving • Saturation Diving • Decompression Diving • Overhead Environments • Aquarium Diving • Night Diving • Kelp Diving • Strong Current Diving • Potential Entanglement/Entrapment • Live boating 	Open Water Skills	The trainee must satisfy the DSO, or DCB-approved designee, of their ability to perform at least the following in open water: <ul style="list-style-type: none"> • Surface dive to a depth of 10 feet (3 meters) without scuba* • Enter and exit water while wearing scuba gear* ^^ • Kick on the surface 400 yards (366 meters) while wearing scuba gear, but not breathing from the scuba unit* • Demonstrate proficiency in air sharing ascent as both donor and receiver* • Demonstrate the ability to maneuver efficiently in the environment, at and below the surface* ^^ • Complete a simulated emergency swimming ascent* • Demonstrate clearing of mask and regulator while submerged*
<ul style="list-style-type: none"> • Specialized Data Gathering Equipment 			
Required Topics:	Suggested Topics:		
Navigation	HazMat Training <ul style="list-style-type: none"> • Chemical Hygiene, Laboratory Safety (Use of Chemicals) 		<ul style="list-style-type: none"> • Underwater communications^^ • Demonstrate ability to achieve and maintain neutral buoyancy while submerged* • Demonstrate techniques of self-rescue and buddy rescue* • Navigate underwater ^ • Plan and execute a dive^ • Demonstrate judgment adequate for safe scientific diving* ^^ Rescue Skills: <ul style="list-style-type: none"> • Rescue from depth and transport 25 yards (23 meters), as a diver, a passive simulated victim of an accident: surface diver, establish buoyancy, stabilize victim • Demonstrate simulated in-water mouth-to-mouth resuscitation • Removal of victim from water to shore or boat • Stressed and panicked diver scenarios • Recommendations For Rescue Of A Submerged Unresponsive Compressed-Gas Diver – Appendix 9 <p>Successfully complete a minimum of one checkout dive and at least eleven additional open water dives in a variety of dive sites, for a cumulative surface to surface time of 6 hours. Dives following the checkout dive(s) may be supervised by an active Scientific Diver holding the necessary depth authorization experienced in the type of diving planned, and with the knowledge and permission of the DSO</p> <p>The eleven dives (minimum) following the initial checkout dive may be conducted over a variety of depth ranges as specified by the OM DCB. Depth progression must proceed shallower to deeper after acceptable skills and judgement have been demonstrated, and are not to exceed 100 feet (30 m) during the initial 12 dive cycle</p> <p>* Checkout dive element ^^ Evaluated on all dives ^ Evaluated at some point during the training cycle</p>
HazMat Training <ul style="list-style-type: none"> • HP Cylinders 			
Decompression Management Tools <ul style="list-style-type: none"> • Dive Tables • Dive Computers • PC Based Software 	Specialized Diving Equipment <ul style="list-style-type: none"> • Full face mask • Dry Suit • Communications • Dive Propulsion Vehicle (DPV) • SMBs/Lift Bags • Line Reels 		
AAUS Scientific Diving Regulations and History <ul style="list-style-type: none"> • Scientific Dive Planning • Coordination with other Agencies • Appropriate Governmental Regulations 			
Hazards of breath-hold diving and ascents			
Dive Physics (Beyond entry level scuba)	Other Topics and Techniques as Determined by the DCB		
Dive Physiology (Beyond entry level scuba)			
Dive Environments			
Decompression Theory and its Application			

5.0 SCIENTIFIC DIVER CERTIFICATION

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

5.40 DEPTH AUTHORIZATIONS - *Diving on air is not permitted beyond a depth of 190 feet.*

5.41 Depth Authorization Levels

5.41.1 Authorization to 30 Foot Depth - This is the initial permit level, approved upon the successful completion of training listed in Sec. 4.00 and 5.30.

5.41.2 Authorization to 60 Foot Depth - A diver holding a 30 foot permit may dive 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 Authorization to 100 and 130 Foot Depths - A diver holding a 60 foot permit may dive to depths of 100 and 130 feet respectively, by logging 6 dives near the maximum depth category. These qualification dives shall be validated by the signature of two authorized individuals who are divers certified to at least the same depth. The diver shall also demonstrate proficiency in the use of the appropriate Decompression Tables.

5.41.4 Authorization to Depths Over 130 Feet - A diver may dive to depths of 150 and 190 feet after the completion of 6 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 a knowledge of the special problems of deep diving, and of special safety requirements.

5.0 SCIENTIFIC DIVER CERTIFICATION

5.42 Progression To Next Depth Level

A certified diver diving under the auspices of FIU may exceed his/her depth certification only if accompanied by a diver authorized to dive to a greater depth. Under these circumstances the diver may exceed his/her depth limit by one step. For authorizations deeper than 190 feet, defer to AAUS Standards in Section 4.40

5.50 CONTINUATION OF AUTHORIZATION

5.51 Minimum Activity to Maintain Authorization

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

5.52 Re-qualification of Depth Authorization

Once the initial certification requirements of Sec. 5.31 - 5.34 are met, divers whose depth authorization has lapsed due to lack of activity may be re-qualified by procedures adopted by the organization's DCB.

5.53 Medical Examination

All 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 scientific diver shall receive clearance to return to diving from a physician before resuming diving activities.

5.60 REVOCATION OF AUTHORIZATION

A diving privileges may be revoked or restricted for cause by the Diving Safety Officer or the DCB.

Violations of regulations set forth in this manual, or other governmental subdivisions not in conflict with this manual, may be considered cause. The 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-authorization. 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 REAUTHORIZATION

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

MEDICAL STANDARDS

6.10 MEDICAL REQUIREMENTS

6.11 General

6.11.1 FIU shall determine that divers have passed a current diving physical examination and have been declared by the examining physician to be fit to engage in diving activities as may be limited or restricted in the medical evaluation report

6.11.2 All medical evaluations required by this standard shall be performed by, or under the direction of, a licensed physician of the applicant-diver's choice, preferably one trained in diving/undersea medicine.

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)

6.12 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 1 year, FIU has obtained the results of that examination, and those results have been reviewed and found satisfactory by FIU.

6.12.2 Thereafter, at five year intervals up to age 40 and every three years after the age of 40 and every 2 years over 60.

6.12.3 After any major injury or illness, or any condition requiring hospitalization for more than 24 hours requires clearance to return to diving from a physician. 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

FIU shall provide a copy of the 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:

6.0 MEDICAL STANDARDS

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

6.14.2 Medical history (See Appendix 3).

6.14.3 Diving physical examination (Section 6.15 and Appendix 2).

6.15 Conditions for which Restriction from Diving is recommended (Adapted from Davis, 1986) (See Appendix 1).

6.16 Laboratory Requirements for Diving Medical Examination:

6.16.1 Initial examination under age 40.

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

6.16.2 Periodic re-examination (every 5 years up to age 40):

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

6.16.3 First exam over age 40:

- Medical History
- Complete physical exam, emphasis on neurological and ontological components
- Detailed assessment of coronary artery disease risk factors using Multiple Risk Factor Assessment (age, family history, lipid profile blood pressure, diabetic screening, smoking history). Further cardiac screening may be indicated based on risk factor assessment.
- Resting EKG
- Chest X-Ray (PA and LAT)
- Urinalysis
- Any further tests deemed necessary by the physician

6.16.4 Periodic re-examination over age 40 (every 3 years); over age 60 (every 2 years):

- Medical History
- Complete physical exam, emphasis on neurological and ontological components
- Detailed assessment of coronary artery disease risk factors using Multiple Risk Factor Assessment (age, family history, lipid profile blood pressure, diabetic screening, smoking history). Further cardiac screening may be indicated based on risk factor assessment.
- Resting EKG
- Urinalysis
- Any further tests deemed necessary by the physician

6.17 Physician's Written Report

6.17.1 After any medical examination relating to the individual's fitness to dive, FIU 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 FIU shall make a copy of the physician's written report available to the individual.

NITROX DIVING GUIDELINES

The following guidelines address the use of nitrox by scientific divers under the auspices of Florida International University (FIU). 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

7.11 Eligibility

Only a certified Scientific Diver or Scientific Diver In Training diving under the auspices of FIU is eligible for authorization to use nitrox. After completion, review and acceptance of application materials, training and qualification as per Sec. 7.12 of these guidelines, an applicant will be authorized to use nitrox within his/her depth authorization, as specified within this manual.

7.12 Application and documentation

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

7.20 REQUIREMENTS FOR AUTHORIZATION TO USE NITROX

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

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

References: "Minimum Course Content for Enriched Air Nitrox Certification" - World Recreational Scuba Training Council (WRSTC), www.wrstc.com. "Recreational diving services- Requirements for training programs on enriched air nitrox (EAN) diving". ISO 11107:2009 - International Organization for Standardization (ISO), www.iso.org

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

7.21 Training

The diver must complete additional theoretical and practical training beyond the Scientific Diver In Training air certification level, to the satisfaction of FIU's DSO (see Section 7.20).

7.22 Examinations

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

7.0 NITROX DIVING GUIDELINES

7.22.1 Written examinations covering the information presented in the classroom training session(s) (i.e., gas theory, oxygen toxicity, partial pressure determination, etc. ...);

7.22.2. Practical examinations covering the information presented in the practical training session(s) (i.e., gas analysis, documentation procedures, etc. ...);

7.22.3. Openwater checkout dives, to appropriate depths, to demonstrate the application of theoretical and practical skills learned.

7.23 Minimum Activity to Maintain Authorization

The diver should log at least one (1) 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. It may be included as part of training to satisfy the Scientific Diver training requirements of this manual.

7.31 Classroom Instruction

7.31.1 Topics should include, but are not limited to: review of previous training; physical gas laws pertaining to nitrox; partial pressure calculations and limits; equivalent air depth (EAD) concept and calculations; oxygen physiology and oxygen toxicity; calculation of oxygen exposure and maximum safe operating depth (MOD); determination of decompression schedules (both by EAD method using approved air dive tables, and using approved nitrox dive tables); dive planning and emergency procedures; mixing procedures and calculations; gas analysis; personnel requirements; equipment marking and maintenance requirements; dive station requirements.

7.31.2 The DSO 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.

7.32 Practical Training

The practical training portion will consist of a review of skills as stated for scuba diving standards, with additional training as follows:

7.32.1 Oxygen analysis of nitrox mixtures;

7.32.2 Determination of MOD, oxygen partial pressure exposure, and oxygen toxicity time limits, for various nitrox mixtures at various depths;

7.0 NITROX DIVING GUIDELINES

7.32.3 Determination of nitrogen-based dive limits status by EAD method using air dive tables, and/or using nitrox dive tables, as approved by the DSO.

7.32.4 Nitrox dive computer use may be included, as approved by the DSO.

7.33 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:

7.33.1 Function, care, use, and maintenance of equipment cleaned for nitrox use;

7.33.2 Physical and physiological considerations of nitrox diving (ex.: O₂, and CO₂ toxicity);

7.33.3 Diving regulations and procedures as related to nitrox diving, either scuba or surface-supplied (depending on intended mode);

7.33.4 Given the proper information, calculation of:

7.33.4.1 Equivalent air depth (EAD) for a given fO₂, and actual depth

7.33.4.2 pO₂ exposure for a given fO₂ and depth;

7.33.4.3 Optimal nitrox mixture for a given pO₂ exposure limit and planned depth;

7.33.4.4 Maximum operational depth (MOD) for a given mix and pO₂ exposure limit;

7.33.4.5 For nitrox production purposes, percentages/psi of oxygen present in a given mixture, and psi of each gas required to produce a fO₂ by partial pressure mixing.

7.33.5 Decompression table and dive computer selection and usage;

7.33.6 Nitrox production methods and considerations;

7.33.7 Oxygen analysis;

7.33.8 Nitrox operational guidelines (Section 7.40), dive planning, and dive station components.

7.0 NITROX DIVING GUIDELINES

7.34 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.

7.35 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 Sec. 7.21 and 7.22.

7.40 SCIENTIFIC DIVING NITROX DIVING REGULATIONS

7.41 Dive Personnel Requirements

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

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

5.40.

7.41.3 Lead Diver - On any dive during which nitrox will be used by any team member, the Lead Diver should be authorized to use nitrox, and hold appropriate authorizations required for the dive, as specified in these guidelines. Lead Diver authorization for nitrox dives by the DSO and/or DCB should occur as part of the dive plan approval process. The Lead diver should:

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

7.41.3.2 As part of the pre-dive procedures, confirm with each diver the nitrox mixture the diver is using, and establish dive team maximum depth and time limits, according to the shortest time limit or shallowest depth limit among the team members.

7.0 NITROX DIVING GUIDELINES

7.41.3.3 The Lead Diver should also reduce the maximum allowable pO₂ exposure limit for the dive team if on-site conditions so indicate (see Sec. 7.42.1.2)

7.42 Dive Parameters

7.42.1 Oxygen Exposure Limits

7.42.1.1 The inspired oxygen partial pressure experienced at depth should not exceed 1.4 ATA. All dives performed using nitrox breathing mixtures should comply with the current *NOAA Diving Manual* "Oxygen Partial Pressure Limits for 'Normal' Exposures"

7.42.1.2 The maximum allowable exposure limit should be reduced in cases where cold or strenuous dive conditions, or extended exposure times are expected. The DSO should consider this in the review of any dive plan application which proposes to use nitrox. The Lead Diver should also review on-site conditions and reduce the allowable pO₂ exposure limits if conditions indicate.

7.42.1.3 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.

7.42.2 Bottom Time Limits

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

7.42.2.2 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*.

7.42.3 Decompression Tables and Gases

7.42.3.1 A set of DCB approved nitrox decompression tables should be available at the dive site.

7.42.3.2 When using the equivalent air depth (EAD) method, dives should be conducted using air decompression tables approved by the DCB.

7.42.3.3 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

7.0 NITROX DIVING GUIDELINES

7.42.3.4 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 of section 7.31 and the oxygen partial pressure limits set forth in Sec. 7.32.

7.42.4 Nitrox Dive Computers

7.42.4.1 Dive Computers may be used to compute decompression status during nitrox dives. Manufacturers' guidelines and operations instructions should be followed.

7.42.4.2 Use of Nitrox dive computers should comply with dive computer guidelines included in these standards (Appendix 10).

7.42.4.3 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 his/her designee.

7.42.4.4 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.

7.42.4.5 Dive computers capable of pO₂ limit and fO₂ adjustment should be checked by the diver prior to the start each dive to assure compatibility with the mix being used.

7.42.5 Repetitive Diving

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

7.42.5.2 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.

7.42.5.3 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.

7.0 NITROX DIVING GUIDELINES

7.42.5.4 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.

7.43 Oxygen Parameters

7.43.1 Authorized Mixtures - Mixtures meeting the criteria outlined in Sec. 7.42.1 may be used for nitrox diving operations, upon approval of the DSO.

7.43.2 Purity

7.43.2.1 Oxygen used for mixing nitrox breathing gas should meet the purity levels for “Medical Grade” (U.S.P.) or “Aviator Grade” standards.

7.43.2.2 In addition to the AAUS Air Purity Guidelines (AAUS Sec. 3.60), the following standard should be met for breathing air that is either a. placed in contact with oxygen concentrations greater than 40%, or 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 (AAUS Sec. 3.60)
- Condensed Hydrocarbons: 5mg/m
- Hydrocarbon Contaminants: No greater than 0.1 mg/m

7.44 Gas Mixing and Analysis for FIU

7. 44.1 Personnel Requirements

7. 44.1.1 Individuals responsible for producing and/or analyzing nitrox mixtures should be knowledgeable and experienced in all aspects of the technique.

7. 44.1.2 Only those individuals approved by the DSO should be responsible for mixing and/or analyzing nitrox mixtures.

7. 44.2 Production Methods - It is the responsibility of the DSO to approve the specific nitrox production method used.

7. 44.3 Analysis Verification by User

7.0 NITROX DIVING GUIDELINES

7. 44.3.1 It is the responsibility of each diver to analyze prior to the dive the oxygen content of his/her scuba cylinder and acknowledge in writing the following information for each cylinder: fO₂, MOD, cylinder pressure, date of analysis, and user's name.

7. 44.3.2 Individual dive log reporting forms should report fO₂ of nitrox used, if different than 21%.

7.50 NITROX DIVING EQUIPMENT

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

- a. Labeled SCUBA Cylinders
- b. Oxygen Analyzers

7.51 Oxygen Cleaning and Maintenance Requirements

7.51.1 Requirement for Oxygen Service

7.51.1.1 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.

7. 51.1.2 Equipment used with oxygen or mixtures containing over forty percent (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.

7.52 Scuba Cylinder Identification Marking

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

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

7.52.2 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.

7.0 NITROX DIVING GUIDELINES

7.52.3 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.

7.52.4 Other markings which identify the cylinder as containing gas mixes other than air may be used per the approval of the DSO.

7.52.5 A contents label should be affixed, to include the current fO₂, date of analysis, and MOD.

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

7.53 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.

7.54 Other Support Equipment

7.54.1 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 (one) 1% accuracy.

7.54.2 All diver and support equipment should be suitable for the fO₂ being used.

7.55 Compressor and Fill Station

7.55.1 Compressor system

7.55.1.1 The compressor/filtration system MUST produce oil-free air.

7.55.1.2 An oil-lubricated compressor placed in service for a nitrox system should be checked for oil and hydrocarbon contamination at least quarterly.

7.55.2 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.

OTHER DIVING TECHNOLOGY

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

8.01 Staged Decompression Diving

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

8.02 Saturation Diving

Divers must comply with the saturation diving guidelines of FIU listed in the current Habitat Operations Diving Manual

8.03 Hookah

8.03.1 Divers using the hookah mode shall be equipped with a diver-carried independent reserve breathing gas supply.

8.03.2 Each hookah diver shall be hose-tended by a separate dive team member while in the water.

8.03.3 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.

8.04 Surface Supplied Diving

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

8.04.1 Divers using the surface supplied mode shall be equipped with a diver-carried independent reserve breathing gas supply.

8.04.2 Each surface supplied diver shall be hose tended by a separate dive team member while in the water.

8.04.3 Divers using the surface supplied mode shall maintain line communication with the surface tender.

8.04.4 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.

8.0 OTHER DIVING TECHNOLOGY

8.04.5 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.

8.04.6 Line tenders have to be qualified and trained in line communications and emergency operations regarding surface supplied diving.

8.05 Closed and Semi-Closed Circuit Scuba (Rebreathers)
Closed and semi-closed circuit scuba (rebreathers) shall meet the following requirements:

8.05.1 Oxygen partial pressure in the breathing gas shall not exceed values approved by the FIU's DCB. The generally accepted maximum value is 1.5 atmospheres ppO₂ at depths greater than 25 fsw (7.6 msw).

8.05.2 Chemicals used for the absorption of carbon dioxide shall be kept in a cool dry location in a sealed container until required for use.

8.05.3 The designated person-in-charge shall determine that the carbon dioxide absorption canister is used in accordance with the manufacturers instructions.

8.05.4 Closed and semi-closed diving equipment will not be used at a depth greater than that recommended by the manufacturer of the equipment.

8.06 Mixed Gas Diving

8.06.1 Nitrox diving

Divers planning to use enriched air (Nitrox) scuba diving must use the following AAUS guidelines which are available through FIU: "Guidelines for Scientific Nitrox Diving and Nitrox Diver Certification, American Academy of Underwater Sciences, 1991.

8.07 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).

8.08 Ice and Polar diving

Divers planning to dive under ice or in polar conditions should use the following: "Guidelines for Conduct of Research Diving", National Science Foundation, Division of Polar Programs, 1990.

8.0 OTHER DIVING TECHNOLOGY

8.09 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. Any divers conducting operations in this environment, must have “special environments” approval from the DSO.

NOTE: For scientific diving requiring any specialized diving techniques or technology not listed within this manual, defer to AAUS Standards.

APPENDICES

1. Diving Medical Exam Overview For The Examining Physician
2. Medical Evaluation Of Fitness For Scuba Diving Report
3. Diving Medical History Form
4. Medical History Question Evaluation Form
5. Definition Of Terms
6. Verification Of Diver Training And Experience
7. AAUS Check Out Dive And Training Evaluation
8. Diving Emergency Management Procedures
9. Accident Response Plan
10. Guidelines For Use Of Dive Computers
11. Safe Ascent Recommendations
12. FIU SDP Important Numbers
13. Citizen Scientist Program
14. Rebreathers
15. Recommendations for rescue of an incapacitated diver

**APPENDIX 1
DIVING MEDICAL EXAM OVERVIEW FOR THE EXAMINING PHYSICIAN****TO THE EXAMINING PHYSICIAN:**

This person, _____, requires a medical examination to assess their fitness for certification as a Scientific Diver for the _____ (Organizational Member). Their answers on the Diving Medical History Form (attached) may indicate potential health or safety risks as noted. Your evaluation is requested on the attached scuba Diving Fitness Medical Evaluation Report. If you have questions about diving medicine, you may wish to consult one of the references on the attached list or contact one of the physicians with expertise in diving medicine whose names and phone numbers appear on an attached list, the Undersea Hyperbaric and Medical Society, or the Divers Alert Network. Please contact the undersigned Diving Safety Officer if you have any questions or concerns about diving medicine or the _____ 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. Recent deaths in the scientific diving community have been attributed to cardiovascular disease. Please consult the following list of conditions that usually restrict candidates from diving. (Adapted from Bove, 1998: bracketed numbers are pages in Bove)

CONDITIONS WHICH MAY DISQUALIFY CANDIDATES FROM DIVING

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

24. Chronic pulmonary disease, including radiographic evidence of pulmonary blebs, bullae, or cysts. [45,46]
25. Diabetes mellitus. [46 - 47]
26. Pregnancy. [56]

SELECTED REFERENCES IN DIVING MEDICINE

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)
(Month/Day/Year)

Date of Medical Evaluation

To The Examining Physician: Scientific divers require periodic scuba diving medical examinations to assess their fitness to engage in diving with self-contained underwater breathing apparatus (scuba). Their answers on the Diving Medical History Form may indicate potential health or safety risks as noted. Scuba diving is an activity that puts unusual stress on the individual in several ways. Your evaluation is requested on this Medical Evaluation form. Your opinion on the applicant's medical fitness is requested. Scuba diving requires heavy exertion. The diver must be free of cardiovascular and respiratory disease (see references, following page). An absolute requirement is the ability of the lungs, middle ears and sinuses to equalize pressure. Any condition that risks the loss of consciousness should disqualify the applicant. Please proceed in accordance with the AAUS Medical Standards (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 Assessment¹ (age, lipid profile, blood pressure, diabetic screening, smoking)

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

PHYSICIAN'S STATEMENT:

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

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

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

Signature MD Date

Name (Print or Type)

9.0 APPENDICES

Address

Telephone Number

E-Mail Address

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

My familiarity with diving medicine is:

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

Name of Applicant (Print or Type) _____

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

Signature of Applicant _____

Date _____

REFERENCES

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

**APPENDIX 3
DIVING MEDICAL HISTORY FORM**

(To Be Completed By Applicant-Diver)

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

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

TO THE APPLICANT:

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

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	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	

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	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	

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

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

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

Signature

Date

APPENDIX 4
RECOMMENDED PHYSICIANS WITH EXPERTISE IN DIVING MEDICINE

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

1. Name: Dr Ivan Montoya
Address: 3663 South Miami Ave, Miami, Fl. 33133, Mercy Hyperbaric Chamber
Telephone: 305-854-0300

2. Name: Dr. Steven Lawyer
Address: 103400 Overseas Highway, Key Largo Fl. 33037
Telephone: (305) 451-1722

3. Name: _____
Address: _____
Telephone: _____

4. Name: _____
Address: _____
Telephone: _____

5. Name: _____
Address: _____
Telephone: _____

APPENDIX 5

DEFINITION OF TERMS

Air sharing - Sharing of an air supply between divers.

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

Alternate Gas Supply - Fully redundant system capable of providing a gas source to the diver should their primary gas supply fail.

Authorization-The DCB authorizes divers to dive using specialized modes of diving, and the depth they may dive to.

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

Bubble Check - Visual examination by the dive team of their diving systems, looking for O-ring leaks or other air leaks conducted in the water prior to entering a cave. Usually included in the "S" Drill.

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

Buddy System -Two comparably equipped scuba divers in the water in constant communication.

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

Cave Dive - A dive, which takes place partially or wholly underground, in which one or more of the environmental parameters defining a cavern dive are exceeded.

Cavern Dive - A dive which takes place partially or wholly underground, in which natural sunlight is continuously visible from the entrance.

Certified Diver - A diver who holds a recognized valid certification from an AAUS OM or internationally recognized certifying agency.

(Scientific Diver) Certification- A diver who holds a recognized valid certification from an AAUS OM

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

Designated Person-In-Charge – Surface Supplied diving mode manning requirement. An individual designated by the OM DCB or designee with the experience or training necessary to direct, and oversee in the surface supplied diving operation being conducted.

Dive - A descent into the water, an underwater diving activity utilizing compressed gas, an ascent, and return to the surface.

Dive Computer - A microprocessor based device which computes a diver’s theoretical decompression status, in real time, by using pressure (depth) and time as input to a decompression model, or set of decompression tables, programmed into the device.

Dive Location - A surface or vessel from which a diving operation is conducted.

Dive Site - Physical location of a diver during a dive.

Dive Table - A profile or set of profiles of depth-time relationships for ascent rates and breathing mixtures to be followed after a specific depth-time exposure or exposures.

Diver – A person who stays underwater for long periods by having compressed gas supplied from the surface or by carrying a supply of compressed gas.

Diver-In-Training - An individual gaining experience and training in additional diving activities under the supervision of a dive team member experienced in those activities.

Diving Mode - A type of diving required specific equipment, procedures, and techniques, for example, snorkel, scuba, surface-supplied air, or mixed gas.

Diving Control Board (DCB) - Group of individuals who act as the official representative of the membership organization in matters concerning the scientific diving program ([See Diving Control Board under Section 1.0](#)).

Diving Safety Officer (DSO) - Individual responsible for the safe conduct of the scientific diving program of the membership organization ([See Diving Safety Officer under Section 1.0](#)).

DPIC – See Designated Person-In-Charge.

EAD - Equivalent Air Depth (see below).

Emergency Swimming Ascent - An ascent made under emergency conditions where the diver may exceed the normal ascent rate.

Enriched Air (EANx) - A name for a breathing mixture of air and oxygen when the percent of oxygen exceeds 21%. This term is considered synonymous with the term “nitrox” ([Section 6.00](#)).

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.

Flooded Mine Diving - Diving in the flooded portions of a man-made mine. Necessitates use of techniques detailed for cave diving.

fO₂ - Fraction of oxygen in a gas mixture, expressed as either a decimal or percentage, by volume.

FSW - Feet of seawater.

Gas Management - Gas planning rule which is used in cave diving environments in which the diver reserves a portion of their available breathing gas for anticipated emergencies (See Rule of Thirds, Sixths).

Gas Matching – The technique of calculating breathing gas reserves and turn pressures for divers using different volume cylinders. Divers outfitted with the same volume cylinders may employ the Rule of Thirds for gas management purposes. Divers outfitted with different volume cylinders will not observe the same gauge readings when their cylinders contain the same gas volume, therefore the Rule of Thirds will not guarantee adequate reserve if both divers must breathe from a single gas volume at a Rule of Thirds turn pressure. Gas Matching is based on individual consumption rates in volume consumed per minute. It allows divers to calculate turn pressures based on combined consumption rates and to convert the required reserve to a gauge based turn pressure specific to each diver’s cylinder configuration.

Guideline - Continuous line used as a navigational reference during a dive leading from the team position to a point where a direct vertical ascent may be made to the surface.

Hookah - While similar to Surface Supplied in that the breathing gas is supplied from the surface by means of a pressurized hose, the supply hose does not require a strength member, pneumofathometer hose, or communication line. Hookah equipment may be as simple as a long hose attached to a standard

scuba cylinder supplying a standard scuba second stage. The diver is responsible for the monitoring his/her own depth, time, and diving profile.

Hyperbaric Chamber - See Recompression chamber.

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

Independent Reserve Breathing Gas - A diver-carried independent supply of air or mixed gas (as appropriate) sufficient under standard operating conditions to allow the diver to reach the surface, or another source of breathing gas, or to be reached by another diver.

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

Life Support Equipment – Underwater equipment necessary to sustain life.

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

Organizational Member (OM) - An organization which is a current member of the AAUS, and which has a program, which adheres to the standards of the AAUS as, set forth in the *AAUS Manual*.

Manifold with Isolator Valve - A manifold joining two diving cylinders, that allows the use of two completely independent regulators. If either regulator fails, it may be shut off, allowing the remaining regulator access to the gas in both of the diving cylinders.

Mixed Gas - Breathing gas containing proportions of inert gas other than nitrogen greater than 1% by volume.

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

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

Nitrox - Any gas mixture comprised predominately of nitrogen and oxygen, most frequently containing between 22% and 40% oxygen. Also be referred to as Enriched Air Nitrox, abbreviated EAN.

Normal Ascent - An ascent made with an adequate air supply at a rate of 30 feet per minute or less.

OTU - Oxygen Toxicity Unit

Oxygen Compatible - A gas delivery system that has components (O-rings, valve seats, diaphragms, etc.) that are compatible with oxygen at a stated pressure and temperature.

Oxygen Service - A gas delivery system that is both oxygen clean and oxygen compatible.

Oxygen Toxicity - Any adverse reaction of the central nervous system (“acute” or “CNS” oxygen toxicity) or lungs (“chronic”, “whole-body”, or “pulmonary” oxygen toxicity) brought on by exposure to an increased (above atmospheric levels) partial pressure of oxygen.

Penetration Distance - Linear distance from the entrance intended or reached by a dive team during a dive at a dive site.

Pressure-Related Injury - An injury resulting from pressure disequilibrium within the body as the result of hyperbaric exposure. Examples include: decompression sickness, pneumothorax, mediastinal emphysema, air embolism, subcutaneous emphysema, or ruptured eardrum.

Pressure Vessel - See cylinder.

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

Primary Reel - Initial guideline used by the dive team from open water to maximum penetration or a permanently installed guideline.

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

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

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

Restriction - Any passage through which two divers cannot easily pass side by side while sharing air.

Rule of Thirds - Gas planning rule which is used in cave diving environments in which the diver reserves 2/3's of their breathing gas supply for exiting the cave or cavern.

Rule of Sixths - Air planning rule which is used in cave or other confined diving environments in which the diver reserves 5/6's of their breathing gas supply (for DPV use, siphon diving, etc.) for exiting the cave or cavern.

Safety Drill - ("S" Drill) - Short gas sharing, equipment evaluation, dive plan, and communication exercise carried out prior to entering a cave or cavern dive by the dive team.

Safety Reel - Secondary reel used as a backup to the primary reel, usually containing 150 feet of guideline that is used in an emergency.

Safety Stop - A stop made between 15-20 feet (5-6 meters) for 3-5 minutes during the final ascent phase of a dive.

Scientific Diving - Scientific diving is defined (29CFR1910.402) as diving performed solely as a necessary part of a scientific, research, or educational activity by employees whose sole purpose for diving is to perform scientific research tasks.

Scuba Diving - A diving mode independent of surface supply in which the diver uses open circuit self-contained underwater breathing apparatus.

Side Mount - A diving mode utilizing two independent SCUBA systems carried along the sides of the diver's body; either of which always has sufficient air to allow the diver to reach the surface unassisted.

Siphon - Cave into which water flows with a generally continuous in-current.

Standby Diver - A diver at the dive location capable of rendering assistance to a diver in the water.

Surface Supplied Diving - Surface Supplied: Dives where the breathing gas is supplied from the surface by means of a pressurized umbilical hose. The umbilical generally consists of a gas supply hose, strength member, pneumofathometer hose, and communication line. The umbilical supplies a helmet or full-face mask. The diver may rely on the tender at the surface to keep up with the divers' depth, time and diving profile.

Swimming Ascent - An ascent, which can be done under normal or emergency conditions accomplished by simply swimming to the surface.

Tender - Used in Surface supplied and tethered diving. The tender comprises the topsides buddy for the in-water diver on the other end of the tether. The tender must have the experience or training to perform the assigned tasks in a safe and healthful manner.

Turn Pressure - The gauge reading of a diver's open circuit scuba system designating the gas limit for terminating the dive and beginning the exit from the water.

Umbilical - Composite hose bundle between a dive location and a diver or bell, or between a diver and a bell, which supplies a diver or bell with breathing gas, communications, power, or heat, as appropriate to the diving mode or conditions, and includes a safety line between the diver and the dive location.

APPENDIX 6

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

A scientific diver that is currently certified under the auspices of Florida International University (FIU), an organizational member of the American Academy of Underwater Sciences (AAUS), shall be recognized by any other organizational member of AAUS and may apply for reciprocity in order to dive with 'the host organization. Organizational members that are in good standing with AAUS operate, at a minimum, under the AAUS Standards for Scientific Diving Certification and Operation of Scientific Diving Programs (1996 edition). The visiting diver will comply with the diving regulations of the host organization's Diving Safety Manual unless previously arranged by both organizations' Diving Control Boards.

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

(Date)

_____ Written scientific diving examination
_____ Last diving medical examination
_____ Most recent Check Out Dive
_____ Scuba regulator/equipment service/test
_____ CPR training (Agency) _____
_____ Administration (Agency) _____
_____ First aid for diving _____
_____ Date of last dive

Number of Dives completed within previous 12 months? _____

Depth certification _____

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

Please check any pertinent specialty certifications:

_____ Dry suit	_____ Rescue	_____ Blue water
_____ Dive Computer	_____ Dive Master	_____ Altitude
_____ Nitrox	_____ Instructor	_____ Ice/Polar
_____ Mixed gas	_____ EMT	_____ Cave

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_____ Closed circuit _____ Dive Accident Management
_____ Night _____ Saturation _____ Chamber operator
_____ Decompression _____ Lifesaving other _____

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 Florida International University.

Diving Safety Officer: _____

(Signature)

(Date)

{Print}

(Telephone, FAX, Email)

APPENDIX 7

FIU/AAUS CHECKOUT DIVE AND TRAINING EVALUATION

Certified scientific divers and Divers-In-Training from AAUS organizational members 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 AAUS 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 watermanship 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 mid-water)
 - 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

APPENDIX 8

DIVING EMERGENCY MANAGEMENT PROCEDURES

Introduction

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

General Procedures

Depending on and according to the names of the diving accident, stabilize the patient. . Administer 100% oxygen, contact local Emergency Medical System (EMS) for transport to medical facility, and contact diving accident coordinator, as appropriate. Explain the circumstances of the dive incident to the evacuation teams. Medics and physicians. Do not assume that a diver understands 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. If No Signs Of Life...Provide (C) 30 Compressions, (A) Open Airway, (B) 2 Breaths
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 Emergency Action Plan of the organizational member.
7. Complete and submit incident report form attached with (Appendix 9) to FIU's DSO and the AAUS (As required in Section 2.72)

APPENDIX 9

ACCIDENT RESPONSE PLAN

Materials Included Emergency Oxygen Kits:

- ✓ Diving Accident Management Flow Chart
- ✓ Emergency Communication Tips
- ✓ CPR Reminders
- ✓ Underwater Accident Report
- ✓ Helicopter Evacuation

The Steps to Take After an Accident or Incident*

1. Provide first aid and oxygen administration to the injured person(s)
(Utilize the flow chart and CPR Reminders)
2. Document signs and symptoms of the victim, time of occurrence of rendering first aid and what was exactly done for the victim, obtain dive profile, and obtain emergency contact information. *(Utilize the Underwater Accident Report Form)*
3. Communications
 - ___ If Offshore: Immediately notify the Coast Guard
(Follow Emergency Communication Sheet)
 - ___ On Land: Call 911
 - ___ Notify Roger Garcia: Dive Safety Office
305-664-2619 Ext: 207
305-509-2523 (Cell Phone)
305-348-2621 Environmental Health and Safety Dept.
 - ___ Notify Jim Fourqurean: Chair DCB
305-348 4084
 - ___ Office of Human Resources: Workman's Compensation
305-348-3273
4. Medical Evacuation Preparation
 - Helicopter Evacuation
(Follow Helicopter Evacuation Sheet)
 - Land Evacuation
(Follow instructions of EMS Personnel to assist)
5. Preliminary Accident Investigation Protocol
 - ___ Obtain all recorded documented information
 - ___ Secure victim's scuba equipment, leave it assembled
 - ___ Do Not Talk to the Media, refer them to Press Relations, 348-2232
 - ___ Make preliminary assessment as to the cause of the accident, task related, equipment problem, environmental, personnel error, or dive plan related.

APPENDIX 10

GUIDELINES FOR USE OF DIVE COMPUTERS

From AAUS Dive Computer Workshop. Lang and Hamilton {Eds.}. U.S.C. Sea Grant Program, Los Angeles, CA. 1989

1. Only those makes and models of dive computers specifically approved by the Diving Control Board may be used.
2. Any diver desiring 100' approval to use a dive computer as a means of determining decompression status must apply to the Diving Control Board, complete an appropriate practical training session and pass a written examination.
3. Each diver relying on a dive computer to plan dives and indicates or determines decompression status must have his own unit.
4. On any given dive, both divers in buddy pair must follow the most conservative dive computer.
5. If the dive computer fails at any time during dive. Dive must be terminated and appropriate surfacing procedures should be initiated immediately.
6. A diver should not dive for 18 hours before activating a dive computer to use it to control his diving.
7. Once dive computer is in use, it must not be switched off until it indicates complete outgassing has occurred or 18 hours have elapsed, whichever comes first.
8. When using a dive computer, non-emergency ascent are to be at a rate specified for the make and model of dive computer being used.
9. Ascent rates shall not exceed 30 fsw/min in the last 60fsw.
10. Whenever practical, divers using a dive computer should make a stop between 10 and 30 feet for 5 min, especially for dives bellow 60 fsw.
11. Only one dive on the dive computer in which the NDL of the tables or dive computer has been exceeded may be made in any 18-hour period.
12. Repetitive and multi-level diving procedures should start the dive or series of dives, at the maximum planned depth, and followed by subsequent dives of shallower exposures.
13. Multiple deep dives require special consideration.

APPENDIX 11
SAFE ASCENT RECOMMENDATIONS
From: AAUS BIOMECHANICS OF SAFE ASCENTS WORKSHOP .1990, Lang and
Egstrom {Eds.}

It has long been the position of the American Academy of Underwater Sciences that the ultimate responsibility for safety rests with the individual diver. The time has come to encourage divers to slow their ascents.

1. Buoyancy compensation is a significant problem in the control of ascents.
2. Training in, and understanding of, proper ascent techniques is fundamental to safe diving practice.
3. Before certification, the diver is to demonstrate proper buoyancy, weighting and a controlled ascent, including a hovering stop.
4. Diver shall periodically review proper ascent techniques to maintain proficiency.
5. Ascent rates shall not exceed 30 fsw per minute.
6. A stop in the 10-30 fsw zone for 3-5 min is recommended on every dive.
7. When using a dive computer, a non-emergency ascent is to be at a rate specified for the make and model of dive computer being used.
8. Each diver shall have instrumentation to monitor ascent rates.
9. Divers using dry suits shall have training in their use.
10. Dry suits shall have a hands-free exhaust valve.
11. BCs shall have a reliable rapid exhaust valve that can be operated in a horizontal swimming position.
12. A buoyancy compensator is required with dry suit use for ascent control and emergency flotation.
13. Breathing 100% oxygen above water is preferred to in-water air procedures for omitted decompression.

APPENDIX 12

FIU SCIENTIFIC DIVING PROGRAM

LIST OF EMERGENCY PHONE NUMBERS

DIVING CONTROL BOARD CHAIRMAN

James Fourqurean

Days (305) 348-4084 or Nights (305) 248-2756

Fax (305) 348-4096

DIVE SAFETY OFFICER

Roger Garcia

Days (305) 664-2916 (ext: 207) or Cell (305) 509-2523

Fax (305) 664-8537

Cell: (305)-509-2523

SEARCH AND RESCUE/CASUALTY EVACUATION

U.S. Coast Guard Miami (305) 350-5611

U.S. Coast Guard Key West (305) 292-8726

U.S. Coast Guard St. Petersburg (813) 893-3454

EMERGENCY MEDICAL SERVICES

Call 911

(DAN) DIVERS ALERT NETWORK

(919) - 684-8111

Call collect...say, "I am reporting a diving accident."

RADIO EMERGENCY FREQUENCIES

International distress voice communications between vessels or aircraft and vessels
2182 kHz or 156.8 kHz. Channel 16 Marine Radio / Channel 9 CB Radio

HYPERBARIC CHAMBERS

Mariners Hyperbaric Dept. (305) 434-1603, Emergency Room; (305) 434-1600

Mercy Hyperbaric Dept. (305) 285-2970, Emergency Room (305) 854-4400

APPENDIX 13**FIU Diving Standard for Citizen Scientists, Educators and Outreach Personnel**

The Occupational Health and Safety Administration (OSHA) has granted an exemption from 29 CFR 1910 Subpart T – Commercial Diving Operations for organizations that meet the exemption requirements for Scientific Diving. FIU is a member of The American Academy of Underwater Sciences (AAUS), and conducts scientific dives in accordance with AAUS standards. However, when FIU elected to become the operating organization for the Aquarius Reef Base, a commitment was made to make program assets more available to non-traditional customers. This included developing programs that engaged citizen scientists, educators and outreach personnel who were typically not included because of the time commitment required to go through approved training protocols or were not members of a reciprocal diving program.

FIU approved Citizen Scientists, Educators and Outreach Personnel must:

- * Must be at least 18 years old. Participation of minors in any diving activities at FIU can only be done following FIU DCB and ORED approval of a detailed proposal for the specific Citizen Science program.
- * Must be a certified diver and provide a copy of their certification card.
- * All citizen scientist dives shall be restricted to a depth no deeper than 70 fsw. Deeper dives require prior approval from the FIU Diving Control Board.
- * Must provide a written approval to dive from their physician.
- * Must fill out the FIU waiver and diver participation forms.
- * Must have comprehensive medical insurance and DAN Accident Insurance. Copies must be submitted to the FIU Diving Safety Officer.
- * All Citizen Science Divers shall be trained in scientific research techniques OR shall apply scientific research techniques in order to collect data as part of an FIU DCB-sanctioned Citizen Science program.
- * Complete a check out dive in shallow water (must have the understanding that we can choose to cancel their dive).
- * All Citizen Scientist Divers will be escorted by at least 1 FIU Safety Observer diver. The number of safety observer divers shall be increased at the discretion of the DSO and or the Diving Supervisor based on the number of Citizen Scientist divers. The number of Citizen Scientist's per project shall not exceed (8) at any given time during the project.
- * Citizen Scientists shall receive "task orientated" training by qualified Scientific Divers or Researchers; and meet the following requirements:

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1. Training shall expose the Citizen Scientist to ‘tasks’ which will assist qualified researchers and scientific divers in meeting project goals.
2. Citizen Scientists “Scope of Work” while diving, shall be limited to the following: Documentation using cameras, slates, water proof paper and fish identification placards. For sampling and specimen collection, they may use collection tubes and small hand tools (Small hammers, small chisel and or cutting devise for dissection). Citizen Scientist are not permitted to use large hand tools nor pneumatic or hydraulic tools, nor shall they perform any dives consistent with commercial diving operations and or trouble shooting tasks.

APPENDIX 14

Rebreathers

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

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

Application of this standard is in addition to pertinent requirements of all other sections of the AAUS Standards for Scientific Diving, Volumes 1 and 2.

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

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

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

12.10 Definition

- A. Rebreathers are defined as any device that recycles some or all of the exhaled gas in the breathing loop and returns it to the diver. Rebreathers maintain levels of oxygen and carbon dioxide that support life by metered injection of oxygen and chemical removal of carbon dioxide. These characteristics fundamentally distinguish rebreathers from open-circuit life support systems, in that the breathing gas composition is dynamic rather than fixed
- B. There are three classes of rebreathers:
 1. Oxygen Rebreathers: Oxygen rebreathers recycle breathing gas, consisting of pure oxygen, replenishing the oxygen metabolized by the diver. Oxygen rebreathers are generally the least complicated design but are limited in depth of use due to the physiological limits associated with oxygen toxicity
 2. Semi-Closed Circuit Rebreathers: Semi-closed circuit rebreathers (SCR) recycle the majority of exhaled breathing gas, venting a portion into the water and replenishing it with a constant or variable amount of a single oxygen-enriched gas

mixture. Gas addition and venting is balanced against diver metabolism to maintain safe oxygen levels

3. Closed-Circuit Rebreathers: Closed-circuit mixed gas rebreathers (CCR) recycle all of the exhaled gas. Electronically controlled CCRs (eCCR) replace metabolized oxygen via an electronically controlled valve, governed by oxygen sensors. Manually controlled CCR (mCCR) rely on mechanical oxygen addition and diver monitoring to control oxygen partial pressure (ppO₂). Depending on the design, manual oxygen addition may be available on eCCR units as a diver override, in case of electronic system failure. Systems are equipped with two cylinders; one with oxygen, the other with a diluent gas source used to make up gas volume with depth increase and to dilute oxygen levels. CCR systems operate to maintain a constant ppO₂ during the dive, regardless of depth

12.20. Prerequisites for use of any rebreather.

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

12.30. Training

- A. Specific training requirements for use of each rebreather model shall be defined by DCB on a case-by-case basis. Training shall include factory-recommended requirements, but may exceed this to prepare for the type of mission intended (e.g., staged decompression or heliox/trimix CCR diving). (See training section for details.)
- B. Successful completion of training does not in itself authorize the diver to use rebreathers. The diver must demonstrate to the DCB or its designee that the diver

possesses the proper attitude, judgment, and discipline to safely conduct rebreather diving in the context of planned operations.

- C. Post training supervised dives are required before the Scientific rebreather diver is authorized to use rebreather for research dives. (see training section for details).

II. Individual Equipment Requirements

Individual Equipment Requirements			
Key: X = include, IA = If Applicable			
	O2	SCR	CCR
DCB approved rebreather make and model	X	X	X
Bottom timer, and depth gauge	X	X	X
Dive computer (separate from rebreather unit)		X	X
Approved dive tables		IA	IA
SMB (surface marker buoy) and line reel or spool with sufficient line to deploy an SMB from the bottom in the training environment	IA	IA	IA
Access to an oxygen analyzer	X	X	X
Cutting implement	X	X	X
BCD capable of floating a diver with a flooded loop and/or dry suit at the	X	X	X
Bailout gas supply of sufficient volume for planned diving activities	X	X	X
Approved CO2 absorbent and other consumables	X	X	X

12.40. Equipment Requirements

A. General

1. Only those models of rebreathers specifically approved by DCB shall be used
2. Rebreathers should meet the quality control/quality assurance protocols of the International Organization for Standardization (ISO) requirements: ISO 9004: 2009 or the most current version, AND successful completion of CE (Conformité Européenne) or DCB approved third party testing
3. Rebreather modifications (including consumables and operational limits) that deviate from or are not covered by manufacturer documentation should be discussed with the manufacturer and approved by the DCB prior to implementation

B. Equipment Maintenance Requirements

1. The DCB or their designee will establish policies for the maintenance of rebreathers and related equipment under their auspices. Rebreathers should be maintained in accordance with manufacturer servicing recommendations
2. Field repairs and replacement of components covered in rebreather diver training is not annual maintenance and may be performed by the rebreather diver in accordance with DCB policy
3. A maintenance log will be kept and will minimally include:
 - a) Dates of service
 - b) Service performed
 - c) Individuals or company performing the service

12.50. Operational Requirments

A. Dive Plan

1. In addition to standard dive plan components, at a minimum all dive plans that include the use of rebreathers must include:
 - a) Information about the specific rebreather model(s) to be used
 - b) Type of CO₂ absorbent material
 - c) Composition and volume(s) of supply gasses
 - d) Bailout procedures
 - e) Other specific details as required by the DCB
 - f) Particular attention should be paid to using rebreathers under conditions where vibration or pulsating water movement could affect electronics or control switches and systems
 - g) Particular attention should be paid to using rebreathers under conditions where heavy physical exertion is anticipated

- B. Ideally, respired gas densities should be less than $5 \text{ g}\cdot\text{L}^{-1}$, and should not exceed $6 \text{ g}\cdot\text{L}^{-1}$ under normal circumstances.
- C. User replaceable consumable rebreather components should be replaced per manufacture recommendations or as defined by the DCB
- D. If performed, periodic field validation of oxygen cells should be conducted per DCB designated procedure
- E. Diver carried off-board bailout is not required under conditions where the onboard reserves are adequate to return the diver to the surface while meeting proper ascent rate and stop requirements, and the system is configured to allow access to onboard gas. These calculations must take into consideration mixed mode operations where an open circuit diver could require assistance in an out of gas situation
- F. Use and reuse of CO_2 scrubber media should be per manufacture recommendations or as defined by the DCB
- G. Planned oxygen partial pressure in the breathing gas shall not exceed 1.4 atmospheres at depths greater than 30 feet, or 1.6 at depths less than 30feet
- H. Both CNS and Oxygen Tolerance Units (OTUs) should be tracked for each diver. Exposure limits should be established by the DCB
- I. The DCB or their designee will:
 - 1. Establish policies for the use of checklists related to rebreather operations
 - 2. Establish policies for pre and post dive equipment checks to be conducted by their divers
 - 3. Establish policies for disinfection of rebreathers to be used by their divers
 - 4. Establish policies for pre-breathing of rebreathers used by their divers
 - 5. Establish policies for the use of mixed mode and mixed rebreather platform dive teams under their auspices.

- a) Mixed mode and/or mixed platform dive teams are permitted.
 - b) At minimum, divers must be cross briefed on basic system operations for establishing positive buoyancy, closing a rebreather diver's breathing loop, and procedures for gas sharing
6. Establish policies for the maximum depth of dives conducted using a particular class of rebreather within the auspices of their diving operations
 7. Establish policies for depth progression/depth certification/depth certification maintenance for divers using rebreathers
 8. Establish policies for implementing workup dives within program
 - a) Pre-operation workup dives, including review and practice of emergency recognition and response skills, and management of task loading are required for operations defined by the DCB as beyond the scope of normal operating conditions.
 9. Establish policies for the minimum use of rebreathers to maintain proficiency.
 - a) The minimum Annual rebreather diving activity should be 12 rebreather dives, with a minimum of 12 h underwater time.
 - b) To count, dives should be no less than 30 min in duration. A required element of maintaining proficiency is the periodic performance and reevaluation of skills related to in-water problem recognition and emergency procedures
 - J. Establish policies for reauthorization for the use of rebreathers if minimum proficiency requirements are not met
 1. Reestablishment of authorization to use rebreathers must require more than just performing a dive on a particular make or model of rebreather
 2. At minimum demonstrated skills included in the required training elements for the level of rebreather operation must be performed and reevaluated.

REBREATHER TRAINING SECTION

A. Entry Level Training

1. The training area for O2 Rebreather should not exceed 20 fsw in depth
2. Entry level CCR and SCR training is limited in depth of 130fsw and shallower
3. Entry level CCR and SCR training is limited to nitrogen/oxygen breathing media
4. Divers at the CCR and SCR entry level may not log dives that require a single decompression stop longer than 10 minutes
5. Who may teach: Individuals authorized as a CCR, SCR, or O2 Rebreather Instructor by the DCB; in all cases, the individual authorized must have operational experience on the rebreather platform being taught, and where applicable the individual being authorized should be authorized as an instructor by the respective rebreather manufacturer or their designee.
6. Maximum Student/Instructor Ratio: 4 to 1. This ratio is to be reduced as required by environmental conditions or operational constraints
7. Upon completion of practical training, the diver must demonstrate proficiency in pre-dive, dive, and post-dive operational procedures for the particular model of rebreather to be used
8. Supervised dives target activities associated with the planned science diving application. Supervisor for these dives is the DSO or designee, experienced with the make/model rebreather being used

Rebreather Entry Level Training Requirements			
Key: X = include, IA = If Applicable, ISE = If So Equipped			
	O2	SCR	CCR
Required Training Topic			
Academic			
History of technology	X	X	X
Medical & physiological aspects of:			
Oxygen toxicity	X	X	X
Chemical burns & caustic	X	X	X
Hypoxia – insufficient O ₂	X	X	X
Hypercapnia – excessive	X	X	X
Arterial gas embolism	X	X	X
Middle Ear Oxygen Absorption Syndrome (oxygen	X	X	X

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Hygienic concerns	X	X	X
Nitrogen absorption & decompression		X	X
CO ₂ retention	X	X	X
Hyperoxia-induced	X	X	X
System design, assembly, and operation, including:			
Layout and design	X	X	X
Oxygen control systems	X	X	X
Diluent control systems		ISE	ISE
Use of checklists	X	X	X
Complete assembly and disassembly of the unit	X	X	X
Canister design & proper packing and handling of chemical absorbent	X	X	X
Deompression management and applicable tracking methods		ISE	X
Oxygen and high pressure gas handling and safety	X	X	X
Fire triangle	X	X	X
Filling of cylinders	X	X	X
Pre-dive testing & trouble shooting	X	X	X
Postdive break-down and maintenance	X	X	X
Trouble shooting and manufacturer authorized field repairs	X	X	X
Required maintenance and and intervals	X	X	X
Manufacturer supported additiona items IADV, Temp Stick, CO2 monitor	ISE	ISE	ISE
Dive planning:			
Operational planning	X	X	X
Gas requirements	X	X	X
Oxygen exposure and management	X	X	X
Gas density calculations		X	X
Oxygen metabolizing calculations	X	X	X
Scrubber limitations	X	X	X
Mixed mode diving (buddies using different dive modes)	X	X	X
Mixed platform diving (buddies using different rebreather platforms)	X	X	X
Problem Recognition & Emergency Procedures:			
Applicable open circuit emergency procedures for common gear	X	X	X
Loss of electronics	ISE	ISE	X
Partially flooded loop	X	X	X
Fully flooded loop	X	X	X
Cell warnings		ISE	X
Battery warnings	ISE	ISE	X
High O ₂ warning	ISE	ISE	X
Low O ₂ warning	ISE	ISE	X
High CO ₂ warning	ISE	ISE	ISE
Recognizing issues as indicated by onboard scrubber monitors	ISE	ISE	ISE
Recognizing hypercapnia signs and symptoms in self or buddy	X	X	X
Excluded O2 cell(s)	ISE	ISE	ISE
Loss of Heads Up Display (HUD)	ISE	ISE	ISE

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Loss of buoyancy	X	X	X
Diluent manual add button not functioning		ISE	ISE
O2 manual add button not functioning	ISE	ISE	ISE
Exhausted oxygen supply	X	X	X
Exhausted diluent supply		ISE	ISE
Lost or exhausted bailout	ISE	ISE	ISE
Handset not functioning	ISE	ISE	ISE
Solenoid stuck open	ISE	ISE	ISE
Solenoid stuck closed	ISE	ISE	ISE
ADV stuck open	ISE	ISE	ISE
ADV stuck closed	ISE	ISE	ISE
Isolator valve(s) not functioning	ISE	ISE	ISE
Oxygen sensor validation	ISE	ISE	X
CO ₂ sensor validation	IA	IA	IA
Gas sharing	X	X	X
Diver assist and diver rescue	X	X	X
Other problem recognition and emergency procedures specific to the particular unit, environment, or diving conditions	X	X	X
Practical Training and Evaluations			
Demonstrated skills shall include, at a minimum:			
Use of checklists	X	X	X
Carbon dioxide absorbent canister packing	X	X	X
Supply gas cylinder analysis and pressure check	X	X	X
Test of one-way valves	X	X	X
System assembly and breathing loop leak Testing	X	X	X
Oxygen control system calibration	ISE	ISE	X
Proper pre-breathe procedure	X	X	X
In-water bubble check	X	X	X
Proper buoyancy control during descent, dive operations, and ascent	X	X	X
System monitoring & control during descent, dive operations, and	X	X	X
Proper interpretation and operation of system instrumentation	X	X	X
Proper buddy contact and communication	X	X	X
Use of a line reel or spool to deploy an SMB from planned dive depth and while controlling buoyancy in the water column	X	X	X
Proper management of line reel or spool, and SMB during ascents and Safety or required stops	X	X	X
Unit removal and replacement on the surface	X	X	X
Bailout and emergency procedures for self and buddy, including:			
System malfunction recognition and solution	X	X	X
Manual system control	ISE	ISE	ISE
Flooded breathing loop recovery	IA	IA	IA
Absorbent canister failure	X	X	X
Alternate bailout options	X	X	X
Manipulation of onboard and offboard cylinder valves	X	X	X

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Manipulation of bailout cylinders (removal, replacement, passing and receiving while maintaining buoyancy control)	ISE	ISE	ISE
Manipulation of quick disconnects, isolator valves, and manual controls specific to the unit and gear configuration	ISE	ISE	ISE
Proper system maintenance, including:			
Breathing loop disassembly and disinfection	X	X	X
Oxygen sensor replacement	ISE	ISE	ISE
Battery removal and replacement or recharging	ISE	ISE	ISE
Other tasks as required by specific rebreather models	X	X	X
Written Evaluation	X	X	X
Supervised Rebreather Dives	X	X	X
Entry Level Training – Minimum Underwater Requirements			
	Pool/Confined Water	Openwater	Supervised Dives
O2	1 Dive, 90 – 120 minutes	4 dives, 120 minute	2 Dives, 120 minute
SCR	1 Dive, 90 – 120 minutes	4 dives, 120 minute	4 dives, 120 minute
CCR	1 Dive, 90 – 120 minutes	8 dives, 380 minute	4 dives, 240 minute

B. Rebreather Required Decompression, Mixed Gas, and Hypoxic Mix Training

9. Required Decompression and Mixed Gas Training may be taught separately or combined. If combined, open water and supervised dive requirements are added together to equal the total of the courses if taught separately

10. Prerequisites:

a) Required Decompression 25 rebreather dives for a minimum cumulative dive time of 25 hours

b) Mixed Gas:

(1) Non-hypoxic Mixes – 25 rebreather dives for a minimum cumulative dive time of 25 hours

(2) Hypoxic Mixes – Rebreather Required Decompression Certification and Mixed Gas Certification and 25 dives for a minimum cumulative dive time of 40 hours on dives requiring decompression

11. Who may teach: Individuals authorized as a CCR/SRC required decompression and/or Mixed Gas and/or Hypoxic Mix instructor by the DCB or their designee (this is in addition to the original authorization from section A #5)
12. Maximum Student/Instructor Ratio: 2 to 1. This ratio is to be reduced as required by environmental conditions or operational constraints
13. Upon completion of practical training, the diver must demonstrate proficiency in pre-dive, dive, and post-dive operational procedures for the particular model of rebreather to be used
14. Supervised dives target activities associated with the planned science diving application. Supervisor for these dives is the DSO or designee, experienced with the make/model rebreather being used

Rebreather Required Decompression, Mixed Gas & Hypoxic Mix Training Requirements			
Key: X = include, IA = If Applicable, ISE = If So Equipped			
	Deco	Mixed Gas	Hypoxic Mixes
Required Training Topic			
Academic			
Review of applicable subject matter from previous	X	X	X
Medical & physiological aspects of:			
Hypercapnia, hypoxia, hyperoxia	X	X	X
Oxygen limitations	X	X	X
Nitrogen limitations	X	X	X
Helium absorption and elimination		X	X
High Pressure Nervous Syndrome			X
System design, assembly, and operation, including:			
Gear considerations and rigging	X	X	X
Gas switching	X	X	X
Dive planning:			
Decompression Calculation	X	X	X
Gradient Factors	X	X	X
Scrubber duration and the effects of depth on scrubber function	X	X	X
Gas requirements including bailout scenarios	X	X	X
Bailout gas management – individual vs team bailout	X	X	X
Gas density calculations	X	X	X
Operational Planning	X	X	X
Equivalent narcosis depth theory		X	X
Gas selection, gas mixing and gas formulas		X	X

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Problem Recognition & Emergency Procedures:			
Applicable open circuit emergency procedures for common gear	X	X	X
Flooded loop	X	X	X
Cell warnings	X	X	X
Battery warnings	X	X	X
Hypercapnia, hypoxia, hyperoxia	X	X	X
Practical Training and Evaluations			
Demonstrated skills shall include, at a minimum:			
Proper demonstration of applicable skills from previous training	X	X	X
Proper manipulation of DSV and/or BOV	X	X	X
Proper descent and bubble check procedures	X	X	X
Proper monitoring of set point switching and pO2 levels	X	X	X
Proper interpretation and operation of system interpretation	X	X	X
System monitoring & control during descent, dive operations, & ascent	X	X	X
Demonstrate the ability to manually change setpoint & electronics settings during the dive	ISE	ISE	ISE
Demonstrate buoyancy control; ability to hover at a fixed position in water column without moving hands or feet	X	X	X
Onboard & offboard valve manipulation for proper use , & reduction of gas loss	X	X	X
Diagnosis of and proper reactions for a flooded absorbent canister	X	X	X
Diagnosis of and proper reactions for CO ₂ breakthrough	X	X	X
Diagnosis of and proper response to cell errors	X	X	X
Diagnosis of and proper reactions for Low oxygen drills	X	X	X
Diagnosis of and proper reactions for Flooded Loop	X	X	X
Diagnosis of & proper reactions for High Oxygen drills	X	X	X
Diagnosis of & proper reactions for electronics and battery	X	X	X
Operation in semi-closed mode	X	X	X
Properly execute the ascent procedure for an incapacitated diver	X	X	X
Demonstrate controlled ascent with an incapacitated diver including surface tow at least 100 feet with equipment removal on surface in water too deep to stand	X	X	X
Proper buddy contact and communication	X	X	X
Use of a line reel or spool to deploy an SMB from planned dive depth & while controlling buoyancy in the water column	X	X	X
Proper management of line reel or spool, and SMB during ascents & safety or required stops	X	X	X
Demonstrate the ability to maintain minimum loop volume	X	X	X
Demonstrate comfort swimming on surface and at depth carrying a single bailout/decompression cylinder/bailout rebreather	X		
Demonstrate ability to pass and retrieve a single bailout/decompression cylinder or bailout rebreather while maintaining position in the water column	X		

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Demonstration the ability to pass and receive multiple bailout / decompression cylinders or bailout rebreather while maintaining position in the water column	IA	X	X
Demonstration of the ability to perform simulated decompression stops at pre-determined depths for scheduled times	X	X	X
Demonstration of the ability to perform decompression stops at pre-determined depth for scheduled times	X	X	X
Demonstrate competence managing multiple bailout cylinders, including drop and recovery while maintaining position in the water column	IA	X	X
Demonstrate appropriate reaction to simulated free-flowing deco reg	X	X	X
Gas share of deco gas for at least 1 minute	X	X	X
Demonstrate oxygen rebreather mode at appropriate stop depths		X	X
Complete bailout scenarios from depth to include decompression obligation on open circuit	X	X	X

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

B. Rebreather Crossover Training

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

APPENDIX 15

Recommendations For Rescue Of A Submerged Unresponsive Compressed-Gas Diver

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