

# Coastal Carolina University

## STANDARDS FOR SCIENTIFIC DIVING

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### FOREWORD

In the winter of 2002 Coastal Carolina University (CCU) began the process of organizing and standardizing scientific diving activities that will primarily be associated with the Marine Science department, the Coastal Marine and Wetland Studies graduate program, and the Burroughs and Chapin Center for Marine and Wetland Studies, as well as other departments within the College of Natural and Applied Sciences. This manual has been created, strictly following the guidelines set forth by the **American Academy of Underwater Sciences (AAUS)**, to govern all ongoing scientific diving research programs in the fields of marine biology and ecology, marine geology and coastal processes, marine and environmental chemistry, physical oceanography, coastal and freshwater wetlands and watersheds, and marine archeology. This manual presents the minimum acceptable safety procedures to be employed in all CCU diving operations.

### ACKNOWLEDGEMENTS

The original document came directly from the AAUS Standards for Scientific Diving and is copied with permission from the AAUS (<http://www.aaus.org/>).

### Revision History

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**Volume 1**  
**Sections 1.00 through 6.00**  
Required For All AAUS Organizational Members

**SECTION 1.00 GENERAL POLICY**

**1.10 Scientific Diving Standards**

**1.11 Purpose**

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

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

This standard was developed and written by AAUS by compiling the policies set forth in the diving manuals of several university, private, and governmental scientific diving programs. These programs share a common heritage with the scientific diving program at the Scripps Institution of Oceanography (SIO). Adherence to the SIO standards has proven both feasible and effective in protecting the health and safety of scientific divers since 1954.

In 1982, OSHA exempted scientific diving from commercial diving regulations (29CFR1910, Subpart T) under certain conditions that are outlined below. The final guidelines for the exemption became effective in 1985 (Federal Register, Vol. 50, No.6, p.1046). AAUS is recognized by OSHA as the scientific diving standard setting organization. Additional standards that extend this document may be adopted by each organizational member, according to local procedure.

**1.12 Scientific Diving Definition**

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

**1.13 Scientific Diving Exemption**

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

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

- b) The purpose of the project using scientific diving is the advancement of science; therefore, information and data resulting from the project are non-proprietary.
- c) The tasks of a scientific diver are those of an observer and data gatherer. Construction and trouble-shooting tasks traditionally associated with commercial diving are not included within scientific diving.
- d) Scientific divers, based on the nature of their activities, must use scientific expertise in studying the underwater environment and therefore, are scientists or scientists-in-training.
- e) In addition, the scientific diving program shall contain at least the following elements (29CFR1910.401):
  - i. 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.
  - ii. Diving Control Board, with the majority of its members being active scientific divers, which shall at a minimum have the authority to: approve and monitor diving projects, review and revise the diving safety manual, assure compliance with the manual, certify the depths to which a diver has been trained, take disciplinary action for unsafe practices, and assure adherence to the buddy system (a diver is accompanied by and is in continuous contact with another diver in the water) for scuba diving.

## **1.14 Review of Standards**

As part of CCU's diving control board annual report, any recommendations for modifications of these standards shall be submitted to the AAUS for consideration.

## **1.20 Operational Control**

### **1.21 Organizational Member Auspices Defined**

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

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

### **1.22 Scientific Diving Standards and Safety Manual**

CCU shall develop and maintain a scientific diving safety manual that provides for the development and implementation of policies and procedures that will enable CCU to meet requirements of local environments and conditions as well as to comply with the

AAUS scientific diving standards. The scientific diving manual shall include, but not be limited to:

- a) A minimal set of guidelines for the development of an organizational member's scientific diving safety manual. Volume 1, Sections 1.00 through 6.00 and the Appendices are required for all manuals. Volume 2, Sections 7.00 through 9.00 are required only when the organizational member conducts that diving activity. Organizational member specific sections are placed in Volume 2.
- b) Emergency evacuation and medical treatment procedures.
- c) Criteria for diver training and certification.
- d) Standards written or adopted by reference for each diving mode utilized which include the following:
  - i. Safety procedures for the diving operation.
  - ii. Responsibilities of the dive team members.
  - iii. Equipment use and maintenance procedures.
  - iv. Emergency procedures.

### **1.23 Diving Safety Officer**

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

- a) Qualifications
  - i. Shall be appointed by the responsible administrative officer or designee, with the advice and counsel of the Diving Control Board.
  - ii. Shall be trained as a scientific diver.
  - iii. Shall be a full member as defined by AAUS.
  - iv. Shall be an active underwater instructor from an internationally recognized certifying agency.
- b) Duties and Responsibilities
  - i. Shall be responsible, through the DCB, to the responsible administrative officer or designee, for the conduct of the scientific diving program of the membership organization. The routine operational authority for this program, including the conduct of training and certification, approval of dive plans, maintenance of diving records, and ensuring compliance with this standard and all relevant regulations of the membership organization, rests with the Diving Safety Officer.
  - ii. 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.
  - iii. Shall be guided in the performance of the required duties by the advice of the DCB, but operational responsibility for the conduct of the local diving program will be retained by the Diving Safety Officer.
  - iv. Shall suspend diving operations considered to be unsafe or unwise.

### **1.24 Diving Control Board**

- a) The Diving Control Board (DCB) shall consist of a majority of active scientific divers. Voting members shall include the Diving Safety Officer, the responsible administrative officer, or designee, and should include other representatives of the diving program such as qualified divers and members selected by procedures established by each organizational member. A chairperson and a secretary may be chosen from the membership of the board according to local procedure.
- b) Has autonomous and absolute authority over the scientific diving program's operation.
- c) Shall approve and monitor diving projects.
- d) Shall review and revise the diving safety manual.
- e) Shall assure compliance with the diving safety manual.
- f) Shall certify the depths to which a diver has been trained.
- g) Shall take disciplinary action for unsafe practices.
- h) Shall assure adherence to the buddy system for scuba diving.
- i) Shall act as the official representative of the CCU in matters concerning the scientific diving program.
- j) Shall act as a board of appeal to consider diver-related problems.
- k) Shall recommend the issue, reissue, or the revocation of diving certifications.
- l) Shall recommend changes in policy and amendments to AAUS and CCU's diving safety manual as the need arises.
- m) Shall establish and/or approve training programs through which the applicants for certification can satisfy the requirements of CCU's diving safety manual.
- n) Shall suspend diving programs that are considered to be unsafe or unwise.
- o) Shall establish criteria for equipment selection and use.
- p) Shall recommend new equipment or techniques.
- q) Shall establish and/or approve facilities for the inspection and maintenance of diving and associated equipment.
- r) Shall ensure that CCU's air station(s) or stations used by CCU divers meet air quality standards as described in Section 3.60.
- s) Shall periodically review the Diving Safety Officer's performance and program.
- t) Shall sit as a board of investigation to inquire into the nature and cause of diving accidents or violations of CCU's diving safety manual.

### **1.25 Instructional Personnel**

- a) Qualifications - All personnel involved in diving instruction under the auspices of CCU shall be qualified for the type of instruction being given.

- b) Selection - Instructional personnel will be selected by the responsible administrative officer, or designee, who will solicit the advice of the DCB in conducting preliminary screening of applicants for instructional positions.

### **1.26 Lead Diver**

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

- a) Coordination with other known activities in the vicinity that are likely to interfere with diving operations.
- b) Ensuring all dive team members possess current certification and are qualified for the type of diving operation.
- c) Planning dives in accordance with Section 2.20
- d) Ensuring safety and emergency equipment is in working order and at the dive site.
- e) Briefing dive team members on:
  - i. Dive objectives.
  - ii. Unusual hazards or environmental conditions likely to affect the safety of the diving operation.
  - iii. Modifications to diving or emergency procedures necessitated by the specific diving operation.
  - iv. Suspending diving operations if in their opinion conditions are not safe.
  - v. Reporting to the DSO and DCB any physical problems or adverse physiological effects including symptoms of pressure-related injuries.

### **1.27 Reciprocity and Visiting Scientific Diver**

- a) Two or more AAUS Organizational Members engaged jointly in diving activities, or engaged jointly in the use of diving resources, shall designate one of the participating Diving Control Boards to govern the joint dive project.
- b) A Scientific Diver from one Organizational Member shall apply for permission to dive under the auspices of another Organizational Member by submitting to the Diving Safety Officer of the host Organizational Member a document containing all the information described in Appendix 8, signed by the Diving Safety Officer or Chairperson of the home Diving Control Board.
- c) A visiting Scientific Diver may be asked to demonstrate their knowledge and skills for the planned dive.
- d) If a host Organizational Member denies a visiting Scientific Diver permission to dive, the host Diving Control Board shall notify the visiting Scientific Diver and their Diving Control Board with an explanation of all reasons for the denial.

### **1.28 Waiver of Requirements**

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

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

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

### **1.40 Consequences of Violation of Regulations by Organizational Members**

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

### **1.50 Record Maintenance**

The Diving Safety Officer or designee shall maintain permanent records for each Scientific Diver certified. The file shall include (1) evidence of certification level, (2) log sheets, (3) results of current physical examination, (4) reports of disciplinary actions by the organizational member Diving Control Board, and (5) other pertinent information deemed necessary.

#### **1.51 Availability of Records:**

- a) Medical records shall be available to the attending physician of a diver or former diver when released in writing by the diver.
- b) Records and documents required by this standard shall be retained by CCU's DCB for the following period:
  - i. Physician's written reports of medical examinations for dive team members - 5 years.
  - ii. Diving safety manual - current document only.
  - iii. Records of dive - 1 year, except 5 years where there has been an incident of pressure-related injury.
  - iv. Pressure-related injury assessment - 5 years.
  - v. Equipment inspection and testing records - current entry or tag, or until equipment is withdrawn from service.

## ***SECTION 2.00 DIVING REGULATIONS FOR SCUBA (OPEN CIRCUIT, COMPRESSED AIR)***

### **2.10 Introduction**

No person shall engage in scientific diving operations under the auspices of CCU's scientific diving program unless they hold a current certification issued pursuant to the provisions of this standard.

### **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 CCU, the lead diver for a proposed operation must formulate a dive plan that should include the following:

- a) Divers qualifications, and the type of certificate or certification held by each diver.
- b) Emergency plan (Appendix 10) with the following information:
  - i. Name, telephone number, and relationship of person to be contacted for each diver in the event of an emergency.
  - ii. Nearest operational decompression chamber.
  - iii. Nearest accessible hospital.
  - iv. Available means of transport.
- c) Approximate number of proposed dives.
- d) Approximate location(s) of proposed dives.
- e) Maximum depth(s), bottom time(s), and pre-established minimum cylinder pressure(s) anticipated.
- f) Decompression status and repetitive dive plans, if required.
- g) Proposed work, equipment, and boats to be employed.
- h) Any hazardous conditions anticipated.

## **2.22 Pre-dive Safety Checks**

- a) Diver's Responsibility:
  - i. Scientific divers shall conduct a functional check of their diving equipment in the presence of the diving buddy or tender.
  - ii. It is the diver's responsibility and duty to refuse to dive if, in their judgment, conditions are unfavorable, or if they would be violating the precepts of their training, of this standard, or the CCU's diving safety manual.
  - iii. No dive team member shall be required to be exposed to hyperbaric conditions against their will, except when necessary to prevent or treat a pressure-related injury.
  - iv. 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.
- b) Equipment Evaluations
  - i. Divers shall ensure that their equipment is in proper working order and that the equipment is suitable for the type of diving operation.
  - ii. Each diver shall have the capability of achieving and maintaining positive buoyancy.
  - iii. Site Evaluation - Environmental conditions at the site will be evaluated.

## **2.30 Diving Procedures**

### **2.31 Solo Diving Prohibition**

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

### **2.32 Refusal to Dive**

- a) The decision to dive is that of the diver. A diver may refuse to dive, without fear of penalty, whenever they feel it is unsafe for them to make the dive.
- b) Safety - The ultimate responsibility for safety rests with the individual diver. It is the diver's responsibility and duty to refuse to dive if, in their judgment, conditions are unsafe or unfavorable, or if they would be violating the precepts of their training or the regulations in this standard.

### **2.33 Termination of the Dive**

- a) It is the responsibility of the diver to terminate the dive, without fear of penalty, whenever they feel it is unsafe to continue the dive, unless it compromises the safety of another diver already in the water.
- b) The dive shall be terminated while there is still sufficient cylinder pressure to permit the diver to safely reach the surface with 500 psi cylinder pressure, including decompression time, or to safely reach an additional air source at the decompression station.

### **2.34 Emergencies and Deviations from Regulations**

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

### **2.35 Alcohol, tobacco, and illegal substances**

Use of alcohol, tobacco, or illegal substances is prohibited on any diving operations conducted under the auspices of these standards. Violations will be handled under section 1.30 and may result in revocation or restriction of the diver's scientific diving certificate.

## **2.40 Post-Dive Procedures**

### **2.41 Post-Dive Safety Checks**

- a) After the completion of a dive, each diver shall report any physical problems, symptoms of decompression sickness, or equipment malfunctions.
- b) When diving outside the no-decompression limits, the divers should remain awake for at least 1 hour after diving, and in the company of a dive team member who is prepared to transport them to a decompression chamber if necessary.

## **2.50 Emergency Procedures**

CCU will develop emergency procedures, which follow the standards of care of the community and must include procedures for emergency care, recompression and evacuation for each dive location (Appendix 10 and 15).

### **2.51 General Policy**

In an emergency, personnel must act quickly and effectively to minimize injury and/or prevent death. While it is impossible to anticipate all emergencies, prior planning and proper training are key to dealing with emergency situations. These guidelines provide a

planning tool which, when used properly, will allow an Emergency Action Plan to be developed and in place prior to the start of diving operations.

### **2.52 Formulating an emergency Action Plan**

When formulating an Emergency Action Plan for an ECU scientific diving project, many factors should be considered. The following is a partial list of information and considerations which deserve forethought as you pull together the Emergency Action Plan for a specific site.

#### **a. Emergency Numbers and Information**

- Number of EMS and nearest hospital phone and location
- Location and contact information for nearest recompression chamber
- Number of poison control
- DAN emergency number (919) 684-8111
- Emergency contact information for divers
- ECU Diving Safety number (919) 328-4041
- Contact list (Diving Safety Officer, Diving Safety Control Board, Environmental Health & Safety, University Risk Manager, etc. This information may vary from project to project and should be updated prior to each operation.)

#### **b. Equipment Requirements at Location**

- Oxygen kit
- AED
- First Aid kit
- Pen and paper
- Forms
- Lines for search/recovery
- Backboard, Life rings, Life jackets, etc.
- Communications (VHF, CB radio, mobile phone, pay phone, etc.)
- Flares and signaling devices
- Additional site specific equipment

#### **c. Personnel Considerations**

- Team members backgrounds and personalities
- Who will be in charge of what?

#### **d. Site considerations**

- Marine life
- Entrapments or entanglements
- Physical Hazards
- Depth
- Currents

#### **e. Action Plan**

- Emergency Recognition / Activation of Emergency Action Plan
- How to recall divers and alert personnel
- Search for and recover injured / missing diver
  - Spotting Team
  - Search and Recovery Team
  - Transport Team (swimmers or boat)
  - Individual to get help

- In-water evaluation and response (airway & breathing)
- Transport to platform or beach
- Extrication from water
- Evaluation and ABC's
- Activation of EMS (ambulance, Coast Guard. etc.)
- Appropriate first aid (CPR, Oxygen, Shock treatment, etc.)
- Gather information (diver, buddy, equipment, observer, DAN neuro-cue-card, ECU Accident Reporting Worksheet)
- Evacuation procedures
  - Evacuation mode/route
  - Call DAN if appropriate.
  - Send information and a carrier with EMS (ensure understand compressed gas was used)
- Notification protocols
- Follow up and reporting procedures

Obviously, a dive accident plan can vary substantially from project to project. Regardless of the project, the emergency accident plan and contingency plans should be formulated and made clear to the dive team. It often helps to visualize a worst case scenario. On-site accident drills are recommended to illustrate roles, required actions, and potential problems.

### **2.53 HELICOPTER EVACUATION PROCEDURES**

- Each helicopter evacuation is different, each one presents its own problems, but knowing what to expect and the procedures to follow can save time, effort, and perhaps a life.
- Try to establish communications with the helicopter. If your boat is unable to furnish the necessary frequency, try to work through another boat.
- Maintain speed of 10 to 15 knots, do not slow down or stop.
- Maintain course into wind about 20 degrees on port bow.
- Put all antennas down if possible, without losing communications.
- Secure all loose objects on/or around decks.
- Always let the lifting device (stretcher) touch the boat before handling it to prevent electric shock.
- Place lift jacket on patient.
- Tie patient in basket, face up.
- If patient cannot communicate, place in the stretcher as much information as you can about him, such as, name, age, address, what happened, and what medication he has been given.
- If the patient is a diving accident victim, ensure flight crew has copy of or is instructed on medical procedures for diving accidents.
- If diving accident victim, ensure flight crew delivers victim to hyperbaric trauma system (recompression chamber complex).
- If patient dies, inform flight crew so that they take no unnecessary risks.

## **2.60 Flying After Diving**

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

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

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

Before ascending to Altitude above (1000 feet) by Land Transport: Divers should follow the appropriate guideline for preflight surface intervals unless the decompression procedure used has accounted for the increase in elevation.

*CCU Dive Control Board **recommends** that divers should have a minimum surface interval of 24 hours before ascending to altitude (over 1000 feet) by aircraft or land transport after any diving activity.*

## **2.70 Record Keeping Requirements**

### **2.71 Personal Diving Log**

Each certified scientific diver shall log every dive made under the auspices of CCU's program, and is encouraged to log all other dives. Standard forms will be provided by CCU. 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 CCU and shall include at least the following:

- a) Name of diver, buddy, and Lead Diver.
- b) Date, time, and location.
- c) Diving modes used.
- d) General nature of diving activities.
- e) Approximate surface and underwater conditions.
- f) Maximum depths, bottom time, and surface interval time.
- g) Diving tables or computers used.
- h) Detailed report of any near or actual incidents.

### **2.72 Required Incident Reporting**

All diving incidents requiring recompression treatment, or resulting in moderate or serious injury, or death shall be reported to the CCU Diving Control Board, CCU Risk Management and the AAUS. CCU'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:

- a) CCU shall record and report occupational injuries and illnesses in accordance with requirements of the appropriate Labor Code section.

- b) If pressure-related injuries are suspected, or if symptoms are evident, the following additional information shall be recorded and retained by CCU, with the record of the dive, for a period of 5 years:
  - i. Complete AAUS Incident Report at <http://www.aaus.org>
  - ii. Written descriptive report to include:
    - Name, address, phone numbers of the principal parties involved.
    - Summary of experience of divers involved.
    - Location, description of dive site, and description of conditions that led up to incident.
    - Description of symptoms, including depth and time of onset.
    - Description and results of treatment.
    - Disposition of case.
    - Recommendations to avoid repetition of incident.
  - iii. CCU shall investigate and document any incident of pressure-related injury and prepare a report that is to be forwarded to AAUS during the annual reporting cycle. This report must first be reviewed and released by the organizational member's Diving Control Board.

## **SECTION 3.00 DIVING EQUIPMENT**

### **3.10 General Policy**

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

### **3.20 Equipment**

#### **3.21 Regulators**

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

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

### **3.23 Scuba Cylinders**

- a) Scuba cylinders shall be designed, constructed, and maintained in accordance with the applicable provisions of the Unfired Pressure Vessel Safety Orders.
- b) Scuba cylinders must be hydrostatically tested in accordance with DOT standards (Every 5 years).
- c) Scuba cylinders must have an internal and external visual inspection at intervals not to exceed 12 months.
- d) Scuba cylinder valves shall be functionally tested at intervals not to exceed 12 months. Cylinder valve “O” rings are to be replaced at the first sign of wear.

### **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 12 months thereafter.

### **3.26 Flotation Devices**

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

### **3.27 Timing Devices, Depth, and Pressure Gauges**

Both members of the buddy team 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**

- a) A set of diving tables, approved by the Diving Control Board, must be available at the dive location.
- b) Dive computers may be utilized in place of diving tables, and must be approved by the Diving Control Board. AAUS recommendations on dive computers are available at <http://www.aaus.org/>.
- c) Dive tables will take precedence over the dive if one or more divers is using tables to determine decompression status.

## **3.30 Auxiliary Equipment**

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

### **3.40 Support Equipment**

a) **First aid supplies**

First aid kit, AED and emergency oxygen system shall be available at the dive site.

b) **Diver's Flag**

A diver's flag, U.S. and International, shall be displayed prominently whenever diving is conducted under circumstances where required or where water traffic is probable.

### **3.41 Compressor Systems - Organizational Member Controlled**

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

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

### **3.50 Equipment Maintenance Record Keeping**

All equipment must be serviced and inspected at a minimum of once a year and or at the first sign of wear or malfunction. 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:

- a) Regulators
- b) Submersible pressure gauges
- c) Depth gauges
- d) Scuba cylinders
- e) Cylinder valves
- f) Diving helmets
- g) Submersible breathing masks
- h) Compressors
- i) Gas control panels
- j) Air storage cylinders
- k) Air filtration systems
- l) Analytical instruments
- m) Buoyancy control devices
- n) Dry suits

### 3.51 Compressor Operation and Air Test Records

- a) Gas analyses and air tests shall be performed on CCU-controlled breathing air compressor at regular intervals of no more than 100 hours of operation or 6 months, whichever occurs first. The results of these tests shall be entered in a formal log and be maintained.
- b) A log shall be maintained showing operation, repair, overhaul, filter maintenance, and temperature adjustment for each CCU-controlled compressor.

### 3.60 Air Quality Standards

Breathing air for scuba shall meet the following specifications as set forth by the Compressed Gas Association (CGA Pamphlet G-7.1).

<b>CGA Grade E</b>	
<b><i>Component</i></b>	<b><i>Maximum</i></b>
Oxygen	20 - 22%/v
Carbon Monoxide	10 PPM/v
Carbon Dioxide	1000 PPM/v
Condensed Hydrocarbons	5 mg/m <sup>3</sup>
Water Vapor (ppm)	(2)
Objectionable Odors	None

For breathing air used in conjunction with self-contained breathing apparatus in extreme cold where moisture can condense and freeze, causing malfunction, a dew point not to exceed -50 degrees F (63 pm v/v) or 10 degrees lower than the coldest temperature expected in the area is required.

## **SECTION 4.00 ENTRY-LEVEL TRAINING REQUIREMENTS**

**D.A.N. Diving Accident Insurance is required for all scientific diving participants.**

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

### 4.10 Evaluation

#### 4.11 Medical Examination

The applicant for training shall be certified by a licensed physician to be medically qualified for diving before proceeding with the training as designated in Section 4.20 (Section 6.00 and Appendices 1 through 4).

#### 4.12 Swimming Evaluation

Applicant shall successfully perform the following tests, or equivalent, in the presence of the Diving Safety Officer, or an examiner approved by the Diving Safety Officer.

- a) Swim underwater without swim aids for a distance of 25 yards without surfacing.
- b) Swim 400 yards in less than 12 minutes without swim aids.
- c) Tread water for 10 minutes, or 2 minutes without the use of hands, without swim aids.

- d) 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 appointed instructor of their ability to perform the following, as a minimum, in a pool or in sheltered water:

- a) Enter water with full equipment.
- b) Clear face mask.
- c) Demonstrate air sharing, including both buddy breathing and the use of alternate air source, as both donor and recipient, with and without a face mask.
- d) Demonstrate the ability to retrieve and clear regulator.
- e) Demonstrate ability to alternate between snorkel and scuba while kicking.
- f) Demonstrate understanding of underwater signs and signals.
- g) Demonstrate simulated in-water mouth-to-mouth resuscitation.
- h) Rescue and transport, as a diver, a passive simulated victim of an accident.
- i) Demonstrate ability to remove and replace equipment while submerged.
- j) 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:

- a) Function, care, use, and maintenance of diving equipment.
- b) Physics and physiology of diving.
- c) Diving regulations and precautions.
- d) Near-shore currents and waves.
- e) Dangerous marine animals.
- f) Emergency procedures, including buoyant ascent and ascent by air sharing.
- g) Currently accepted decompression procedures.
- h) Demonstrate the proper use of dive tables.
- i) Underwater communications.
- j) Aspects of freshwater and altitude diving.
- k) Hazards of breath-hold diving and ascents.
- l) Planning and supervision of diving operations.
- m) Diving hazards.
- n) 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 their ability to perform at least the following in open water:

- a) Surface dive to a depth of 10 feet in open water without scuba.
- b) Demonstrate proficiency in air sharing as both donor and receiver.
- c) Enter and leave open water or surf, or leave and board a diving vessel, while wearing scuba gear.
- d) Kick on the surface 400 yards while wearing scuba gear, but not breathing from the scuba unit.
- e) Demonstrate judgment adequate for safe diving.
- f) Demonstrate, where appropriate, the ability to maneuver efficiently in the environment, at and below the surface.
- g) Complete a simulated emergency swimming ascent.
- h) Demonstrate clearing of mask and regulator while submerged.
- i) Demonstrate ability to achieve and maintain neutral buoyancy while submerged.
- j) Demonstrate techniques of self-rescue and buddy rescue.
- k) Navigate underwater.
- l) Plan and execute a dive.
- m) Successfully complete 6 open water dives for a minimum total time of 3 hours, of which 1 ½ hours cumulative bottom time must be on scuba. No more than 3 training dives shall be made in any 1 day.

### ***SECTION 5.00 SCIENTIFIC DIVER CERTIFICATION***

**D.A.N. Diving Accident Insurance is required for all scientific diving participants.**

#### **5.10 Certification Types**

##### **5.11 Scientific Diver Certification**

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

##### **5.12 Temporary Diver Permit**

This permit constitutes a waiver of the requirements of Section 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 standard.

- a) Requirements of this section may be waived by the Diving Safety Officer if the person in question has demonstrated proficiency in diving and can contribute measurably to a planned dive. A statement of the temporary diver's qualifications shall be submitted to the Diving Safety Officer as a part of the

dive plan. Temporary permits shall be restricted to the planned diving operation and shall comply with all other policies, regulations, and standards of this standard, including medical requirements.

## **5.20 General Policy**

AAUS requires that no person shall engage in scientific diving unless that person is authorized by CCU pursuant to the provisions of this standard. Only a person diving under the auspices of CCU that subscribes to the practices of AAUS is eligible for a 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 they are sufficiently skilled and proficient to be certified. This skill will be acknowledged by the signature of the Diving Safety Officer. Any applicant who does not possess the necessary judgment, under diving conditions, for the safety of the diver and their partner, may be denied organizational member scientific diving privileges. Minimum documentation and examinations required are as follows:

### **5.31 Prerequisites**

- a) Application - Application for certification shall be made to the Diving Safety Officer on the form prescribed by the organizational member.
- b) Medical approval. Each applicant for diver certification shall submit a statement from a licensed physician, based on an approved medical examination, attesting to the applicant's fitness for diving (Section 6.00 and Appendices 1 through 4).
- c) Scientific Diver-In-Training Permit - This permit signifies that a diver has completed and been certified as at least an open water diver through an internationally recognized certifying agency or scientific diving program, and has the knowledge skills and experience to that gained by successful completion of training as specified in Section 4.00.

### **5.32 Theoretical and Practical Training**

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

- a) Required Topics (include, but not limited to):
  - a. Diving Emergency Care Training
    - i. Cardiopulmonary Resuscitation (CPR)
    - ii. Standard or Basic First Aid
    - iii. Recognition of DCS and AGE
    - iv. Accident Management
    - v. Field Neurological Exam
    - vi. Oxygen Administration

- b. Dive Rescue
  - c. Dive Physics
  - d. Dive Physiology
  - e. Dive Environments
  - f. Decompression Theory and its Application
  - g. AAUS Scientific Diving Regulations and History
    - i. Scientific Dive Planning
    - ii. Coordination with other Agencies
    - iii. Appropriate Governmental Regulations
  - h. Scientific Method
  - i. Data Gathering Techniques (Only Items specific to area of study are required)
    - i. Quadrating
    - ii. Transecting
    - iii. Mapping
    - iv. Coring
    - v. Photography
    - vi. Tagging
    - vii. Collecting
    - viii. Animal Handling
    - ix. Archaeology
    - x. Common Biota
      - Organism Identification
      - Behavior
      - Ecology
    - xi. Site Selection, Location, and Re-location
    - xii. Specialized Equipment for data gathering
  - j. HazMat Training
    - i. HP Cylinders
    - ii. Chemical Hygiene, Laboratory Safety (Use Of Chemicals)
- b) Suggested Topics (include, but not limited to):
- a. Specific Dive Modes (methods of gas delivery)
    - i. Open Circuit
    - ii. Hooka
    - iii. Surface Supplied diving

- b. Small Boat Operation
  - c. Rebreathers
    - i. Closed
    - ii. Semi-closed
  - d. Specialized Breathing Gas
    - i. Nitrox
    - ii. Mixed Gas
  - e. Specialized Environments and Conditions
    - i. Blue Water Diving,
    - ii. Ice and Polar Diving (Cold Water Diving)
    - iii. Zero Visibility Diving
    - iv. Polluted Water Diving,
    - v. Saturation Diving
    - vi. Decompression Diving
    - vii. Overhead Environments
    - viii. Aquarium Diving
    - ix. Night Diving
    - x. Kelp Diving
    - xi. Strong Current Diving (Live-boating)
    - xii. Potential Entanglement
  - f. Specialized Diving Equipment
    - i. Full face mask
    - ii. Dry Suit
    - iii. Communications
- c) Practical training must include a checkout dive, with evaluation of the skills listed in Section 4.20 (Open Water Evaluation), with the DSO or qualified delegate followed by at least 11 ocean or open water dives in a variety of dive sites and diving conditions, for a cumulative bottom time of 6 hours. Dives following the checkout dive must be supervised by a certified Scientific Diver with experience in the type of diving planned, with the knowledge and permission of the DSO.
- d) Examinations
- a. Written examination
    - i. General exam required for scientific diver certification.
    - ii. Examination covering the suggested topics at the DSO's discretion.

- b. Examination of equipment.
  - i. Personal diving equipment
  - ii. Task specific equipment

## **5.40 Depth Certifications**

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

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

- a) Certification to 30 Foot Depth - Initial permit level, approved upon the successful completion of training listed in Section 4.00 and 5.30.
- b) Certification to 60 Foot Depth - A diver holding a 30 foot certificate may be certified to a depth of 60 feet after successfully completing, under supervision, 12 logged training dives to depths between 31 and 60 feet, for a minimum total time of 4 hours.
- c) Certification to 100 Foot Depth - A diver holding a 60 foot certificate may be certified to a depth of 100 feet after successfully completing, 4 dives to depths between 61 and 100 feet. The diver shall also demonstrate proficiency in the use of the appropriate Dive Tables. **Diving on nitrox is not permitted beyond a depth of 100 feet.**
- d) Certification to 130 Foot Depth - A diver holding a 100 foot certificate may be certified to a depth of 130 feet after successfully completing, 4 dives to depths between 100 and 130 feet. The diver shall also demonstrate proficiency in the use of the appropriate Dive Tables.
- e) Certification to 150 Foot Depth - A diver holding a 130 foot certificate may be certified to a depth of 150 feet after successfully completing, 4 dives to depths between 130 and 150 feet. The diver must also demonstrate knowledge of the special problems of deep diving, and of special safety requirements.
- f) Certification to 190 Foot Depth - A diver holding a 150 foot certificate may be certified to a depth of 190 feet after successfully completing, 4 dives to depths between 150 and 190 feet. The diver must also demonstrate knowledge of the special problems of deep diving, and of special safety requirements. **Diving on air is not permitted beyond a depth of 190 feet.**

## **5.50 Continuation of Certificate**

### **5.51 Minimum Activity to Maintain Certification**

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

## **5.52 Emergency Care Training**

In addition to maintaining a current medical and minimum diving activity, persons certified under this standard must maintain current certification in First Aid, CPR and Oxygen Administration.

## **5.53 Re-qualification of Depth Certificate**

Once the initial certification requirements of Section 5.30 are met, divers whose depth certification has lapsed due to lack of activity may be re-qualified by procedures adopted by the organization's DCB.

## **5.54 Medical Examination**

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

## **5.55 Maintaining Fitness to Dive**

It is the divers responsibility to maintain fitness to dive. Fitness to dive refers to general physical fitness adequate to meet projected project goals and diving conditions, as well as fitness on a day to day basis including, but not limited to: proper attitude, hydration, and nutrition

## **5.60 Revocation of Certification**

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

## **5.70 Recertification**

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

# **SECTION 6.00 MEDICAL STANDARDS**

## **6.10 Medical Requirements**

### **6.11 General**

- a) Coastal Carolina University 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.

- b) 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.
- c) 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:

- a) Before a diver may begin diving, unless an equivalent initial medical evaluation has been given within the preceding 5 years (3 years if over the age of 40, 2 years if over the age of 60), CCU has obtained the results of that examination, and those results have been reviewed and found satisfactory by CCU.
- b) Thereafter, at 5 year intervals up to age 40, every 3 years after the age of 40, and every 2 years after the age of 60.
- c) Clearance to return to diving must be obtained from a physician following any major injury or illness, or any condition requiring hospital care. 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**

CCU 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 6.10 shall consist of the following:

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

### **6.15 Conditions Which May Disqualify Candidates From Diving**

**(Adapted from Bove, 1998)**

- a) Abnormalities of the tympanic membrane, such as perforation, presence of a monomeric membrane, or inability to auto inflate the middle ears.
- b) Vertigo including Meniere's Disease.
- c) Stapedectomy or middle ear reconstructive surgery.
- d) Recent ocular surgery.
- e) Psychiatric disorders including claustrophobia, suicidal ideation, psychosis, anxiety states, untreated depression.
- f) Substance abuse, including alcohol.
- g) Episodic loss of consciousness.
- h) History of seizure.

- i) History of stroke or a fixed neurological deficit.
- j) Recurring neurologic disorders, including transient ischemic attacks.
- k) History of intracranial aneurysm, other vascular malformation or intracranial hemorrhage.
- l) History of neurological decompression illness with residual deficit.
- m) Head injury with sequelae.
- n) Hematologic disorders including coagulopathies.
- o) Evidence of coronary artery disease or high risk for coronary artery disease.
- p) Atrial septal defects.
- q) Significant valvular heart disease - isolated mitral valve prolapse is not disqualifying.
- r) Significant cardiac rhythm or conduction abnormalities.
- s) Implanted cardiac pacemakers and cardiac defibrillators (ICD).
- t) Inadequate exercise tolerance.
- u) Severe hypertension.
- v) History of spontaneous or traumatic pneumothorax.
- w) Asthma.
- x) Chronic pulmonary disease, including radiographic evidence of pulmonary blebs, bullae or cysts.
- y) Diabetes mellitus.
- z) Pregnancy.

**6.16 Laboratory Requirements for Diving Medical Evaluation and Intervals.**

- a) Initial examination under age 40:
  - a. Medical History
  - b. Complete Physical Exam, emphasis on neurological and otological components
  - c. Chest X-ray
  - d. Spirometry
  - e. Hematocrit or Hemoglobin
  - f. Urinalysis
  - g. Any further tests deemed necessary by the physician.
- b) Periodic re-examination under age 40 (every 5 years):
  - a. Medical History
  - b. Complete Physical Exam, emphasis on neurological and otological components
  - c. Hematocrit or Hemoglobin

- d. Urinalysis
  - e. Any further tests deemed necessary by the physician.
- c) Initial exam over age 40:
- a. Medical History
  - b. Complete Physical Exam, emphasis on neurological and otological components.
  - c. Assessment of coronary artery disease using Multiple-Risk-Factor Assessment<sup>1</sup> (age, lipid profile, blood pressure, diabetic screening, smoker)
    - i. Resting EKG
    - ii. Chest X-ray
    - iii. Spirometry
    - iv. Urinalysis
    - v. Hematocrit or Hemoglobin
    - vi. Any further tests deemed necessary by the physician
    - vii. Exercise stress testing may be indicated based on risk factor assessment.<sup>2</sup>
  - d. Periodic re-examination over age 40 (every 3 years); over age 60 (every 2 years):
    - i. Medical History
    - ii. Complete Physical Exam, emphasis on neurological and otological components
    - iii. Assessment of coronary artery disease using Multiple-Risk-Factor Assessment<sup>1</sup> (age, lipid profile, blood pressure, diabetic screening, smoker)
    - iv. Resting EKG
    - v. Urinalysis
    - vi. Hematocrit or Hemoglobin
    - vii. Any further tests deemed necessary by the physician
    - viii. Exercise stress testing may be indicated based on risk factor assessment.<sup>2</sup>

### **6.17 Physician's Written Report**

After any medical examination relating to the individual's fitness to dive, the organizational member shall obtain a written report prepared by the examining physician, that 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.

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

<sup>1</sup>“Assessment of Cardiovascular Risk by Use of Multiple-Risk-Factor Assessment Equations.” Grundy *et al.* 1999. AHA/ACC Scientific Statement. <http://www.acc.org/clinical/consensus/risk/risk1999.pdf>

<sup>2</sup>Gibbons RJ, *et al.* ACC/AHA Guidelines for Exercise Testing. A report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines (Committee on Exercise Testing). *Journal of the American College of Cardiology*. 30:260-311, 1997. <http://www.acc.org/clinical/guidelines/exercise/exercise.pdf>

**Volume 2**  
**Sections 7.00 through 11.00**  
Required Only When Conducting Described Diving Activities  
and  
Coastal Carolina University Specific Sections

## **SECTION 7.00 NITROX DIVING GUIDELINES**

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

### **7.10 Prerequisites**

#### **7.11 Eligibility**

Only a certified Scientific Diver or Scientific Diver In Training (Sections 4.00 and 5.00) diving under the auspices of a member organization is eligible for authorization to use nitrox. After completion, review and acceptance of application materials, training and qualification, an applicant will be authorized to use nitrox within their depth authorization, as specified in Section 5.40.

#### **7.12 Application and Documentation**

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

### **7.20 Requirements for Authorization to Use Nitrox**

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

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

#### **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 the member organizations DSO and DCB (Section 7.30).

#### **7.22 Examinations**

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

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

- b) Practical examinations covering the information presented in the practical training session(s) (*i.e.*, gas analysis, documentation procedures, *etc.*);
- c) 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 nitrox dive per year. Failure to meet the minimum activity level may be cause for restriction or revocation of nitrox authorization.

## **7.30 Nitrox Training Guidelines**

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

### **7.31 Classroom Instruction**

- a) 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.
- b) DCB may choose to limit standard nitrox diver training to procedures applicable to diving, and subsequently reserve training such as nitrox production methods, oxygen cleaning, and dive station topics to divers requiring specialized authorization in these areas.

### **7.32 Practical Training**

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

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

### **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:

- a) Function, care, use, and maintenance of equipment cleaned for nitrox use.
- b) Physical and physiological considerations of nitrox diving (*ex.*: O<sub>2</sub> and CO<sub>2</sub> toxicity).
- c) Diving regulations and procedures as related to nitrox diving, either scuba or surface supplied (depending on intended mode).

- d) Given the proper information, calculation of:
  - i. Equivalent air depth (EAD) for a given  $fO_2$  and actual depth;
  - ii.  $pO_2$  exposure for a given  $fO_2$  and depth;
  - iii. Optimal nitrox mixture for a given  $pO_2$  exposure limit and planned depth;
  - iv. Maximum operational depth (MOD) for a given mix and  $pO_2$  exposure limit;
  - v. For nitrox production purposes, percentages/psi of oxygen present in a given mixture, and psi of each gas required to produce a  $fO_2$  by partial pressure mixing.
- e) Dive table and dive computer selection and usage;
- f) Nitrox production methods and considerations.
- g) Oxygen analysis.
- h) Nitrox operational guidelines (Section 7.40), dive planning, and dive station components.

### **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, inwater 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 Section 11.60.

## **7.40 Scientific Nitrox Diving Regulations**

### **7.41 Dive Personnel Requirements**

- a) Nitrox Diver In Training - A Diver In Training, who has completed the requirements of Section 4.00 and the training and authorization sections of these guidelines, may be authorized by the DSO to use nitrox under the direct supervision a Scientific Diver who also holds nitrox authorization. Dive depths should be restricted to those specified in the diver's authorization.
- b) Scientific Diver - A Scientific Diver who has completed the requirements of Section 5.00 and the training and authorization sections of these guidelines, may be authorized by the DSO to use nitrox. Depth authorization to use nitrox should be the same as those specified in the diver's authorization, as described in Section. 5.40.
- c) Lead Diver - On any dive during which nitrox will be used by any team member, the Lead Diver should be authorized to use nitrox, and hold appropriate authorizations required for the dive, as specified in AAUS Standards. Lead Diver authorization for nitrox dives by the DSO and/or DCB should occur as part of the dive plan approval process. In addition to responsibilities listed in Section 1.20, the Lead Diver should:

- i. As part of the dive planning process, verify that all divers using nitrox on a dive are properly qualified and authorized;
- ii. 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.
- iii. The Lead Diver should also reduce the maximum allowable pO<sub>2</sub> exposure limit for the dive team if on-site conditions so indicate (see Sec. 7.42.).

#### **7.42 Dive Parameters**

##### **a) Oxygen Exposure Limits**

- i. The inspired oxygen partial pressure experienced at depth should not exceed 1.6 ATA. All dives performed using nitrox breathing mixtures should comply with the current *NOAA Diving Manual* “Oxygen Partial Pressure Limits for ‘Normal’ Exposures”
- ii. The maximum allowable exposure limit should be reduced in cases where cold or strenuous dive conditions, or extended exposure times are expected. The DCB should consider this in the review of any dive plan application, which proposes to use nitrox. The Lead Diver should also review on-site conditions and reduce the allowable pO<sub>2</sub> exposure limits if conditions indicate.
- iii. 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.

##### **b) Bottom Time Limits**

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

##### **c) Dive Tables and Gases**

- i. A set of DCB approved nitrox dive tables should be available at the dive site.
- ii. When using the equivalent air depth (EAD) method, dives should be conducted using air dive tables approved by the DCB.
- iii. 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
- iv. Breathing mixtures used while performing in-water decompression, or for bail-out purposes, should contain the same or greater oxygen content as that being used during the dive, within the confines of depth limitations and oxygen partial pressure limits set forth in Section 7.40 Dive Parameters.

- d) Nitrox Dive Computers
  - i. Dive computers may be used to compute decompression status during nitrox dives. Manufacturers' guidelines and operations instructions should be followed.
  - ii. Use of Nitrox dive computers should comply with dive computer guidelines included in the AAUS Standards.
  - iii. Nitrox dive computer users should demonstrate a clear understanding of the display, operations, and manipulation of the unit being used for nitrox diving prior to using the computer, to the satisfaction of the DSO or designee.
  - iv. 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.
  - v. Dive computers capable of pO<sub>2</sub> limit and fO<sub>2</sub> adjustment should be checked by the diver prior to the start each dive to assure compatibility with the mix being used.
- e) Repetitive Diving
  - i. Repetitive dives using nitrox mixtures should be performed in compliance with procedures required of the specific dive tables used.
  - ii. 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.
  - iii. 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.
  - iv. 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**

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

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

#### **7.44 Gas Mixing and Analysis for Organizational Members**

- a) Personnel Requirements
  - i. Individuals responsible for producing and/or analyzing nitrox mixtures should be knowledgeable and experienced in all aspects of the technique.
  - ii. Only those individuals approved by the DSO and/or DCB should be responsible for mixing and/or analyzing nitrox mixtures.
- b) Production Methods - It is the responsibility of the DCB to approve the specific nitrox production method used.
- c) Analysis Verification by User
  - i. It is the responsibility of each diver to analyze prior to the dive the oxygen content of his/her scuba cylinder and acknowledge in writing the following information for each cylinder: fO<sub>2</sub>, MOD, cylinder pressure, date of analysis, and user's name.
  - ii. Individual dive log reporting forms should report fO<sub>2</sub> of nitrox used, if different than 21%.

#### **7.50 Nitrox Diving Equipment**

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

- Labeled SCUBA Cylinders
- Oxygen Analyzers

#### **7.51 Oxygen Cleaning and Maintenance Requirements**

- a) Requirement for Oxygen Service
  - i. 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.
  - ii. Equipment used with oxygen or mixtures containing over 40% by volume oxygen shall be designed and maintained for oxygen service. Oxygen systems over 125 psig shall have slow-opening shut-off valves. This should include the following equipment: scuba cylinders, cylinder valves, scuba and other regulators, cylinder pressure gauges, hoses, diver support equipment, compressors, and fill station components and plumbing.

**7.52 Scuba Cylinder Identification Marking** -- Scuba cylinders to be used with nitrox mixtures should have the following identification documentation affixed to the cylinder.

- a) Cylinders should be marked “NITROX”, or “EANx”, or “Enriched Air”.
- b) Nitrox identification color-coding should include a 4-inch wide green band around the cylinder, starting immediately below the shoulder curvature. If the cylinder is not yellow, the green band should be bordered above and below by a 1-inch yellow band.
  - i. 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.
  - ii. Other markings, which identify the cylinder as containing gas mixes other than Air, may be used as the approval of the DCB.
  - iii. A contents label should be affixed, to include the current fO<sub>2</sub>, date of analysis, and MOD.
  - iv. 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**

- a) An oxygen analyzer is required which is capable of determining the oxygen content in the scuba cylinder. Two analyzers are recommended to reduce the likelihood of errors due to a faulty analyzer. The analyzer should be capable of reading a scale of 0 to 100% oxygen, within 1% accuracy.
- b) All diver and support equipment should be suitable for the fO<sub>2</sub> being used.

#### **7.55 Compressor and fill system**

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

**Fill Station Components** - All components of a nitrox fill station that will contact nitrox mixtures containing greater than 40% oxygen should be cleaned and maintained for oxygen service. This includes cylinders, whips, gauges, valves, and connecting lines.

## **SECTION 8.00 AQUARIUM DIVING OPERATIONS**

### **8.10 General Policy**

Section 8.00 applies to scientific aquarium divers only.

**Definition** - A scientific aquarium diver is a scientific diver who is diving solely within an aquarium. An aquarium is a shallow, confined body of water, which is operated by or under the control of an institution and is used for the purposes of specimen exhibit, education, husbandry, or research.

It is recognized that within scientific aquarium diving there are environments and equipment that fall outside the scope of those addressed in this standard. In those circumstances it is the responsibility of the organizational member's Dive Control Board to establish the requirements and protocol under which diving will be safely conducted.

Note: All of the standards set forth in other sections of this standard shall apply, except as otherwise provided in this section.

## **8.20 The Buddy System In Scientific Aquarium Diving**

All scuba diving activities in the confined environment of an aquarium shall be conducted in accordance with the buddy system, whereby both divers, or a diver and a tender as provided below, are always in visual contact with one another, can always communicate with one another, and can always render prompt and effective assistance either in response to an emergency or to prevent an emergency.

A diver and tender comprise a buddy team in the confined environment of an aquarium only when the maximum depth does not exceed 30 feet, and there are no overhead obstructions or entanglement hazards for the diver, and the tender is equipped, ready and able to conduct or direct a prompt and effective in-water retrieval of the diver at all times during the dive.

## **8.30 Diving Equipment**

Section 3.20 is modified to read as follows:

In an aquarium of a known maximum obtainable depth:

- a) A depth indicator is not required, except that a repetitive diver shall use the same computer used on any prior dive.
- b) Only one buddy must be equipped with a timing device.
- c) The maximum obtainable depth of the aquarium shall be used as the diving depth.

## **8.40 Scientific Aquarium Diver Certification**

A Scientific Aquarium Diver is a certification enabling the qualified diver to participate in scientific diving in accordance with Section 8.00 as provided below.

All of the standards set forth in sections 4.0 and 5.0 of this standard shall apply, except that Section 5.30 of this standard is modified to read as follows:

Practical training shall include at least 12 supervised aquarium dives for a cumulative bottom time of 6 hours. No more than 3 of these dives shall be made in 1 day.

## **8.50 Scientific Aquarium Diving Using Other Diving Technology**

### **8.51 Surface Supplied Scientific Aquarium Diving**

Definition: For purposes of scientific aquarium diving, surface supplied diving is described as a mode of diving using open circuit, surface supplied compressed gas which is provided to the diver at the dive location and may or may not include voice communication with the surface tender.

- a) Divers using the surface supplied mode shall be equipped with a diver-carried independent reserve breathing gas supply. Scientific aquarium divers using conventional scuba masks, full-face masks, or non-lockdown type helmets are exempt from this standard provided:
  - i. There are no overhead obstructions or entanglements.
  - ii. The diver is proficient in performing a Controlled Emergency Swimming Ascent from at least as deep as the maximum depth of the aquarium.
  - iii. The diver is proficient in performing out of air emergency drills, including ascent and mask/helmet removal.
  - iv. Each surface supplied diver shall be hose-tended by a separate dive team member while in the water. Scientific aquarium divers are exempt from this standard, provided the tender is monitoring only one air source, there is mutual assistance between divers and there are no overhead obstructions or entanglements.
- b) Divers using the surface supplied mode shall maintain communication with the surface tender. The surface supplied breathing gas supply (volume and intermediate pressure) shall be sufficient to support all surface supplied divers in the water for the duration of the planned dive.
- c) 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. Scientific aquarium divers are exempt from this standard, provided the tender is equipped, ready and able to conduct a prompt and effective in-water retrieval of the diver at all times during the dive.”
- d) Surface supplied equipment must be configured to allow retrieval of the diver by the surface tender without risk of interrupting air supply to the diver.
- e) All surface supplied applications used for scientific aquarium diving shall have a non-return valve at the attachment point between helmet or mask hose, which shall close readily and positively.

## **SECTION 9.00 STAGED DECOMPRESSION DIVING**

Decompression diving shall be defined as any diving during which the diver cannot perform a direct return to the surface without performing a mandatory decompression stop to allow the release of inert gas from the diver’s body.

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

### **9.10 Minimum Experience and Training Requirements**

- a) Prerequisites:
  - i. Scientific Diver qualification according to Section 5.00.
  - ii. Minimum of 100 logged dives.
  - iii. Demonstration of the ability to safely plan and conduct dives deeper than 100 feet.

- iv. Nitrox certification/authorization according to AAUS Section 7.00 recommended.
- b) Training shall be appropriate for the conditions in which dive operations are to be conducted.
- c) Minimum Training shall include the following:
  - i. A minimum of 6 hours of classroom training to ensure theoretical knowledge to include: physics and physiology of decompression; decompression planning and procedures; gas management; equipment configurations; decompression method, emergency procedures.
  - ii. It is recommended that at least one training session be conducted in a pool or sheltered water setting, to cover equipment handling and familiarization, swimming and buoyancy control, to estimate gas consumption rates, and to practice emergency procedures.
  - iii. At least 6 open-water training dives simulating/requiring decompression shall be conducted, emphasizing planning and execution of required decompression dives, and including practice of emergency procedures.
  - iv. Progression to greater depths shall be by 4-dive increments at depth intervals as specified in Section 5.40.
  - v. No training dives requiring decompression shall be conducted until the diver has demonstrated acceptable skills under simulated conditions.
  - vi. The following are the minimum skills the diver must demonstrate proficiently during dives simulating and requiring decompression:
    - buoyancy control
    - Proper ascent rate
    - Proper depth control
    - Equipment manipulation
    - Stage/decompression bottle use as pertinent to planned diving operation
    - Buddy skills
    - Gas management
    - Time management
    - Task loading
    - Emergency skills
  - vii. Divers shall demonstrate to the satisfaction of the DSO or the DSO's designee proficiency in planning and executing required decompression dives appropriate to the conditions in which diving operations are to be conducted.
  - viii. Upon completion of training, the diver shall be authorized to conduct required decompression dives with DSO approval.

## **9.20 Minimum Equipment Requirements:**

- a) Valve and regulator systems for primary (bottom) gas supplies shall be configured in a redundant manner that allows continuous breathing gas

- delivery in the event of failure of any one component of the regulator/valve system.
- b) Cylinders with volume and configuration adequate for planned diving operations.
  - c) One of the second stages on the primary gas supply shall be configured with a hose of adequate length to facilitate effective emergency gas sharing in the intended environment.
  - d) Minimum dive equipment shall include:
    - i. Snorkel is optional at the DCB's discretion, as determined by the conditions and environment.
    - ii. Diver location devices adequate for the planned diving operations and environment.
    - iii. Compass
  - e) Redundancy in the following components is desirable or required at the discretion of the DCB or DSO:
    - i. Decompression Schedules
    - ii. Dive Timing Devices
    - iii. Depth gauges
    - iv. Buoyancy Control Devices
    - v. Cutting devices
    - vi. Lift bags and line reels

### **9.30 Minimum Operational Requirements**

- a) Approval of dive plan applications to conduct required decompression dives shall be on a case-by-case basis.
- b) The maximum pO<sub>2</sub> to be used for planning required decompression dives is 1.6. It is recommended that a pO<sub>2</sub> of less than 1.6 be used during bottom exposure.
- c) Divers gas supplies shall be adequate to meet planned operational requirements and foreseeable emergency situations.
- d) Decompression dives may be planned using dive tables, dive computers, and/or PC software approved by the DSO/DCB.
- e) Breathing gases used while performing in-water decompression shall contain the same or greater oxygen content as that used during the bottom phase of the dive.
- f) The dive team prior to each dive shall review emergency procedures appropriate for the planned dive.
- g) If breathing gas mixtures other than air are used for required decompression, their use shall be in accordance with those regulations set forth in the appropriate sections of this standard.
- h) The maximum depth for required decompression using air as the bottom gas shall be 190 feet.

- i) Use of additional nitrox and/or high-oxygen fraction decompression mixtures as travel and decompression gases to decrease decompression obligations is encouraged.
- j) Use of alternate inert gas mixtures to limit narcosis is encouraged for depths greater than 150 feet.
- k) If a period of more than 6 months has elapsed since the last mixed gas dive, a series of progressive workup dives to return the diver(s) to proficiency status prior to the start of project diving operations are recommended.
- l) Mission specific workup dives are recommended.

## **SECTION 10.00 MIXED GAS DIVING**

Mixed gas diving is defined as dives done while breathing gas mixes containing proportions greater than 1% by volume of an inert gas other than nitrogen.

### **10.10 Minimum Experience and Training Requirements**

- a) Prerequisites:
  - i. Nitrox certification and authorization (Section 7.00)
  - ii. If the intended use entails required decompression stops, divers will be previously certified and authorized in decompression diving (Section 9.00).
  - iii. Divers shall demonstrate to the DCB's satisfaction skills, knowledge, and attitude appropriate for training in the safe use of mixed gases.
- b) Classroom training including:
  - i. Review of topics and issues previously outlined in nitrox and required decompression diving training as pertinent to the planned operations.
  - ii. The use of helium or other inert gases, and the use of multiple decompression gases.
  - iii. Equipment configurations
  - iv. Mixed gas decompression planning
  - v. Gas management planning
  - vi. Thermal considerations
  - vii. END determination
  - viii. Mission planning and logistics
  - ix. Emergency procedures
  - x. Mixed gas production methods
  - xi. Methods of gas handling and cylinder filling
  - xii. Oxygen exposure management
  - xiii. Gas analysis

- xiv. Mixed gas physics and physiology
  
- c) Practical Training:
  - i. Confined water session(s) in which divers demonstrate proficiency in required skills and techniques for proposed diving operations.
  - ii. A minimum of 6 open water training dives.
  - iii. At least one initial dive shall be in 130 feet or less to practice equipment handling and emergency procedures.
  - iv. Subsequent dives will gradually increase in depth, with a majority of the training dives being conducted between 130 feet and the planned operational depth.
  - v. Planned operational depth for initial training dives shall not exceed 260 feet.
  - vi. Diving operations beyond 260 feet requires additional training dives.

## **10.20 Equipment and Gas Quality Requirements**

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

## **10.30 Minimum Operational Requirements**

- a) Approval of dive plan applications to conduct mixed gas dives shall be on a case-by-case basis.
- b) All applicable operational requirements for nitrox and decompression diving shall be met.
- c) The maximum  $pO_2$  to be used for planning required decompression dives is 1.6. It is recommended that a  $pO_2$  of less than 1.6 be used during bottom exposure.
- d) Maximum planned Oxygen Toxicity Units (OTU) will be considered based on mission duration.
- e) Divers decompressing on high-oxygen concentration mixtures shall closely monitor one another for signs of acute oxygen toxicity.

If a period of more than 6 months has elapsed since the last mixed gas dive, a series of progressive workup dives to return the diver(s) to proficiency status prior to the start of project diving operations are recommended.

## **SECTION 11.00 OTHER DIVING TECHNOLOGY**

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

### **11.10 Blue Water Diving**

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

### **11.20 Ice And Polar Diving**

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

### **11.30 Overhead Environments**

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

### **11.40 Saturation Diving**

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

### **11.50 Hookah**

Divers using the hookah mode shall be equipped with a diver-carried independent reserve breathing gas supply. Each hookah diver shall be hose-tended by a separate dive team member while in the water. However, the hookah diver is responsible for monitoring his or her own depth and dive profile for each dive. 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.

### **11.60 Surface Supplied Diving**

Surface supplied divers shall comply with all scuba diving procedures in this standard (Section 2.30). Surface supplied diving shall not be conducted at depths greater than 190 feet. Divers using the surface supplied mode shall be equipped with a diver-carried independent reserve breathing gas supply. Each surface supplied diver shall be hose tended by a separate dive team member while in the water.

Divers using the surface supplied mode are responsible for monitoring his or her own depth and dive profile for each dive.

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

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.

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.

### **11.70 Zero Visibility diving**

Divers planning to dive under zero visibility conditions must first complete the CCU zero visibility training module or demonstrate comparable experience.

## **APPENDICES**

## Appendix 1. Diving Medical Exam Overview for the Examining Physician

(Page 1 of 2)

TO THE EXAMINING PHYSICIAN:

This person, \_\_\_\_\_, requires a medical examination to assess their fitness for certification as a Scientific Diver for Coastal Carolina University (CCU). 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. Please contact the undersigned Diving Safety Officer if you have any questions or concerns about diving medicine or the CCU standards. Thank you for your assistance.

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

\_\_\_\_\_  
Date

\_\_\_\_\_  
Printed Name

\_\_\_\_\_  
Phone Number

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

### CONDITIONS WHICH MAY DISQUALIFY CANDIDATES FROM DIVING

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

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]

(CONTINUED ON NEXT PAGE)

15. Evidence of coronary artery disease or high risk for coronary artery disease<sup>1</sup>. [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<sup>2</sup>. [42 - 44]
24. Chronic pulmonary disease, including radiographic evidence of pulmonary blebs, bullae, or cysts. [45,46]
25. Diabetes mellitus. [46 - 47]
26. Pregnancy. [56]

#### SELECTED REFERENCES IN DIVING MEDICINE

Most of these are available from Best Publishing Company, P.O. Box 30100, Flagstaff, AZ 86003-0100, the Divers Alert Network (DAN) or the Undersea and Hyperbaric Medical Association (UHMS), Bethesda, MD.

- ACC/AHA Guidelines for Exercise Testing. A report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines (Committee on Exercise Testing). Gibbons RJ, et al. 1997. Journal of the American College of Cardiology. 30:260-311. <http://circ.ahajournals.org/cgi/content/full/96/1/345>
- Alert Diver Magazine; Articles on diving medicine <http://www.diversalertnetwork.org/medical/articles/index.asp>
- “Are Asthmatics Fit to Dive? “ Elliott DH, ed. 1996 Undersea and Hyperbaric Medical Society, Kensington, MD.
- “Assessment of Cardiovascular Risk by Use of Multiple-Risk-Factor Assessment Equations.” Grundy et. al. 1999. AHA/ACC Scientific Statement. <http://circ.ahajournals.org/cgi/reprint/circulationaha;100/13/1481>
- DIVING MEDICINE, Third Edition, 1997. A. Bove and J. Davis. W.B. Saunders Company, Philadelphia
- DIVING AND SUBAQUATIC MEDICINE, Third Edition, 1994. C. Edmonds, C. Lowery and J. Pennefather. Butterworth-Heinemann Ltd. Oxford
- **MEDICAL EXAMINATION OF SPORT SCUBA DIVERS, 1998. Alfred Bove, M.D., Ph.D. (ed.). Medical Seminars, Inc. San Antonio, TX**
- NOAA DIVING MANUAL, NOAA. Superintendent of Documents, U.S. Government Printing Office, Washington, D.C.
- U.S. NAVY DIVING MANUAL. Superintendent of Documents, U.S. Government Printing Office, Washington, D.C.

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<sup>1</sup> “Assessment of Cardiovascular Risk by Use of Multiple-Risk-Factor Assessment Equations.” Grundy et. al. 1999. AHA/ACC Scientific Statement. <http://circ.ahajournals.org/cgi/reprint/circulationaha;100/13/1481>

<sup>2</sup> “Are Asthmatics Fit to Dive? “ Elliott DH, ed. 1996 Undersea and Hyperbaric Medical Society, Kensington, MD.

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

(Page 1 of 2)

\_\_\_\_\_  
Name of Applicant (Print or Type)  
To The PHYSICIAN:

\_\_\_\_\_  
Date (Mo/Day/Year)

This person is an applicant for training or is presently certified to engage in diving with self-contained underwater breathing apparatus (scuba). This is an activity that puts unusual stress on the individual in several ways. 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. An absolute requirement is the ability of the lungs, middle ear and sinuses to equalize pressure. Any condition that risks the loss of consciousness should disqualify the applicant.

**TESTS:** Please initial that the following tests were completed.

**Initial Examination**

- \_\_\_\_\_ Medical History
- \_\_\_\_\_ Complete Physical Exam with emphasis on neurological and otological components
- \_\_\_\_\_ Chest X-Ray
- \_\_\_\_\_ Spirometry
- \_\_\_\_\_ Hematocrit or Hemoglobin
  
- \_\_\_\_\_ Urinalysis
- \_\_\_\_\_ Any further tests deemed necessary by the physician

**Additional testing for over age 40**

- \_\_\_\_\_ Resting EKG
  - \_\_\_\_\_ Assessment of coronary artery disease using Multiple-Risk-Factor Assessment<sup>3</sup>
- (age, lipid profile, blood pressure, diabetic screening, smoker) Note: Exercise stress testing may be indicated based on risk factor assessment<sup>6</sup>

**Re-examination**

**(Every 5 years under age 40,  
first exam over age 40,  
every 3 years over age 40,  
every 2 years over age 60)**

- \_\_\_\_\_ Medical History
- \_\_\_\_\_ Complete Physical Exam, with emphasis on neurological and otological components
- \_\_\_\_\_ Hematocrit or Hemoglobin
- \_\_\_\_\_ Urinalysis
- \_\_\_\_\_ Any further tests deemed necessary by the physician

**Additional testing for over age 40**

- \_\_\_\_\_ Resting EKG
  - \_\_\_\_\_ Assessment of coronary artery disease using Multiple-Risk-Factor Assessment<sup>3</sup>
- (age, lipid profile, blood pressure, diabetic screening, smoker) Note: Exercise stress testing may be indicated based on risk factor assessment<sup>6</sup>

<sup>3</sup> "Assessment of Cardiovascular Risk by Use of Multiple-Risk-Factor Assessment Equations." Grundy et. al. 1999. AHA/ACC Scientific Statement. <http://www.acc.org/clinical/consensus/risk/risk1999.pdf>

<sup>6</sup> Gibbons RJ, et al. ACC/AHA Guidelines for Exercise Testing. A report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines (Committee on Exercise Testing). Journal of the American College of Cardiology. 30:260-311, 1997. <http://www.acc.org/clinical/guidelines/exercise/exercise.pdf>

**RECOMMENDATION:**

APPROVAL. I find no medical condition(s) that I consider incompatible with diving.

RESTRICTED ACTIVITY APPROVAL. The applicant may dive in certain circumstances as described in REMARKS.

FURTHER TESTING REQUIRED. I have encountered a potential contraindication to diving. Additional medical tests must be performed before a final assessment can be made. See REMARKS.

REJECT. This applicant has medical condition(s), which, in my opinion, clearly would constitute unacceptable hazards to health and safety in diving

**REMARKS:** \_\_\_\_\_

\_\_\_\_\_

**PHYSICIAN'S STATEMENT:** I have evaluated the above-mentioned individual according to the American Academy of Underwater Sciences medical standards for scientific diving (Section 6.00), and find no conditions that may be disqualifying. 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.

\_\_\_\_\_ M.D.  
Date Signature

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

\_\_\_\_\_  
Address

\_\_\_\_\_  
Telephone Number

My familiarity with applicant is:

- \_\_\_\_\_ With this exam only
  - \_\_\_\_\_ Regular Physician for \_\_\_\_\_ years
  - \_\_\_\_\_ Other
- (describe) \_\_\_\_\_

My familiarity with diving medicine is:

\_\_\_\_\_

**APPLICANT'S RELEASE OF MEDICAL INFORMATION FORM**

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

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

### Appendix 3. Diving Medical History Form

(To Be Completed By Applicant-Diver)

(Page 1 of 2)

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

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

#### TO THE APPLICANT:

Scuba diving makes considerable demands on you, both physically and mentally. Diving with certain medical conditions may be asking for trouble not only for yourself, but also to anyone coming to your aid if you get into difficulty in the water. Therefore, it is prudent to meet certain medical and physical requirements before beginning a diving or training program.

Your answers to the questions are as important, in determining your fitness as your physical examination. Obviously, you should give accurate information or the medical screening procedure becomes useless.

This form shall be kept confidential. 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 and they 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. Please respect the advice and the intent of this medical history form.

<b>Have you ever had or do you presently have any of the following?</b>	<b>Yes</b>	<b>No</b>	<b>Comments</b>
1. Trouble with your ears, including ruptured eardrum, difficulty clearing your ears, or surgery.			
2. Trouble with dizziness.			
3. Eye surgery.			
4. Depression, anxiety, claustrophobia, etc.			
5. Substance abuse, including alcohol.			
6. Loss of consciousness.			
7. Epilepsy or other seizures, convulsions, or fits.			
8. Stroke or a fixed neurological deficit.			
9. Recurring neurologic disorders, including transient ischemic attacks.			
10. Aneurysms or bleeding in the brain.			
11. Decompression sickness or embolism.			
12. Head injury.			
13. Disorders of the blood, or easy bleeding.			
14. Heart disease, diabetes, high cholesterol.			
<b>(CONTINUED ON NEXT PAGE)</b>			



## Appendix 4. Medical History Questions Evaluation Form

(Medical History Screening Aid)

1 - B	21 - B
2 - B	22 - A
3 - B	23 - B
4 - B	24 - A
5 - B	25 - B
6 - B	26 - B
7 - A	27 - B
8 - B	28 - B
9 - A	29 - B
10 - A	30 - B
11 - B	31 - C
12 - B	32 - C
13 - B	33 - C
14 - B	34 - C
15 - B	
16 - B	
17 - B	
18 - B	
19 - B	
20 - B	

When a "Yes" answer is checked:

A = Absolute contraindication to diving;

B = Relative contraindication to diving, requires careful review by a physician;

C = Of interest, not a contraindication.

## Appendix 5. Recommended Physicians with Expertise in Diving Medicine

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

1. Dr. James Wright M.D.

Name

Seacoast Medical Center

Address

Little River, SC 29566

(843) 222-0300

Telephone

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

Name

Address

Telephone

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

Name

Address

Telephone

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

Name

Address

Telephone

## **Appendix 6. Selected References in Diving Medicine**

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

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

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

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

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

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

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

## Appendix 7. Definition of Terms

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

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

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

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

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

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

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

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

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

**Controlled Ascent** - Any one of several kinds of ascents including normal, swimming, and air sharing ascents where the diver(s) maintain control so a pause or stop can be made during the ascent.

**Cylinder** - A pressure vessel for the storage of gases.

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

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

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

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

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

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

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

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

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

**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 Control Board (DCB)** - Group of individuals who act as the official representatives of the membership organization (CCU) in matters concerning the scientific diving program (Section 1.24).

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

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

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

**Emergency Ascent** - An ascent made under emergency conditions where the diver exceeds the normal ascent rate.

**Enriched Air (EANx)** - A name for a breathing mixture of air and oxygen when the percent of oxygen exceeds 21%. This term is considered synonymous with the term “nitrox” (Section 7.00).

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

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

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

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

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

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

**Hyperbaric Chamber** - See decompression chamber.

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

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

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

**Mixed Gas** - MG

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

**MOD** - Maximum Operating Depth, usually determined as the depth at which the pO<sub>2</sub> for a given gas mixture reaches a predetermined maximum.

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

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

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

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

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

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

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

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

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

**Oxygen Toxicity** - 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.

**Oxygen Toxicity Unit** - OTU

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

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

**Pressure Vessel** - See cylinder.

**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.

**Project leader**- Person initiating, coordinating, and/or supervising scientific field research project.

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

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

**Recompression Chamber** - see decompression chamber.

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

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

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

**Surface Supplied Diving** - A diving mode in which the diver in the water is supplied from the dive location with compressed gas for breathing.

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

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

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

## Appendix 8. AAUS Request for Diving Reciprocity Form Verification of Diver Training and Experience

(Page 1 of 2)

Diver: \_\_\_\_\_

Date: \_\_\_\_\_

This letter serves to verify that the above listed person has met the training and pre-requisites as indicated below, and has completed all requirements necessary to be certified as a \_\_\_\_\_ as established by the \_\_\_\_\_

Diving Safety Manual, and has demonstrated competency in the indicated areas.

\_\_\_\_\_ is an AAUS OM and meets or exceeds all AAUS training requirements.

**The following is a brief summary of this diver's personnel file regarding dive status at \_\_\_\_\_.**

\_\_\_\_\_ Scuba certification (Agency) \_\_\_\_\_

\_\_\_\_\_ Written scientific diving examination

\_\_\_\_\_ Last diving medical examination

\_\_\_\_\_ Most recent checkout dive

\_\_\_\_\_ Scuba regulator/equipment service/test

\_\_\_\_\_ CPR training (Agency) \_\_\_\_\_

\_\_\_\_\_ Oxygen administration (Agency) \_\_\_\_\_

\_\_\_\_\_ First aid for diving \_\_\_\_\_

\_\_\_\_\_ 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

\_\_\_\_\_ Dive Computer

\_\_\_\_\_ Nitrox

\_\_\_\_\_ Mixed gas

\_\_\_\_\_ Closed circuit

\_\_\_\_\_ Saturation

\_\_\_\_\_ Decompression

\_\_\_\_\_ Other

\_\_\_\_\_ Rescue

\_\_\_\_\_ Divemaster

\_\_\_\_\_ Instructor

\_\_\_\_\_ EMT

\_\_\_\_\_ Dive Accident Management

\_\_\_\_\_ Chamber operator

\_\_\_\_\_ Lifesaving

\_\_\_\_\_ Blue water

\_\_\_\_\_ Altitude

\_\_\_\_\_ Ice/Polar

\_\_\_\_\_ Cave

\_\_\_\_\_ Night

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(CONTINUED ON NEXT PAGE)

Name of diver: \_\_\_\_\_

Telephone: (work) \_\_\_\_\_ (home) \_\_\_\_\_

Address: \_\_\_\_\_

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Health Insurance Company: \_\_\_\_\_ Policy # \_\_\_\_\_

D.A.N. Diver Accident Coverage: Policy # \_\_\_\_\_

Emergency Information: (To notify in an emergency)

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

Relationship: \_\_\_\_\_

Telephone: (work) \_\_\_\_\_ (home) \_\_\_\_\_

Address: \_\_\_\_\_

---

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

(Name of AAUS Organizational Member)

Diving Safety Officer: \_\_\_\_\_ / \_\_\_\_ / \_\_\_\_  
(Signature) (Date)

\_\_\_\_\_  
(Print)

Telephone: (\_\_\_\_\_) \_\_\_\_\_ FAX: (\_\_\_\_\_) \_\_\_\_\_

Email: \_\_\_\_\_

## Appendix 9. 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 midwater)
- Proper descent and ascent with B.C.
- Remove and replace weight belt while submerged
- Remove and replace scuba cylinder while submerged
- Alternate air source breathing with and without mask (donor/receiver)
- Buddy breathing with and without mask (donor/receiver)
- Simulated emergency swimming ascent
- Compass and underwater navigation
- Simulated decompression and safety stop
- Rescue:
  - Self rescue techniques
  - Tows of conscious and unconscious victim
  - Simulated in-water rescue breathing
  - Rescue of submerged non-breathing diver (including equipment removal, simulated rescue breathing, towing, and recovery to boat or shore)
  - Use of emergency oxygen on breathing and non-breathing victim
  - Accident management and evacuation procedures

### Additional Training (optional)

- Compressor/ Fill station orientation and usage
- Small boat handling

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## **Appendix 10. Diving Emergency Management Procedures**

### **Introduction**

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

### **General Procedures**

Depending on and according to the nature of the diving accident, stabilize the patient, administer 100% oxygen, contact local Emergency Medical System (EMS) for transport to medical facility, contact diving accident coordinator, as appropriate. Explain the circumstances of the dive incident to the evacuation teams, medics and physicians. Do not assume that they understand why 100% oxygen may be required for the diving accident victim or that recompression treatment may be necessary.

- 1. Make appropriate contact with victim or rescue as required.**
- 2. Establish (A)irway, (B)reathing, (C)irculation as required.**
- 3. Administer 100% oxygen, if appropriate (in cases of Decompression Illness, or Near Drowning).**
- 4. Call local Emergency Medical System (EMS) for transport to nearest medical treatment facility.**
- 5. Call appropriate Diving Accident Coordinator for contact with diving physician and recompression chamber, etc.**
- 6. Notify DSO or designee according to the Emergency Action Plan of the organizational member.**
- 7. Complete and submit Incident Report Form(Appendix 13) to the DCB and Risk Management of CCU and the AAUS (As required in Section 2.72).**

### **List of Emergency Contact Numbers Appropriate For Dive Location:**

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## Appendix 12. Emergency Phone Numbers

### Emergency Phone Numbers

#### **Horry County, SC:**

U.S. Coast Guard:	VHF Channel 16
Emergency services	911
U.S. Air Ambulance:	(800) 633-5384
Grand Strand Medical Center:	(843) 692-1000
Conway Medical Center:	(843) 347-7111

#### **Georgetown County, SC:**

U.S. Coast Guard:	VHF Channel 16
Emergency services	911
D.A.N. (Emergency Only):	(919) 684-8111
D.A.N. (Emergency Only/collect calls):	(919) 684-4326
U.S. Air Ambulance:	(800) 633-5384
Georgetown Memorial Hospital	(843) 527-7000

#### **Charleston County, SC:**

U.S. Coast Guard:	VHF Channel 16
Emergency services	911
D.A.N. (Emergency Only):	(919) 684-8111
D.A.N. (Emergency Only/collect calls):	(919) 684-4326
U.S. Air Ambulance:	(800) 633-5384
St Francis Hospital	(843) 402-1037

#### **Wilmington, NC:**

U.S. Coast Guard:	VHF Channel 16
Emergency services	911
D.A.N. (Emergency Only):	(919) 684-8111
D.A.N. (Emergency Only/collect calls):	(919) 684-4326
U.S. Air Ambulance:	(800) 633-3590

<b><u>Poison Control Center</u></b>	(800) 222-1222
	(800) 922-1117

**Appendix 13. Project Dive Plan**

**Project dive plan**

(Page 1 of 2)

PROJECT \_\_\_\_\_ DATES \_\_\_\_\_

SCIENTIFIC SUPERVISOR \_\_\_\_\_

DIVE MASTER \_\_\_\_\_

PURPOSE:            ()Scientific   ()Proficiency   ()Training   ()Recreational

MODE:                () SCUBA    ()Surface supplied   ()Other: \_\_\_\_\_

BREATHING GAS: ()Air   ()Nitrox: mix: \_\_\_\_/\_\_\_\_   ()Other: \_\_\_\_\_

DIVE SITE(s): \_\_\_\_\_

MAXIMUM DEPTH(s) \_\_\_\_\_ MAXIMUM TIME(s) \_\_\_\_\_

APPROXIMATE NUMBER OF PROPOSED DIVES \_\_\_\_\_

INDIVIDUAL REPETITIVE DIVE SCHEDULES: Daily: \_\_\_\_\_ Weekly \_\_\_\_\_

SUMMARY OF PROPOSED WORK (List equipment & boats to be employed, a description of site conditions anticipated, and details of any hazardous conditions anticipated. Use additional paper as needed.): \_\_\_\_\_

**EMERGENCY CONTACT INFORMATION** (Include phone numbers, location, and detailed directions):

**Divers Alert Network (D.A.N.):** (919) 684-8111 / call collect at (919) 684-4326

**Emergency services:** 911 / **(U. S. Coast Guard)** VHS Ch16

**Poison Control Center:** (800) 222-1222 / (800) 922-1117

**U.S. Air Ambulance:** \_\_\_\_\_

**Hospital:** \_\_\_\_\_

**Ambulance:** \_\_\_\_\_

**Law Enforcement:** \_\_\_\_\_

REQUIRED SAFETY EQUIPMENT: Oxygen Kit, AED, First Aid Kit

EQUIPMENT OR SUPPORT REQUESTED FROM THE DIVE SAFETY OFFICE: \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**(CONTINUED ON NEXT PAGE)**

## Project Dive Plan (continued)

(Page 2 of 2)

PARTICIPANT NAME	CONTACT PHONE #	EMERGENCY PHONE #
1) _____	(____) _____	(____) _____
2) _____	(____) _____	(____) _____
3) _____	(____) _____	(____) _____
4) _____	(____) _____	(____) _____
5) _____	(____) _____	(____) _____
6) _____	(____) _____	(____) _____
7) _____	(____) _____	(____) _____
8) _____	(____) _____	(____) _____
9) _____	(____) _____	(____) _____
10) _____	(____) _____	(____) _____
11) _____	(____) _____	(____) _____
12) _____	(____) _____	(____) _____
13) _____	(____) _____	(____) _____
14) _____	(____) _____	(____) _____
15) _____	(____) _____	(____) _____
16) _____	(____) _____	(____) _____
17) _____	(____) _____	(____) _____
18) _____	(____) _____	(____) _____
19) _____	(____) _____	(____) _____
20) _____	(____) _____	(____) _____

**Appendix 14. Release, waiver, risk, and indemnification form**

(Page 1 of 2)

**COASTAL CAROLINA UNIVERSITY**

**RELEASE OF LIABILITY, WAIVER OF CLAIMS, ASSUMPTION OF RISK,  
AND INDEMNIFICATION AGREEMENT FOR SCIENTIFIC DIVING  
ACTIVITIES**

**(To be completed prior to each University-related scientific diving training or trip)**

\_\_\_\_\_, I, \_\_\_\_\_ (print), do hereby affirm and acknowledge that I have been fully informed of the inherent risks associated with snorkeling, skin and/or scuba diving for scientific purposes. I fully understand that these risks can lead to personal injury, illness, paralysis, permanent disability, and death or damage to my property. I understand that scientific diving operations may be conducted at a site that is remote from a recompression chamber, nevertheless, I choose to proceed even in the absence of a recompression chamber. Additionally, I understand that there are also risks associated with dive travel, including, but not limited to the possible injury or loss of life as a result of a dive boat accident, as well as any travel to and from dive sites, drowning, capsizing, rough water conditions, water hazards, diving in unfamiliar water, using diving equipment, injuries inflicted by animals, plants and/or microbes, accidents or illness in remote locations without medical facilities, man-made objects in the water including but not limited to: ropes, bridge pilings, obstructions, the forces of nature including but not limited to, lightning, weather changes, water level changes, and my physical condition and the physical exertion associated with diving. Despite the potential hazards and dangers associated with the activity of scientific diving, I voluntarily agree to participate in the scientific diving and hereby accept and assume all risks, known and unknown and assume all responsibility for the losses, cost and/or damages following such injury, disability, paralysis or death, even if caused in whole or part by the negligence of Coastal Carolina University (CCU).

\_\_\_\_\_ I understand the nature of scientific diving and my experience and capabilities, and believe myself qualified and able to participate in the scientific diving activities. I am currently a certified scuba diver. I understand that I may inspect the premises, facilities and equipment to be used or with which I may come in contact. If I believe anything to be unsafe, I will immediately refuse to participate further in scientific diving. I understand that there is no penalty or forfeiture of any kind if I withdraw.

\_\_\_\_\_ In consideration of being allowed to participate in snorkeling, skin and/or scuba diving for scientific purposes, as well as the use of any of the facilities and the use of the equipment of the below listed releases, I hereby agree as follows:

\_\_\_\_\_ **(1) TO WAIVE AND RELEASE ANY AND ALL CLAIMS** based upon negligence, active or passive with the exception of intentional, wanton, or willful misconduct that I may have in the future against any of the following named persons or entities and their officers, directors, employees, representatives, agents, and volunteers.

Facility: Coastal Carolina University

Others:

Dive Leader/Supervisor(s): \_\_\_\_\_

Scientific Supervisor(s): \_\_\_\_\_

**(CONTINUED ON NEXT PAGE)**

\_\_\_\_\_ **(2) TO RELEASE CCU**, their officers, directors, employees, representatives, students, agents, and volunteers, from liability and responsibility, whatsoever for any claim of action that I, my estate, heirs, executors or assigns may have for any personal injury, property damage or wrongful death arising from snorkeling skin and/or scuba diving for scientific purposes whether caused by active or passive negligence of CCU or otherwise with the exception of gross negligence. By executing this document, I agree to hold CCU harmless for any injury, including paralysis, or permanent disability, or loss of life which may occur to me during the snorkeling, skin and/or scuba diving for scientific purposes and/or instruction.

\_\_\_\_\_ **(3) BY ENTERING INTO THIS AGREEMENT**, I am not relying on any oral or written representation or statements made by CCU, other than what is set forth in this agreement. I further agree that this Agreement shall be governed by and interpreted in accordance with the laws of the State of South Carolina, United States of America.

\_\_\_\_\_ **(4) IF ANY PROVISION OF THIS RELEASE** is found to be unenforceable or invalid, that provision shall severed from this release. The remainder of this release will then be construed as though the unenforceable provision had never been contained in this document.

\_\_\_\_\_ With the scientific diving process having been fully explained to me and all of my questions answered to my satisfaction, I agree to participate in the scientific diving, fully aware of the activities and risks that may be involved. I also understand that this is a legal document which is binding on me, my heirs, and assigns and on those who may claim by or through me. I am eighteen years of age or older, have full capacity to enter into this Agreement, and do so voluntarily.

**I HAVE READ THIS AGREEMENT, I UNDERSTAND IT AND I AGREE TO BE BOUND BY IT.**

Signed this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_\_

Name of Activity: \_\_\_\_\_

Dates of Activity: \_\_\_\_\_

Participant Signature: \_\_\_\_\_

Printed Name: \_\_\_\_\_

Date of Birth (mm/dd/yy): \_\_\_\_\_ / \_\_\_\_\_ / \_\_\_\_\_

Witness Signature: \_\_\_\_\_

Witness Printed Name: \_\_\_\_\_

(If participant is under 18 years old)

Parent or Legal Guardian Signature: \_\_\_\_\_

Parent or Legal Guardian Printed Name: \_\_\_\_\_

Witness Signature: \_\_\_\_\_

Witness Printed Name: \_\_\_\_\_

## **Appendix 15. CCU Dive Emergency Procedures Guidelines**

(Page 1 of 3)

### **CCU DIVE EMERGENCY PROCEDURES GUIDELINES**

#### **General Policy**

In an emergency, personnel must act quickly and effectively to minimize injury and/or prevent death. While it is impossible to anticipate all emergencies, prior planning and proper training are key to dealing with emergency situations. These guidelines provide a planning tool which, when used properly, will allow an Emergency Action Plan to be developed and in place prior to the start of diving operations.

#### **Formulating an emergency Action Plan**

When formulating an Emergency Action Plan for a CCU scientific diving project, many factors should be considered. The following is a partial list of information and considerations which deserve forethought as you pull together the Emergency Action Plan for a specific site.

#### **Emergency Numbers and Information**

- Number of EMS and nearest hospital phone and location
- Location and contact information for nearest recompression chamber
- Number of poison control
- DAN emergency number (919) 684-8111
- Emergency contact information for divers
- CCU Diving Safety number (843) 349-4052
- Contact list Diving Safety Officer, Diving Safety Control Board, University Risk Manager, etc. This information may vary from project to project and must be updated prior to each operation.)

#### **Equipment Requirements at Location**

- Oxygen kit
- AED
- First Aid kit
- Pen and paper
- Forms
- Lines for search/recovery
- Backboard, Life rings, Life jackets, etc.
- Communications equipment (VHF radio, cellular phone, pay phone, CB radio, etc.)
- Flares and signaling devices
- Additional site specific equipment

#### **Personnel Considerations**

- Team members backgrounds and personalities
- Who will be in charge of what?

#### **Site considerations**

- Marine life
- Entrapments or entanglements
- Physical Hazards
- Depth
- Currents

**(CONTINUED ON NEXT PAGE)**

## Action Plan

- Emergency Recognition / Activation of Emergency Action Plan
- How to recall divers and alert personnel
- Search for and recover injured / missing diver
  - Spotting Team
  - Search and Recovery Team
  - Transport Team (swimmers or boat)
  - Individual to get help
- In-water evaluation and response (airway & breathing)
- Transport to platform or beach
- Extrication from water
- Evaluation and ABC's
- Activation of EMS (ambulance, Coast Guard. etc.)
- Appropriate first aid (CPR, Oxygen, Shock treatment, etc.)
- Gather information (diver, buddy, equipment, observer, DAN neuro-cue-card, CCU Accident Reporting Worksheet)
- Evacuation procedures
  - Evacuation mode/route
  - Call DAN if appropriate.
  - Send information and a carrier with EMS (ensure understand compressed gas was used)
- Notification protocols
- Follow up and reporting procedures

Obviously, a dive accident plan can vary substantially from project to project. Regardless of the project, the emergency accident plan and contingency plans should be formulated and made clear to the dive team. It often helps to visualize a worst case scenario. On-site accident drills are recommended to illustrate roles, required actions, and potential problems.

## HELICOPTER EVACUATION PROCEDURES

- Each helicopter evacuation is different, each one presents its own problems, but knowing what to expect and the procedures to follow can save time, effort, and perhaps a life.
  - Try to establish communications with the helicopter. If your boat is unable to furnish the necessary frequency, try to work through another boat.
  - Maintain speed of 10 to 15 knots, do not slow down or stop.
  - Maintain course into wind about 20 degrees on port bow.
  - Put all antennas down if possible, without losing communications.
  - Secure all loose objects on/or around decks.
  - Always let the lifting device (stretcher) touch the boat before handling it to prevent electric shock.
  - Place lift jacket on patient.
  - Tie patient in basket, face up.

**(CONTINUED ON NEXT PAGE)**

- If patient cannot communicate, place in the stretcher as much information as you can about him, such as, name, age, address, what happened, and what medication he has been given.
- If the patient is a diving accident victim, ensure flight crew has copy of or is instructed on medical procedures for diving accidents.
- If diving accident victim, ensure flight crew delivers victim to hyperbaric trauma system (recompression chamber complex).
- If patient dies, inform flight crew so that they take no unnecessary risks.

## Appendix 16. Dive Computer Guidelines

### DIVE COMPUTER GUIDELINES

1. Only those makes and models of dive computers specifically approved by the Diving Control Board may be used.
2. Any diver desiring the approval to use a dive computer as a means of determining decompression status must apply to the Diving Control Board, complete an appropriate practical training session and pass a written examination.
3. Each diver relying on a dive computer to plan dives and indicate or determine decompression status must have his/her own unit.
4. On any given dive, both divers in the buddy pair must follow the most conservative dive computer.
5. If the dive computer fails at any time during the dive, the dive must be terminated and appropriate surfacing procedures should be initiated immediately.
6. A diver should not dive for 18 hours before activating a dive computer to use it to control their diving.
7. Once the dive computer is in use, it must not be switched off until it indicates complete out gassing has occurred or 18 hours have elapsed, whichever comes first.
8. When using a dive computer, non emergency ascents are to be at a rate specified for the make and model of dive computer being used.
10. Whenever practical, divers using a dive computer should make a stop between 10 and 30 feet for 5 minutes, especially for dives below 60 fsw.
11. Multiple deep dives require special consideration.

## Appendix 17. Safe Ascent Guidelines

### SAFE ASCENT GUIDELINES

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 (AAUS) that the ultimate responsibility for safety rests with the individual diver. The time has come to encourage divers to slow their ascents.

Buoyancy compensation is a significant problem in the control of ascents.

1. Buoyancy compensation control must be maintained 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 30fsw per minute.
6. A safety stop, during ascent, in the 15-20fsw zone for 3-5 min is recommended on every dive.
7. A safety stop, during ascent, half way to the surface for 1 min is recommended on every dive to 66fsw (20msw) or deeper. Example: Ascending from a 70fsw dive, a diver's 1<sup>st</sup> safety stop is at 35fsw for :01 min. The diver's 2<sup>nd</sup> safety stop is at 15-20fsw for :03-:05 min
8. When using a dive computer or tables, non-emergency ascents are to be at the rate specified for the system being used.
9. Each diver shall have instrumentation to monitor ascent rates.
10. Divers using dry suits shall have training in their use.
11. Dry suits shall have a hands-free exhaust valve.
12. BCs shall have a reliable rapid exhaust valve which can be operated in a horizontal swimming position.
13. A buoyancy compensator is required with dry suit use for ascent control and emergency flotation.
14. Breathing 100% oxygen above water is required for omitted mandatory decompression stop. In-water air procedures for omitted decompression are prohibited!

## Appendix 18. Reverse Dive Profiles Workshop

# Reverse Dive Profiles Workshop

Michael A. Lang and Charles E. Lehner

Co-Chairs

Smithsonian Institution

October 29-30, 1999

Co Sponsors:

Smithsonian Institution

Divers Alert Network

American Academy of Underwater Sciences

Diving Equipment and Marketing Association

Dive Training Magazine

### Workshop Findings

- Historically, neither the U.S. Navy nor the commercial sector have prohibited reverse dive profiles
- Reverse dive profiles are being performed in recreational, scientific, commercial, and military diving
- The prohibition of reverse dive profiles by recreational training organizations cannot be traced to any definite diving experience that indicates an increased risk of Decompression Sickness (DCS)
- No convincing evidence was presented that reverse dive profiles within the no-decompression limits leads to a measurable increase in the risk of DCS

### Workshop Conclusion

- We find no reason for the diving communities to prohibit reverse dive profiles for no-decompression dives less than 40 msw (130 fsw) and depth differentials less than 12 msw (40 fsw).

## **Appendix 19. CCU Diving Safety Rules**

(Page 1 of 5)

# **COASTAL CAROLINA UNIVERSITY (CCU) DIVING SAFETY RULES**

### **\_\_\_\_ 1. Certification**

No individual will be allowed to participate in CCU diving operations unless he/she holds a valid Scuba Certification from a recognized agency (NAUI, PADI, SSI, NASDS, YMCA, Etc...) and a CCU Scientific Diver Certification, CCU Diver -in-Training Permit, Temporary Diver Authorization, AAUS Scientific Diver Certification, VIP diver authorization, or a NOAA Diving Program Certification. The individual may be required to participate in scheduled training and certification activities prior to beginning or during the diving research mission.

### **\_\_\_\_ 2. Divers Responsibility**

Ultimate responsibility for safety rests with the individual diver. Therefore, it is the diver's responsibility and duty to refuse to dive if the diver feels uncomfortable with the tasks or dive plan, or if conditions are judged to be unsafe or unfavorable, or he/she would be violating the conditions of his/her training or CCU diving regulations. A diver should also withdraw from diving if he/she does not feel well enough to safely complete the dive. A diver may refuse to dive, without fear of penalty, whenever they feel it is unsafe for them to make the dive.

### **\_\_\_\_ 3. Supervision**

A CCU certified Dive Master will be provided for all diving operations. The Dive Master shall have complete operational authority and full responsibility for all diving activities. This shall include, but is not limited to, any decisions regarding operational diving procedures, proper equipment, individual diver fitness, ship or vessel operations as they affect diving and operational weather-ocean related judgments. The Dive Master has the authority to terminate any diving operation he/she feels is unsafe or unwise. The Dive Master may be responsible for only six in-water divers at any one time during normal working dives. If live boating, then no more than four in water divers are allowed at any one time.

### **\_\_\_\_ 4. Dive Planning**

A dive plan will be formulated prior to engaging in diving activities. This will be reviewed and discussed by all diving participants. This plan should include the proposed site, proposed tasks, maximum bottom time, maximum depth anticipated, minimum cylinder pressures, a review of surface conditions and underwater conditions and any hazards anticipated. A pre-dive briefing or safety briefing will be conducted by the onsite Dive Master.

**(CONTINUED ON NEXT PAGE)**

## **5. Dive Procedures**

### **a. Depth Limits**

Maximum depth for air or enriched air nitrox will be 100 FSW for 36% EANx. No-decompression stop dives will be in accordance with the US Navy Standard Air Decompression Tables. Provisional dives beyond 100 FSW will not be granted. These dives require additional training and operational procedures, since these dive profiles are likely to incur decompression obligations. Maximum depth for extended range and technical diving is 250 FSW. Special permission will not be granted by the CCU Diving Control Board for conducting extended range and technical diving.

### **b. Ascent Rates**

Maximum Ascent rate during all diving operations is not to exceed 30 feet per minute. This will be measured with the use of a depth gauge and time keeping device (dive watch, computer, bottom timer, etc...). In the unlikely event of an independent out-of-air ascent, the diver will ascend as slowly as possible but as fast as necessary.

### **c. Sea States**

Acceptable sea conditions for safe scientific scuba diving depend on a number of conditions including mode of operation, task to be performed, equipment to be used and personnel qualifications. Therefore, the following standards are considered general guidelines to assist the Dive Master in determining safe and normal operating conditions.

- Maximum Sea State: Three to Five-foot (3'- 5') seas.
- Maximum Current: One (1) knot.

### **d. Dive Tables**

No-decompression and decompression diving will be in accordance with the U.S. Navy Standard Air Decompression Table, No-Decompression Limits and Repetitive Group Designation Table, and Residual Nitrogen Timetable. Enriched Air Nitrox diving will be conducted in accordance with NOAA NNI Table, NOAA NNII Table, or the equivalent air depth (EAD) concept based on the U.S. Navy Standard Air Decompression Tables.

### **e. The Dive Team**

No diver shall dive unattended. The dive team shall consist of at least two divers, unless the diver is tended from the surface or using surface supplied diving equipment. The divers are required to maintain buddy contact throughout the dive. The guidelines for effective buddy contact include staying in visual contact, maintaining effective communication and being in a position to render assistance if necessary. In situations of limited or low visibility, when visual contact may be difficult or impossible, then the dive team is required to maintain physical contact or use a buddy line.

### **f. Boat diving/Live boating**

A certified boat operator who can operate the vessel, navigate, and return to the dock will remain on board the vessel at all times during normal diving operations. When necessary, live boating procedures may be followed for diving operations and a thorough procedural briefing will be conducted for all concerned personnel.

**(CONTINUED ON NEXT PAGE)**

**g. Hours of operation**

Normal work hours for participants engaged in scientific diving activities should not exceed twelve (12) hours during any twenty-four hour period. A minimum rest period of eight (8) continuous hours is required during each twenty-four hour period for all diving participant.

**h. Specialty Training**

Whenever additional specialty training is required, it will consist of, but not be limited to; enriched air nitrox diving techniques, drysuit diving, full face mask scuba, aquanaut/saturation diving, surface supplied and habitat supplied, umbilical dive training and dive computers.

**i. Enriched Air Diving**

All divers using enriched air nitrox diving techniques will be required to obtain approved EANx training and certification from CCU or equivalent instructional agency (IANffi, ANDI, TDI, PADI, NAUI) prior to conducting EANx Scuba or EANx surface supplied dives. It is the responsibility of each diver to confirm the oxygen content of his/her scuba cylinder and verify in writing:

- The PPO<sub>2</sub> cut-off depth (MOD), and appropriate enriched air mixture to be used on the dive,
- The planned maximum depth and allowable bottom time permitted for the mixture contained in his/her scuba cylinder.

**j. Safety Stops**

An in-water safety stop is recommended for all dives to forty (40) feet and beyond or approach within ten (10) minutes of the no-decompression time limit. This safety stop should be conducted for at least 3-5 minutes at a depth of 15-20 feet. All divers conducting safety stops must use an ascent line or anchor line for a visual reference or physical aid and the diver is to remain at rest. If the sea states are marginal and exceed three (3) feet or a strong current exists, then safety stops should not be performed. This safety stop is considered a delay in ascent and the time spent will not be counted against bottom time. Divers should reach the surface with no less than 500 psi remaining in their Scuba cylinders.

**k. Cold and Arduous Diving Rule**

If the dive is extremely cold and/or the underwater tasks are strenuous, then the Dive Master may elect for divers to follow a cold and arduous diving rule. This rule will consist of a repetitive group letter adjustment, which will limit no-decompression limits and reduce them by one letter group for single dives and repetitive dives.

**l. Flying after Diving**

A minimum surface interval of 24 hours is required before ascent to altitude up to 8,000 feet in a commercial jet airliner. Divers who make multiple dives per day or over many days, or dives that require obligated decompression stops should take special precautions and wait for an extended surface interval beyond 24 hours before ascending to altitude (Divers Alert Network, June 1994). A minimum surface interval of 48 hours is required for saturation divers who have undergone normal saturation decompression procedures.

**(CONTINUED ON NEXT PAGE)**

## **6. Dive Equipment**

An individual diver may choose to use his/her personal diving equipment for scientific diving as long as it meets equipment guidelines set forth by CCU. Personal diving equipment must be serviced annually, be in good working condition and will be inspected by the Dive Master prior to use. Diving equipment using compressed gas with an oxygen content of 40% or greater must be cleaned for oxygen service standards.

### **a. Diving Regulator**

All divers will be required to dive with a submersible pressure gauge and an alternate air source (alternate air source can consist of either an octopus regulator, Scubapro Air II, Sherwood Shadow, Spare air or pony bottle with regulator).

### **b. Buoyancy Compensator**

A buoyancy compensator will be worn by each diver. The buoyancy compensator shall have two means of inflation, both oral and mechanical.

### **c. Diving Harness and Weight Belt**

Weight belts and diving harnesses will have a one hand quick release capability and be of a length suitable for the individual. Weight belts used in conjunction with saturation diving will have two quick release buckles for added security.

### **d. Compass**

The use of an underwater compass is recommended for all divers for general navigation and orientation during the dive.

### **e. Depth Gauge**

All divers shall wear a depth gauge or dive computer to record depth profiles.

### **f. Dive Timer**

All divers shall wear a dive watch, dive computer or pressure activated stopwatch to record bottom time.

### **g. Variable Volume Drysuit**

The use of variable volume drysuits are allowed if the participants have proper training and receive dry suit certification.

### **h. Dive Flag**

A Code Alpha and Sport diving flag shall be flown at the dive site so that it can be seen from 360 degrees to indicate underwater diving operations.

### **i. Dive Computers**

Dive Computers are permitted for use and can be used to control the dive profile. Divers must follow the Guidelines for use of Dive Computers, from the AAUS Dive Computer Workshop.

## **7. Emergency Procedures**

### **a. Emergency Assistance Plan**

Diving participants will review diving accident management prior to engaging in scientific diving activities. A copy of an Emergency Assistance Plan will be carried on-board by the Dive Master which outlines the nearest medical facility and recompression facility appropriate for the diving location.

(CONTINUED ON NEXT PAGE)

**b. Emergency Equipment**

The following first aid equipment will be present and available on-site for all diving related activities: divers first aid kit, AED, and oxygen demand valve resuscitator unit.

**c. Violations**

Violations of the CCU Diving Safety Rules will involve a review by the University Diving Safety Officer and Diving Control Board and could result in revocation or suspension of CCU approved diving certification.

**8. Record Keeping**

Permanent records will be kept for each diver trained and certified for diving with CCU. These files will include medical examination(s), diver certifications, training and qualification records and dive logs for a period of 5 years. The "inactive diver" files are maintained on those individuals whose certification has lapsed, but plan to apply for recertification. All dives or hyperbaric chamber exposures performed under the auspices of CCU will be logged and filed in the mission report folder.

**9. Reporting of Injuries**

Report any and/or all diving related injuries immediately to the on-site Dive Master or a regular CCU faculty/staff member. Notification will ensure prompt action and immediate treatment to minimize or resolve any medical complications. CCU Dive Master will prepare a Diving Incident Report to document the nature of the injury and action taken. The Diving Incident Report is to be submitted to the CCU Dive Control Board, Dive Safety Officer, and Risk Management.

**I HAVE READ THESE UNIVERSITY DIVING SAFETY RULES, I UNDERSTAND THEM AND I AGREE TO BE BOUND BY THEM.**

Signed this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_\_

Name of Activity: \_\_\_\_\_

Dates of Activity: \_\_\_\_\_

Participant Signature: \_\_\_\_\_

Printed Name: \_\_\_\_\_

Date of Birth (mm/dd/yy): \_\_\_\_\_ / \_\_\_\_\_ / \_\_\_\_\_

(If participant is under 18 years old)

Parent or Legal Guardian Signature: \_\_\_\_\_

Parent or Legal Guardian Printed Name: \_\_\_\_\_

Witness Signature: \_\_\_\_\_ / \_\_\_\_\_ / \_\_\_\_\_

Printed Name: \_\_\_\_\_

## Appendix 20. Diver Application Form

(Page 1 of 2)

### COASTAL CAROLINA UNIVERSITY SCIENTIFIC DIVING PROGRAM DIVER APPLICATION FOR THE YEAR \_\_\_\_\_

**Certification level requested:** (check one)

<input type="checkbox"/> _____	Project Diving Coordinator	<input type="checkbox"/> _____	Scientific Diver-in-Training
<input type="checkbox"/> _____	Dive Master	<input type="checkbox"/> _____	Recreational Diver
<input type="checkbox"/> _____	Scientific Diver	<input type="checkbox"/> _____	Temporary Scientific Diver

Name \_\_\_\_\_ e-mail add. \_\_\_\_\_

Local address \_\_\_\_\_ Telephone \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_

Next of kin \_\_\_\_\_ Relationship \_\_\_\_\_

Address \_\_\_\_\_ Telephone \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_

Status: Faculty \_\_\_\_\_ Staff \_\_\_\_\_ Grad \_\_\_\_\_ Undergrad \_\_\_\_\_ Dept \_\_\_\_\_

Social Security Number \_\_\_\_\_ Birth date \_\_\_\_\_

Have DAN or other diving insurance covering evacuation and chamber costs? Yes \_\_\_\_\_ No \_\_\_\_\_

DAN # \_\_\_\_\_

**Diving certifications:**

Agency	Certification	Date	Location	Instructor
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

**Ancillary diving certifications:**

	Date	Level	Agency	Comment
CPR	_____	_____	_____	_____
First Aid	_____	_____	_____	_____
Life Saving	_____	_____	_____	_____
Emergency O <sub>2</sub>	_____	_____	_____	_____
A.E.D.	_____	_____	_____	_____

(CONTINUED ON NEXT PAGE)

**Diving Activity:**

Number of years \_\_\_\_\_ Hours of dive time \_\_\_\_\_ Greatest depth \_\_\_\_\_

Total number dives \_\_\_\_\_

Total number dives this year \_\_\_\_\_

Total dives to: 0-30' \_\_\_\_\_ 31-60' \_\_\_\_\_ 61-100 \_\_\_\_\_ 100-130' \_\_\_\_\_ >130'' \_\_\_\_\_

Dive locations \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**Diving experience:** Check areas in which you have some diving experience and double check areas if you are very experienced:

_____ Ocean	_____ Low visibility	_____ Research	_____ Dive computer
_____ Fresh	_____ Kelp/weeds	_____ Collecting	_____ Search/recovery
_____ Surf	_____ Cold water	_____ Photography	_____ Decompression
_____ Shore	_____ Tropical	_____ Spearfishing	_____ Strong current
_____ Night	_____ Blue water	_____ Surface supply	_____ Dry suit
_____ Caves	_____ Under ice	_____ Mixed gas	_____ Saturation

## **Appendix 21. Dive Statistics Collection Criteria and Definitions**

### **CCU / AAUS STATISTICS COLLECTION CRITERIA AND DEFINITIONS**

(Page 1 of 4)

#### **COLLECTION CRITERIA:**

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

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

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

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

Dives will not be differentiated as openwater or confined water dives. But openwater and confined water dives will be logged and submitted for AAUS statistics classified as either scientific or training/proficiency.

A "Diver Logging a Dive" is defined as a person who is diving under the auspices of your scientific diving organization. Dives logged by divers from another AAUS Organization will be reported with the divers home organization. Only a diver who has actually logged a dive during the reporting period is counted under this category.

Incident(s) occurring during the collection cycle. Only incidents occurring during, or resulting from, a dive where the diver is breathing a compressed gas will be submitted to AAUS.

#### **DEFINITIONS:**

##### Dive Classification:

- **Scientific Dives:** Dives that meet the scientific diving exemption as defined in 29 CFR 1910.402. Diving tasks traditionally associated with a specific scientific discipline are considered a scientific dive. Construction and trouble-shooting tasks traditionally associated with commercial diving are not considered a scientific dive.

- Training and Proficiency Dives: Dives performed as part of a scientific diver training program, or dives performed in maintenance of a scientific diving certification/authorization.

#### Breathing Gas:

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

#### Diving Mode:

- Open Circuit Scuba: Dives where the breathing gas is inhaled from a self contained underwater breathing apparatus and all of the exhaled gas leaves the breathing loop.
- Surface Supplied: Dives where the breathing gas is supplied from the surface by means of a pressurized umbilical hose. The umbilical generally consists of a gas supply hose, strength member, pneumofathometer hose, and communication line. The umbilical supplies a helmet or full-face mask. The diver may rely on the tender at the surface to keep up with the divers' depth, time and diving profile.
- Hookah: While similar to Surface Supplied in that the breathing gas is supplied from the surface by means of a pressurized hose, the supply hose does not require a strength member, pneumofathometer hose, or communication line. Hookah equipment may be as simple as a long hose attached to a standard scuba cylinder supplying a standard scuba second stage. The diver is responsible for the monitoring his/her own depth, time, and diving profile.
- Rebreathers: Dives where the breathing gas is repeatedly recycled in the breathing loop. The breathing loop may be fully closed or semi-closed. Note: A rebreather dive ending in an open circuit bailout is still logged as a rebreather dive.

#### Decompression Planning and Calculation Method:

- Dive Tables
- Dive Computer
- PC Based Decompression Software

#### Depth Ranges:

Depth ranges for sorting logged dives are 0-30, 31-60, 61-100, 101-130, 131-150, 151-190, and 191->. Depths are in feet seawater. A dive is logged to the maximum depth reached during the dive. Note: Only "The Number of Dives Logged" and "The Number of Divers Logging Dives" will be collected for this category.

### Specialized Environments:

- **Required Decompression:** Any dive where the diver exceeds the no-decompression limit of the decompression planning method being employed.
- **Overhead Environments:** Any dive where the diver does not have direct access to the surface due to a physical obstruction.
- **Blue Water Diving:** Openwater diving where the bottom is generally greater than 200 feet deep and requiring the use of multiple-tethered diving techniques.
- **Ice and Polar Diving:** Any dive conducted under ice or in polar conditions. Note: An Ice Dive would also be classified as an Overhead Environment dive.
- **Saturation Diving:** Excursion dives conducted as part of a saturation mission are to be logged by "classification", "mode", "gas", etc. The "surface" for these excursions is defined as leaving and surfacing within the Habitat. Time spent within the Habitat or chamber shall not be logged by AAUS.
- **Aquarium:** An aquarium is a shallow, confined body of water, which is operated by or under the control of an institution and is used for the purposes of specimen exhibit, education, husbandry, or research. (Not a swimming pool)

### Incident Types:

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

Incident Classification Rating Scale:

- Minor: Injuries that the OM considers being minor in nature. Examples of this classification of incident would include, but not be limited to:
  - Mask squeeze that produced discoloration of the eyes.
  - Lacerations requiring medical attention but not involving moderate or severe bleeding.
  - Other injuries that would not be expected to produce long term adverse effects on the diver's health or diving status.
  
- Moderate: Injuries that the OM considers being moderate in nature. Examples of this classification would include, but not be limited to:
  - DCS symptoms that resolved with the administration of oxygen, hyperbaric treatment given as a precaution.
  - DCS symptoms resolved with the first hyperbaric treatment.
  - Broken bones.
  - Torn ligaments or cartilage.
  - Concussion.
  - Ear barotrauma requiring surgical repair.
  
- Serious: Injuries that the OM considers being serious in nature. Examples of this classification would include, but not be limited to:
  - Arterial Gas Embolism.
  - DCS symptoms requiring multiple hyperbaric treatment.
  - Near drowning.
  - Oxygen Toxicity.
  - Hypercapnea.
  - Spinal injuries.
  - Heart attack.
  - Fatality.



Appendix 23. Project Dive Log

CCU Project Dive Log

Project Name				Date	Project Leader				Lead Diver				
D i v e  P l a n	Diver's Name												
	Dive #												
	N2/O2 (Air/EANX)												
	Tank Pressure												
	Prev. Rep Group												
	Surface Interval												
	New Rep. Group												
	RNT												
	Max Depth												
	No-Deco Limit												
	PPO2 Max Time												
	Max Dive Time												
	Deco Schedule												
	Min. Tank Press.												
	Diver's Initials												
D i v e  D a t a	Time Down												
	Time Up												
	In Water Time												
	Safety Stop												
	Bottom Time												
	Max Depth												
	Tank Press. In												
	Tank Press. Out												
	Gas Expended												

A **Dive Plan** must be completed and reviewed before conducting any diving activity.

All **Dive Data** must be recorded immediately after each dive.