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**Environmental Health and Safety**  
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**Diving Safety Manual**

**Version #2.0**

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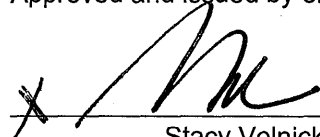
**1. PURPOSE:**

Cover page for FAU Diving Safety Manual

**2. CONTENTS:**

**FAU Diving Safety Manual, 161 pages.**

Approved and issued by order of:

  
 Stacy Volnick  
 VICE PRESIDENT OF ADMINSTRATIVE AFFAIRS

DATE: *10/31/2023*

**POLICY MAINTENANCE SECTION**

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**THIS POLICY RESCINDS ALL OTHER WRITTEN DIRECTIVES REGARDING THIS TOPIC.**

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2.0	10/30/23	11.0, Appendix M, Removed list of Physicians, Moved snorkeling to Surface-Water Activities Manual	<input type="checkbox"/> Diving and Boating Board



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FLORIDA ATLANTIC  
UNIVERSITY

ENVIRONMENTAL HEALTH AND SAFETY

# Diving Safety Manual

Florida Atlantic University  
Office of Environmental Health and Safety  
September 2023

## Approval Page

This Florida Atlantic University “Diving Safety Manual” has been reviewed and is approved for implementation by the Florida Atlantic University Diving and Boating Board. This manual replaces and supersedes all earlier versions.

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## MANUAL REVISIONS

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Cover page to new FAU/EH&S logo.	October 2007	Ian Anderson	109 Updated contact info	June 2011	David Muncher
Added building and room numbers to address.	October 2007	Ian Anderson	171 Added Appendix K	August 2011	David Muncher
Reformat to current AAUS manual	October 2007	Ian Anderson	Pg 40-42 Pg 95-102 New AAUS Med Standards	February 2012	David Muncher
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11.0 Appendix M  Removed list of Physicians  Moved snorkeling to Surface-Water Activities Manual	September 2023	L. McNamee			



# Volume 1

Sections 1.00 through 5.00

## SECTION 1.00 GENERAL POLICY

### 1.10 Scientific Diving Standards

#### *Introduction*

A Diving and Boating Safety Subcommittee (DBSS) was originally established on April 17, 1998 by the Provost of Florida Atlantic University (FAU). The Division of Research has replaced the DBSS, which formerly reported to the Research Safety Committee, with a stand-alone Diving and Boating Board (DBB). The DBB is delegated the authority to promulgate and administer University policies and procedures with regard to all diving and boating operations conducted in conjunction with academic and research activities at Florida Atlantic University. This manual, together with the Role and Function document of the FAU Diving and Boating Board, the American Academy of Underwater Sciences (AAUS) Standards for Scientific Diving, and applicable regulations, constitutes the FAU Diving and Boating Safety Program. The DBB has no oversight responsibilities for recreational diving by FAU organizations (i.e., diving clubs, etc.), which are not part of the academic and/or research missions of the University.

In August 2003, the American Academy of Underwater Sciences (AAUS) developed a consensus manual entitled, *Standards for Scientific Diving*, which FAU has adopted and incorporated by reference into the FAU Diving and Boating Safety Manual. The AAUS Manual is a minimum set of requirements, and organizations are free to insert additional protective measures and information specific to operational requirements.

When using this manual it is important to realize that all AAUS requirements apply and that there may be additional FAU requirements or procedures. The FAU Diving Safety Manual is most effectively navigated on the web or in its Portable Document Format (pdf) where the document's hot links can be utilized. Questions about, or difficulties in using, this manual can be referred to the Diving Safety Officer or the Diving Safety Office in the Department of Environmental Health & Safety (561-297-3129 or [ehs@fau.edu](mailto:ehs@fau.edu)).

Throughout this manual the Diving and Boating Board is equivalent to a Diving Control Board and may be used interchangeably. Similarly, Diving and Boating Safety Officer is used interchangeably with Diving Safety Officer and with reference to Boating Safety, Boating Safety Officer.

#### *Purpose*

The purpose of this Manual and the Scientific Diving Standards contained herein, is to:

Ensure that all scientific diving under the jurisdiction of Florida Atlantic University 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 with other AAUS member organizations. Fulfillment of the purposes must be consistent with the furtherance of research and safety. It is the responsibility of each FAU certified diver to read and follow these standards.

These standards set minimal requirements 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. Boating standards and regulations can be found in the FAU Boating Safety Manual.

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

In 1982, OSHA exempted scientific diving from commercial diving regulations (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.

AAUS has been recognized as the organization which sets scientific diving standards. This manual incorporates all AAUS standards and extends them based on local procedure and by assent of the Florida Atlantic University Diving and Boating Board.

### *Scientific Diving Definition*

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

### *Scientific Diving Exemption*

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

- a) The Diving and Boating Board consists of a majority of active scientific divers and has autonomous and absolute authority over the scientific diving program's operation.
- b) The purpose of the project using scientific diving is the advancement of science; therefore, information and data resulting from the project are non-proprietary.
- c) The tasks of a scientific diver are those of an observer and data gatherer. Construction and trouble-shooting tasks traditionally associated with commercial diving are not included within scientific diving.
- d) Scientific divers, based on the nature of their activities, must use scientific expertise in studying the underwater environment and therefore, are scientists or scientists-in-training.
- e) In addition, the scientific diving program must contain at least the following elements defined by OSHA in 29CFR1910.401(a)(2)(iv):
  1. Diving safety manual which includes at a minimum: Procedures covering all diving operations specific to the program; including procedures for emergency care, recompression and evacuation, and the criteria for diver training and

certification.

2. Diving and Boating Board, with the majority of its members being active scientific divers, which must at a minimum have the authority to: approve and monitor diving projects, review and revise the diving safety manual, assure compliance with the manual, certify the depths to which a diver has been trained, take disciplinary action for unsafe practices, and assure adherence to the buddy system (a diver is accompanied by and is in continuous contact with another diver in the water) for scuba diving.

### *Review of Standards*

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

## **1.20 Operational Control**

### *Florida Atlantic University Auspices Defined*

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

Florida Atlantic University adheres to the AAUS Standards for Scientific Diving Certification and Operation of Scientific Diving Programs. The administration of the FAU Diving Safety Program which includes all scientific diving resides with the FAU Diving and Boating Board (DBB).

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

### *Florida Atlantic University Diving Safety Manual*

Florida Atlantic University has developed and maintains a scientific diving safety manual that provides for the development and implementation of policies and procedures that enable FAU to meet requirements of local environments and conditions as well as to comply with the AAUS scientific diving standards. FAU's Diving Safety Manual must include, but is not limited to:

- a) Emergency evacuation and medical treatment procedures.
- b) Criteria for diver training and certification.
- c) Standards written or adopted by reference for each diving mode utilized which include the following:
  1. Safety procedures for the diving operation.
  2. Responsibilities of the dive team members.
  3. Equipment use and maintenance procedures.
  4. Emergency procedures.

- d) Regulations for the operation of FAU vessels and boats.

### *Diving and Boating Safety Officer*

The Diving and Boating Safety Officer serves as a member of the Diving and Boating Board (DBB). This person must be a fully qualified Diving Safety Officer (DBSO) and Boating Safety Officer (BSO) and have a broad technical and scientific expertise in research related diving and vessel operation.

a) Qualifications:

1. Must be appointed by the responsible administrative officer or designee, with the advice and counsel of the Diving and Boating Board.
2. Must be trained as a scientific diver.
3. Must be a full member as defined by AAUS.
4. Must be an active underwater instructor from a nationally or internationally recognized certifying agency.
5. Must possess the knowledge, skills, and abilities (i.e., training and experience) necessary to oversee the Florida Atlantic University Boating Safety Program including:
  - a. Knowledge of applicable Federal and State laws for the operation of vessels.
  - b. Knowledge of all FAU boating policies and regulations.
6. Must have a working diving knowledge of:
  - a. Scuba (open circuit).
  - b. Nitrox.
  - c. Diving physics and physiology.
  - d. Gas laws.
  - e. Recompression and treatment tables.
  - f. Recompression chamber operations.
  - g. Recognition of signs and symptoms and immediate management of diving maladies.
  - h. Air compressors.
  - i. Safety, rescue, diving accident management, and emergency procedures concerning diving operations
7. Recommended knowledge should include:
  - a. Mixed gas.
  - b. Semi-enclosed and closed-circuit rebreather.
  - c. Gas mixing and analysis.
  - d. Lock-out diving.
  - e. Certification as a CPR/First-Aid Instructor.
  - f. Certification as an Oxygen First Aid Instructor.
8. Have a minimum of 5 years diving experience.
9. Must exhibit leadership qualities and be willing to assume full responsibility for all diving operations and diving personnel.
10. Be capable of planning, logging and directing all diving operations.
11. Be familiar with all FAU diving regulations concerning diving operations.
12. Have a broad knowledge of diving equipment, the limitations of each type, and the ability to determine the safety of this equipment.
13. Must attend an AAUS DBSO Orientation within one year of accepting a position at

an AAUS approved OM, unless he/she has served as a DBSO for another current AAUS OM within the last year.

b) Duties and Responsibilities

1. The DBSO is responsible, through the DBB, to the Department of Environmental Health and Safety, for the conduct of the scientific diving and boating safety program of Florida Atlantic University.
2. If delegated by the DBB, the routine operational authority for these programs, including the conduct of training, authorizations and certification, approval of dive plans, maintenance of diving records, and ensuring compliance with this manual and all relevant regulations rests with the Diving and Boating Safety Officer;
3. Serves as a voting member of the DBB and as the University's Diving Safety Officer;
4. Ensures either the primary or alternate DBSO is in attendance for all DBB meetings;
5. May permit portions of this program to be carried out by a qualified delegate, although the Diving and Boating Safety Officer may not delegate responsibility for the safe conduct any aspect of the FAU scientific diving program;
6. Is guided in the performance of the required duties by the advice of the DBB, but operational responsibility for the conduct of the local diving program will be retained by the Diving and Boating Safety Officer;
7. Must suspend diving operations the DBSO considers to be unsafe, injurious to health, improperly supervised, or unwise;
8. Must bring unresolved issues of non-compliance to the board for investigation and resolution
9. Provide program updates and relevant documentation to the DBB, as needed including written annual reports of all diving operations.
10. Must maintain and update the Diving and Boating Safety Manuals as needed.
11. Must conduct investigations of diving and boating accidents and submit a report in writing to the Diving and Boating Board, and Director of Environmental Health and Safety.

### *Diving and Boating Board*

The Diving and Boating Board (DBB) has been delegated the authority to promulgate and administer University policies and procedures regarding all diving and boating operations conducted in conjunction with academic and research activities at Florida Atlantic University.

The DBB is equivalent to the Diving Control Board required by the Occupational Safety and Health Administration at 29 CFR 1910.401(2)(iv), which exempts scientific diving from the commercial diving regulations.

The Vice President for Administrative Affairs (VPAA) will make the initial appointments to the DBB, including the committee Chair. The Chair cannot be a representative of EH&S. Vacancies in the membership will be filled by appointment by the VPAA. Nominees are communicated to the VPAA by EH&S of the DBB chair for review and final appointment. Terms of service on the DBB (including the Chair) will be for staggered terms to ensure consistency of board activities and procedures.

- a) The Diving and Boating Board (DBB) must consist at least five (5) members, a majority of which must be active scientific divers, with at least one member representing Environmental Health and Safety (EH&S). Voting members include the Diving and Boating Safety Officer, the responsible administrative officer, or designee, and should include other representatives of the diving program such as qualified divers and members of the FAU boating community.
- b) Establish additional standards, protocols, and operational procedures beyond the AAUS minimums to address FAU specific needs and concerns.
- c) Must approve and monitor diving projects.
- d) Must review and approve the Diving and Boating Safety Manuals.
- e) Must assure compliance with the Diving and Boating Safety Manuals.
- f) Must approve the depths to which a diver has been trained.
- g) Must take disciplinary action for unsafe practices.
- h) Must ensure programs foster adherence to the buddy system for scuba diving.
- i) Must act as the official representative of Florida Atlantic University in matters concerning the scientific diving and boating programs.
- j) Must act as a board of appeal to consider diver-related problems.
- k) Must recommend the issue, reissue, or the revocation of diving authorizations.
- l) Must recommend changes in policy and amendments to AAUS and Florida Atlantic University's Diving and Boating Safety Manuals as the need arises.
- m) Must establish and/or approve training programs through which the applicants for certification can satisfy the requirements of Florida Atlantic University's diving safety manual.
- n) Must suspend diving programs that are considered to be unsafe or unwise.
- o) Must establish criteria for equipment selection and use.
- p) Must recommend new equipment or techniques.
- q) Must establish and/or approve facilities for the inspection and maintenance of diving and associated equipment.
- r) Must ensure that the Florida Atlantic University air station(s) meet air quality standards as described in [Section 3.60](#).
- s) Must periodically review the Diving and Boating Safety Officer's performance and program.
- t) Must investigate diving accidents within FAU's diving program or violations of Florida Atlantic University's diving safety manual.

At FAU, operational conduct and oversight of the scientific diving program is delegated to the DBSO within the Office of Environmental Health and Safety. The principle responsibility of both the DBB and the DBSO is always safety.

#### *Instructional Personnel*

- a) Qualifications - All personnel involved in diving instruction under the auspices of FAU must 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 DBB in conducting preliminary screening of applicants for instructional positions.

## Departmental Controls and Responsibility

University departments and programs may own and provide resources in support of scientific diving operations to FAU Scientific Divers. Such resources may include diving equipment, other diving supplies, boats or motor vehicles. Prior to release, each department or program, which provides resources in support of diving, shall have measures in place to ensure that:

- a) Departmental diving resources are serviced and maintained in compliance with pertinent sections of this manual and approved by the DBB/DBSO;
- b) Departmental diving resources are limited to use by personnel authorized by the DBB/DBSO.

Departmental control measures shall be implemented to the satisfaction of the DBB. A periodic review of departmental control measures shall be made by the DBSO. Results of the review must be reported to the DBB and Head of the department or program with recommendations regarding whether revisions in departmental procedures are needed.

### *Diving Supervisor*

Certain FAU divers, duly qualified, may be selected by the DBSO as Diving Supervisors. While fulfilling these duties, the Diving Supervisor reports directly to the DBSO. All decisions regarding the safety of diving operations must be made by the DBSO and/or the Diving Supervisor, irrespective of the Diving Supervisor's immediate supervisor. A Diving Supervisor has the authority to suspend diving operations, if in their opinion, conditions are unsafe. Only under emergency conditions may the Diving Supervisor alter provisions set forth in this manual. In so doing, the Diving Supervisor must exercise prudence and have reasonable assurance that departure from this manual would enhance personnel safety.

- a) Qualifications:
  1. Must have a working diving knowledge of:
    - a. Scuba (open circuit).
    - b. Nitrox.
    - c. Diving physics and physiology.
    - d. Gas laws.
    - e. Recompression and treatment tables.
    - f. Recompression chamber operations.
    - g. Recognition of signs and symptoms and immediate management of diving maladies.
    - h. Air compressors.
    - i. Safety, rescue, diving accident management and emergency procedures concerning diving operations
  2. Recommended knowledge should include:
    - a. Mixed gas.
    - b. Semi-enclosed and closed-circuit rebreather.
    - c. Gas mixing and analysis.
    - d. Lock-out diving.



3. Have a minimum of 5 years diving experience.
  4. Must exhibit leadership qualities and be willing to assume full responsibility for all diving operations and diving personnel.
  5. Be capable of planning, logging and directing all diving operations.
  6. Be familiar with all FAU diving regulations concerning diving operations.
  7. Has a broad knowledge of diving equipment, the limitations of each type, and the ability to determine the safety of this equipment.
- b) Responsibilities include, but are not limited to the following:
1. Schedule, plan and direct diving operations as assigned.
  2. Approve dive plans and submit copies to the DBSO.
  3. Brief Operations Director or Master of Vessel, whichever is appropriate, concerning dive plans and emergency procedures.
  4. Maintain a log of all diving activities within their department and submit a summary of diving activities and dive logs for each diver for each cruise or dive trip to the DBSO.
  5. Supervise maintenance of diving equipment for their department.
  6. Maintain a record of all facilities, personnel and equipment within their department, with information as to capability and qualification.
  7. Recommend to the DBSO changes which will increase the safety and efficiency of diving operations.
  8. Review divers' qualifications and recommend depth qualification levels to the DBSO.
  9. May temporarily revoke or restrict diving certification of any diver for cause during a diving operation.
  10. Report immediately in writing to the DBSO any accident or violation of this manual during a diving operation under the Diving Supervisor's supervision.
  11. Maintain competency in advanced levels of scuba diving, dive rescue, and dive accident management.

*Lead Diver (Diver-in-Charge)*

For each dive, one individual must be designated as the Lead Diver who must be at the dive location during the diving operation. The Lead Diver shall act as on-site supervisor, shall ensure

that diving operations are conducted in a safe manner as described herein during that given operation. The Lead Diver may only supervise dives to depths that do not exceed their depth limitation.

a) Qualifications:

1. Must be an experienced diver and must be an active FAU certified diver in the Diving Safety Program, capable of planning and supervising a diving operation safely. A diver with a FAU Temporary Diver Permit may not be the Lead Diver without the expressed written approval of the FAU Diving Safety Officer and demonstration of proficient diving experience;
2. Must have knowledge of safety, rescue, diving accident management, and emergency procedures concerning diving operations;
3. Must be familiar with all FAU diving regulations.

b) Responsibilities and Duties:

1. Coordination with other known activities in the vicinity that are likely to interfere with diving operations.
2. Ensuring all dive team members possess current certification and are qualified for the type of diving operation.
3. Planning dives in accordance with [Section 2.20](#) and all other FAU Standards within this Manual, and submission of FAU Dive Plan Form ([Appendix E](#)) to the DBSO, with special consideration for repetitive dive status of each diver, decompression schedules, and emergency plans.
4. Schedule and direct diving operations.
5. Ensure that all divers have proper and required equipment.
6. Ensuring safety and emergency equipment is in working order and at the dive site.
7. Evaluate environmental conditions before diving.
8. Briefing dive team members on:
  - a. Dive objectives.
  - b. Unusual hazards or environmental conditions likely to affect the safety of the diving operation.
  - c. Modifications to diving, emergency procedures or diver's signals necessitated by the specific diving operation.
9. Suspending diving operations if in their opinion conditions are not safe.

10. Reporting to the DBSO or any physical problems or adverse physiological effects including accidents or symptoms of pressure-related injuries, during a diving operation under the Lead Diver's supervision.
11. Brief Diving Supervisor, Operations Director or Master of Vessel, whichever is appropriate, concerning dive plans and emergency procedures.
12. Ensure that proper action is taken during a diving emergency or accident.
13. May temporarily revoke or restrict diving certification of any diver for cause during a diving operation under the Lead Diver's supervision.
14. Report immediately in writing to the DBSO any violation of this manual during a diving operation under the Lead Diver's supervision.

#### *Reciprocity and Visiting Scientific Diver*

No visiting diver may dive on FAU projects, from FAU vessels or small boats, or use FAU dive equipment without prior approval by the FAU Diving Safety Officer. Reciprocity for scientific divers in good standing exists between FAU and other AAUS Organizational Members.

- a) Two or more AAUS Organizational Members (OM) engaged jointly in diving activities, or engaged jointly in the use of diving resources, must designate one of the participating Diving Control Boards to govern the joint dive project. However, responsibility for the individual divers ultimately resides with the home OM.
- b) A Scientific Diver from one Organizational Member must apply for permission to dive under the auspices of another Organizational Member by submitting to the Diving Safety Officer of the host Organizational Member a document containing all the information described in [Appendix 6](#), signed by the Diving Safety Officer or Chairperson of the home Diving Control Board.
- c) A visiting Scientific Diver may be asked to demonstrate to the DBSO, or designee, of the host organization their knowledge and skills for the planned dive and to submit additional forms.
- d) If a host Organizational Member denies a visiting Scientific Diver permission to dive, the host Diving Control Board must notify the visiting Scientific Diver and their Diving Control Board with an explanation of all reasons for the denial.
- e) Visiting divers from non-AAUS organizations may apply to the FAU Diving and Boating Board through the FAU Diving Safety Officer for a FAU Temporary Diver Permit. Requirements and documents for this permit are described in [Section 4.30](#) of this manual.

#### *Waiver of Requirements*

The Diving and Boating 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 requirements of this manual may be cause for the revocation or restriction of a diver's scientific diving authorization by the DBB. The DBB may direct the University to invoke additional sanctions (e.g., through withholding proposals, grants, or contracts) against the responsible parties if the situation warrants.

### **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 Florida Atlantic University's recognition by AAUS.

### **1.50 Record Maintenance**

The Diving Safety Officer or designee must maintain permanent records for the university's diving program and all authorized Scientific Divers. The file must include, but not limited to, evidence of certification level, log sheets, waiver, results of current physical examination, reports of disciplinary actions by the FAU Diving and Boating Control Board, and other pertinent information deemed necessary.

#### *Availability of Records:*

- a) Medical records must be available to the attending physician of a diver or former diver when released in writing by the diver.
- b) All non-confidential records must be available to employees, former employees, or authorized representative upon request to the FAU DBB/DBSO. Confidential records (i.e., medical records) will not be released without written permission of the affected individual.
- c) Records and documents required by this standard must be retained by Florida Atlantic University for the following minimum periods:
  1. Diving Safety Manuals – only required to maintain record of current document.
  2. Equipment inspection and testing records – current entry or tag, or until equipment is withdrawn from service.
  3. Records of dive – minimum of one year for paper copies, 5 years where there has been an incident of pressure-related injury. Digitally stored database records will be kept indefinitely.
  4. Medical approval to dive – Minimum of 1 year past the expiration of the current document except 5 years where there has been an incident of pressure-related injury.
  5. Diver training records – Minimum of 1 year beyond the life of the diver's program participation.
  6. Diver authorization(s) – Minimum of 1 year beyond the life of the diver's program

- participation.
7. Records of hospitalization or pressure-related injury assessment - 5 years
  8. Reports of disciplinary actions by the DBB – Minimum of 1 year beyond the life of the diver’s program participation.
  9. All other documents, indefinitely or at the discretion of the DBSO.

### **1.60 Violation Review and Disciplinary Process**

The DBB has the authority and obligation to require changes in any project or practice to comply with regulations or to meet reasonable standards of safety and health. In the event that any project or practice presents imminent danger to the health or safety of any individual, or presents a threat to the safety of property, the DBB shall have the authority to immediately suspend the project or practice. In such cases, the DBB must notify the:

- a) Chairperson of the Department involved;
- b) Dean of the College to which the Department belongs;
- c) Director of EH&S;
- d) Vice President for Research

For situations of non-compliance that are brought to the attention of the Board, the DBB (or designee) will provide a prompt report of the circumstances to the VPR, EH&S, and Research Integrity with a copy to the PI, respective college dean and department chair. Within 3-5 business days (or as soon as feasibly possible) following the halting of the activity or project, the DBB will convene to assess the situation. The DBSO will be charged to present the circumstances surrounding the incident with a written report provided to the DBB, which will include a written report from the PI. The DBB will consider all available facts and evidence, make a determination regarding the incident and follow up with a final, written report to all parties concerned including the VPR, College and Provost’s offices. If the DBB does determine that the event or activity does constitute non-compliance, the PI will be required to present a corrective action plan to address the non-compliance with a plan that such an event or activity will not occur again in the future. The DBSO will work with the PI, department chair and college dean on this corrective action plan and the final plan will be submitted to the DBB for review and final approval. Only once the corrective action plan has been reviewed and approved by the DBB can the project or activity be resumed. All communications associated with the non-compliance must be appropriately documented.

Once the corrective action plan has been approved by the DBB the PI will be given a timeline to implement the plan and follow up with the DBB. If the PI does not follow the corrective action plan within the required timeline, the DBB will notify the PI that he/she has thirty (30) days from the date of the follow up notice to satisfactorily implement the corrective action plan. Should this deadline not be adhered to, the DBB will notify the FAU Vice President of Research, the Provost’s

office, the College Dean and Department Chair for further action.

Should any faculty or staff believe that they have been or will be adversely affected by action or inaction of the DBB, or have concerns related to the diving and safety program at FAU, those persons will be encouraged to openly discuss such instances with and resolve any differences directly with the DBB. If a faculty or staff member objects to a DBB recommendation concerning a violation of a DBB policy or procedure, a written complaint must be filed with RI within 30 days of the recommendation. The complaint shall state the nature of the objection(s) including any adverse effects, specify the actions or inactions that are at issue, and specify the remedial action(s) that would satisfy the appellant's concerns. Previous efforts to resolve the objection(s) and the outcome shall be noted in this document. Within thirty (30) days after receipt of the complaint, the respondent (i.e., DBB) shall provide a response, in writing, to the appellant. If the appellant and the respondent are unable to resolve the written complaint informally, RI shall schedule a meeting between the respondent, the appellant, the DBB Chair, the DBSO, the Assistant Vice President for Research Integrity, the Director of EH&S, and the VPR to discuss and resolve the issue. Ultimate decision making is with the VPR.

For more information regarding the Role and Function of the Diving and Boating Safety Officer and the Diving and Boating Board, refer to the [Role and Function document](#).

## SECTION 2.00 DIVING REGULATIONS

### 2.10 Introduction

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

### 2.20 Pre-Dive Procedures

#### *Dive Plans*

Before conducting any diving operations under the auspices of the University, the Lead Diver for a proposed operation must formulate a dive plan, and submit it to the DBSO for review at least five business days before the scheduled diving operation(s). Dives should be planned around the competency of the least experienced diver. No dive(s) shall be conducted under the auspices of FAU without an approved dive plan, signed by the DBSO.

The DBSO must review and approve or disapprove the dive plan in a timely fashion. For complicated operations or those occurring outside the United States, the DBSO may request the approval of the DBB. In such cases, additional time for approval may be required. Approval must be obtained prior to commencement of diving operations (see FAU [Appendix E](#), Dive Plan Form). Dive Plan Forms are also available on the EH&S website (<http://www.fau.edu/ehs>) under the "Diving and Boating Safety Program" link.

Before conducting any diving operations under the auspices of Florida Atlantic University, the Lead Diver for a proposed operation must formulate a dive plan ([Appendix E](#)) that should include the following:

- a) Divers Mode(s) and Gas(es)
- b) Divers' authorization including qualifications and the type of certificate or certification held by each diver.
- c) Approximate number of proposed dives.
- d) Location(s) of proposed dives.
- e) Estimated depth(s) and bottom time(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.
- i) Emergency Action Plan (see [Appendix 7](#)) with the following information:
  1. Name, telephone number, and relationship of person to be contacted for each diver in the event of an emergency.

2. Nearest operational decompression chamber.
  3. Nearest accessible hospital.
  4. Available means of transport.
- j) In water details of the dive plan should include:
1. Dive Buddy assignments and tasks
  2. Goals and objectives
  3. Maximum depth(s) and bottom time
  4. Gas management plan
  5. Entry, exit, decent, and ascent procedures
- Perceived environmental and operational hazards and mitigations
- Emergency and diver recall procedures

#### *Diver Responsibility and Refusal to Dive*

- a) The ultimate responsibility for the safety rests with the individual diver. It is the diver's responsibility and duty to refuse to dive, without fear of penalty, if in their judgement, conditions are unsafe or unfavorable, or if they would be violating the precepts of regulations in this Manual.
- b) 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.
- c) Each diver must maintain good physical condition and shall not 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. Nor shall divers or their partner dive under the influence of medicines, drugs, alcohol or other substances which may hamper a diver's coordination or good judgment.
- d) No diver shall exceed his/her depth limit certification except as outlined in [Section 4.40](#) of this manual or by prior approval of the DBSO.
- e) Divers must insure their equipment is in proper working order prior to each dive and that the equipment is suitable for the type of diving operation planned. Equipment failures must be reported to the Diving Supervisor or Lead Diver. Scientific divers must conduct a functional check of their diving equipment in the presence of the diving buddy or tender.

#### *Pre-dive Procedures and Safety Checks*



- f) Prior to the dive the Lead Diver must brief the divers regarding the following:
  - 1. Dive buddy assignments and tasks.
  - 2. Dive objectives.
  - 3. Maximum depth(s) and bottom time
  - 4. Turn around pressure and required surfacing pressure.
  - 5. Entry, exit, decent and ascent procedures.
  - 6. Perceived environmental and operational hazards and mitigations.
  - 7. Emergency procedures, including location of nearest phone or radio, emergency plan, first aid/oxygen kit, and diver recall.
  - 8. Diver's signals.
  - 9. Review dive tables/computers used, allowable no-decompression bottom times for a planned depth and next greater depth for each diver.
- g) Equipment Evaluations
  - 1. All diving and safety equipment must meet the requirements and specifications given in [Section 3.00](#).
  - 2. Divers must ensure that their equipment is in proper working order and that the equipment is suitable for the type of diving operation.
  - 3. Each diver must have the capability of achieving and maintaining positive buoyancy.
- h) Site Evaluation - Environmental conditions at the site will be evaluated.
- i) Any changes to an approved dive plan (including date, location, personnel) must be approved by the DBSO prior to the dive.

## 2.30 Diving Rules and Procedures

### *Solo Diving Prohibition*

All diving activities must assure adherence to the buddy system for scuba diving. This buddy system is based upon mutual assistance, especially in the case of an emergency. Solo diving with scuba shall be allowed in the case of emergency or if tethered and with the expressed consent of the DBSO.

### *Decompression Management*

- a) On any given dive, both the divers on the buddy pair must follow the most conservative dive profile

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

#### *Termination of the Dive*

- c) Any dive must be terminated while there is still sufficient cylinder pressure to permit the diver to safely reach the surface, including decompression time, or to safely reach an additional air source at the decompression station.
- d) 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.

#### *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 post-dive written report of such actions must be submitted to the Diving and Boating Board explaining the circumstances and justifications.

#### *Separation and Missing Diver Protocol*

- a) Diver separation- In the event that the divers become separated (on descent or on the bottom), they must try to reestablish contact for 1-2 minutes, then surface to re-establish contact, and review dive tables/computers for repetitive dive.
- b) Missing divers- The dive team (and/or boat operator) should immediately recover any remaining divers and begin search, starting at the point of the dive site and working down current considering rate of drift. If possible, a float should mark the dive site and another float with drogue set to drift to indicate possible direction and speed of missing diver. The dive team should immediately establish contact with the Coast Guard (Channel 16 in most US locations). Then the dive team (boat operator or Coast Guard) should make the following general call to all vessels on Ch 16 and on other commonly used radio channels (ex. 20, 68): “PAN PAN..all vessels please be on the lookout for missing divers, state name and description of your vessel, location, depth, how many divers, and time they should have surface.”

#### *Dive Tables/Computers*

All dive tables, dive computers, and dive software must be approved by the FAU DBB.

- a) Dive Tables- A copy of approved dive tables must be at the dive location in all cases, even when using the dive computers. All tables used must be at least as conservative as the US Navy Tables.
- b) Dive Computers-Divers who wish to use dive computers must receive training and be certified by the FAU DBSO in the use of dive computers. Each diver must exhibit to the DBSO’s satisfaction competency and a complete understanding of the computer they will use. All computer use must be in accordance with AAUS standards in [Appendix 8](#). The DBB reserves the right to refuse the use of any make or model of dive computer.
- c) Dive software must be approved before use by the DBB on a case by case basis.

## *Safety Equipment*

Safety Equipment appropriate for the planned dive must be available including:

- a) Diver's first-aid kit.
- b) Emergency oxygen resuscitator.
- c) Dive Flags- Appropriate diving signals or flags must be prominently displayed for all types of diving including snorkeling in accord with [Section 3.40](#).

## *Standby Diver*

The presence of a standby diver with no decompression loading (i.e., no residual nitrogen), fully ready to enter the water, is recommended in all diving circumstances and may be required by the DBSO, Diving Supervisor, or Lead Diver, especially in operations with higher than normal risks such as diving in currents, in extremely limited visibility, or in deep water.

## *Limited Visibility*

Under limited visibility conditions, divers must wear a compass and be instructed in its use as well as use a close Buddy System and a tether, in that order, as conditions become worse.

## *Surface Monitoring*

When more than four divers are in the water at once, the Lead Diver may appoint one person who is not diving to monitor the dive. The appointed person must monitor entry and exit times of all divers, so as to insure that all divers and dive parties are accounted for.

## *Deep diving (greater than 100 feet)*

- a) A weighted down line must be secured to the support vessel unless drift diving with a surface float.
- b) Divers must plan sufficient gas supply to allow for an emergency decompression stop.

## *Diving from Vessels*

- a) The support vessel must be equipped with a VHF radio, first-aid kit, and oxygen resuscitator.
- b) When diving from an anchored vessel, the divers must ascend and descend on a down-line separate from any heavy anchor chain which may cause injury.
- c) When diving in current, if the vessel is at anchor, a tag line with a float must be streamed approximately 100' behind the vessel.
- d) When diving from a mother vessel, a small support vessel must be readied for immediate launch, or preferably in the water to retrieve fatigued or incapacitated divers.
- e) A boat operator must remain aboard the support vessel during the dive unless this

requirement is waived by the DBSO or Diving Supervisor under certain circumstances, such as shallow dives in calm conditions or use of permanently moored buoys.

- f) If more than four dives are in the water safety procedures outlined for Surface Monitoring above should be employed.
- g) Divers must carry a whistle, inflatable safety marker/float. For offshore diving, an air horn and safety flares are recommended.
- h) Prior to the dive, the dive team must record the coordinates or location of the dive site, time of start of dive, and planned time for end of dive. This log shall remain on board with the boat operator.

### *Drift diving*

Each team member must carry a surface float during a drift dive. Surface floats must be large enough to stay on the surface if moored on the bottom, must have sufficient line and strength for depth and current conditions, line should have reel for easy deployment and recovery, and bitter end should be securely attached to a hook for securing to the bottom. If multiple buddy teams are using one float, all divers must stay within close proximity to the float line, and a minimum of two divers must ascend together.

### *Night diving*

- a) Divers must carry a whistle and marker light (strobe or chemical stick) attached to their dive gear.
- b) Divers must carry a dive light and each buddy team must carry a backup light.
- c) A weighted down line with a light or strobe should be secured to the support vessel.

### *Safety Stops*

Safety stops of 3 to 5 minutes at 15 (10-20) feet should be conducted on any dive that exceeds 30 fsw and are required for any dives over 60 feet and for any repetitive dive. A safety stop of 5 minutes at 15 feet is required for multi-level dives (using either dive tables or computers).

### *Ascent Rates*

Ascent rates should not exceed 60 feet/minute regardless of depth. During the last 60 feet ascent rates must not exceed 30 feet/minute.

## **2.40 Post-Dive Procedures**

### *Post-Dive Safety Checks*

- a) After the completion of a dive, each diver must report any physical problems, symptoms of decompression sickness, or equipment malfunctions to the Lead Diver, DBSO, and/or DCB.

- 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.
- c) All dives must be logged by each diver on the FAU Dive Log Sheet ([Appendix F](#)) and be submitted to the DBSO by the 5<sup>th</sup> of the following month. Dive logs may be submitted after this date, however, logs not submitted on time could affect the approval of future dive plans.
- d) Divers must secure and be responsible for all gear following each dive.

## 2.50 Emergency Procedures

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 treatment is initiated as soon as possible. Florida Atlantic University has developed emergency procedures which follow the standards of care of the community and includes procedures for emergency care, recompression and evacuation for each dive location ([Appendix 7](#), Hospitals and Recompression Chamber Phone Numbers, and [Appendix 7](#), the Diving Emergency Accident Manual).

### *Preparedness*

- a) All diving personnel must be prepared to respond properly in the event of a diving accident.
- b) Periodic retraining and routine practice are essential elements in emergency preparedness; emergency drills are encouraged.

### *On-Site Accident Management Procedures*

- a) The Lead Diver or Diving Supervisor must take charge at the scene of the accident and delegate tasks to other responsible individuals.
- b) Stabilize life-sustaining functions and follow Accident Management Flow Chart ([Appendix 7](#)).
- c) Establish radio communications through the Master of Vessel with predetermined medical facility ([Appendix 7](#)).
- d) Transmit the following information to the physician:
  - 1. Accident Call-In Data ([Appendix 7](#))
  - 2. Neurological Exam Checklist ([Appendix 7](#))
  - 3. Checklist for Secondary Assessment of Injury ([Appendix 7](#)).
- e) All diving equipment of accident victim must be kept intact and tagged for later inspection and analysis.

### *Emergency Evacuation*

- a) Have the vessel operator contact U.S. Coast Guard (radio HF-2182, VHF-channel 16) or other appropriate authorities ([Appendix 7](#)).
- b) Follow medical evacuation procedures ([Appendix 7](#)).
- c) Follow helicopter evacuation procedures, as necessary ([Appendix 7](#)).

### *Notification of Authorities*

- a) After any serious diving accident or incident, the following personnel must be notified immediately, or as soon as possible: Diving Safety Officer, Chairman-Diving and Boating Board.
- b) After any diving incident resulting in injuries or symptoms, a written report (Accident/Incident Form [Appendix L](#)) must be submitted within one week by the Lead Diver to the DBSO.
- c) After any diving accident or injury, requiring recompression treatment or resulting in moderate or serious injury, or death, a written report must be submitted within one week by the DBSO to the Chairman, Diving and Boating Board, and the Director, Environmental Health and Safety with the following information:
  1. Complete AAUS Accident Report ([Appendix L](#)).
  2. Name, address, phone number of the principal parties.
  3. Summary of experience of divers involved.
  4. Location, description of dive site and conditions that led up to the incident.
  5. Description of symptoms, including depth and time of onset.
  6. Description and results of treatment.
  7. Disposition of the case.
  8. Recommendations to avoid repetition of incident.
- d) The FAU DBB must investigate and document any incident of pressure-related injury and prepare a report which is to be forwarded to AAUS during the annual reporting cycle. This report must be reviewed and released by the FAU Diving and Boating Board.

### **2.60 Flying After Diving or Ascending to Altitude (over 1000 feet/304 meters)**

All divers are cautioned against flying or ascending to altitude immediately after diving. The resultant decrease in pressure may bring on decompression sickness. Divers should wait a minimum of a 12-hour surface interval before ascending to altitude and must not violate the “rules for flying after diving” according to the dive table or dive computer that he/she used for the dive.

The following surface intervals between diving OR ascending to altitude are required:

- a) Following a single no-decompression dive – Divers should have a minimum preflight

- surface interval of 12 hours; greater if required by dive table or dive computer used.
- b) Repetitive or Multi-day diving – 24 hours, minimum.
  - c) Decompression dive - 24 hours minimum, 48 hours recommended.
  - d) Mixed-gas or saturation dive - Consult hyperbaric physician.
  - e) After recompression chamber treatment – Consult hyperbaric physician.
  - f) Before ascending to altitude above 1000 feet (304 meters): divers should follow the appropriate guideline for preflight surface intervals unless the decompression procedures used has accounted for the increase in elevation.

## 2.70 Record Keeping Requirements

### *Recording*

- a) The DBSO and Diving Supervisors must maintain records of all dive logs, compressor air analyses, scuba equipment testing and inspections, and recompression chamber logs.
- b) The DBSO must record the occurrence of any diving-related injury or illness which requires any diver to be hospitalized or after an episode of unconsciousness related to diving activity, or after treatment in a recompression chamber resulting from diving.
- c) The DBSO must maintain records for each diver including evidence of certification, dive history, current FAU certification and depth limitations, dive logs, results of most recent diving physical examination, reports of any diving related injury or illness, reports of disciplinary actions related to diving, and reports of non-adherence to FAU diving standards.
- d) Minutes from meetings of the Diving and Boating Board are the responsibility of the Division of Research and must distributed to Diving and Boating Board, and the Director of Environmental Health and Safety.
- e) Annual dive summary reports must be compiled by the Diving Supervisors and DBSO.
- f) Annual dive summary reports and dive accident reports of serious nature must be submitted to the Diving and Boating Control Board, and AAUS by the DBSO.

### *Personal Diving Log*

Each authorized scientific diver must log every dive made under the auspices of Florida Atlantic University's and is encouraged to log all other dives. Standardized dive log forms are required by Florida Atlantic University and may found in [Appendix F](#) and on the FAU/EHS website at <http://www.fau.edu/facilities/ehs/safety/diving-boating-safety-forms.php>.

Log sheets must be submitted to the Diving Safety Officer on at least a monthly basis by the 5<sup>th</sup> of each month. Failure to submit dive logs may affect future dive plan approval. DBSO will keep the log sheets as part of each diver's permanent file. Personal dive logs must include:

- 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.

### *Required Incident Reporting*

All diving incidents requiring recompression treatment, or resulting in moderate or serious injury, or death must be reported to the FAU Diving and Boating Board and the AAUS in a timely manner. Florida Atlantic University's regular procedures for incident reporting, including those required by the AAUS, shall be followed. The report will specify the circumstances of the incident and the extent of any injuries or illnesses.

Additional information must meet the following reporting requirements:

- a) Florida Atlantic University must 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 must be recorded and retained by Florida Atlantic University, with the record of the dive, for a period of 5 years:
  1. Completed AAUS Accident/Incident Report (Accident/Incident Form [Appendix L](#)).
  2. Written descriptive report to include:
    - Name, address, phone numbers of the principal parties involved
    - Summary of experience of divers involved
    - Location, description of dive site, and description of conditions that led up to incident
    - The circumstances of the incident and the extent of any injuries or illnesses.
    - Description of symptoms, including depth and time of onset
    - Description and results of treatment
    - Disposition of case
    - Recommendations to avoid repetition of incident
- c) Florida Atlantic University will 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 FAU Diving and Boating Board and at a minimum contain
  - Complete AAUS Incident Report
  - Summary of experience of divers involved.
  - Description of dive site, and the description of conditions that led up to incident.
  - The circumstances of the incident and the extent of any injuries or illnesses.
  - Description of symptoms, including depth and time of onset.
  - Description and result of treatment
  - Disposition of case.



- Recommendation to avoid repetition of incident.

## SECTION 3.00 DIVING EQUIPMENT

### 3.10 General Policy

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

### 3.20 Equipment

All diving equipment used on FAU projects must be approved by the Diving Safety Officer. All equipment must be regularly examined by the person using them.

#### *Regulators and Gauges*

- Scuba regulators and gauges must be inspected and tested prior to each use and serviced, at a minimum, according to manufacturer's recommendations
- Standard open circuit (OC) regulator configuration is:
  - A first stage
  - Primary 2<sup>nd</sup> stage
  - Back up 2<sup>nd</sup> stage
  - Submersible Pressure Gauge (SPG)
  - Inflator hose for a Buoyancy Compensator Device
- A Full Face Mask may be used in place of the primary 2<sup>nd</sup> stage according to manufacturer's recommendations

#### *Equipment for Determination of Decompression Status*

- Each member of the buddy team must have an underwater timing device and depth indicator, or dive computer
- If dive tables are being used a set must be available at the dive location
- If a dive computer is used the diver must use the same computer used on repetitive dives.
- In an aquarium or other manmade structure of a known maximum obtainable depth:
  - A depth indicator is not required, except when a diver's decompression status must be taken into consideration on repetitive dives.
  - Only one buddy must be equipped with a timing device.
  - The maximum obtainable depth of the aquarium must be used as the diving depth.

#### *Scuba Cylinders*

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

#### *Buoyancy Compensation Devices (BCD)*

- Each diver must have the capability of achieving and maintaining neutral buoyancy underwater and positive buoyancy at the surface.
- BCDs, dry suits, or other variable volume buoyancy compensation devices must be equipped with an exhaust valve.

- These devices must be functionally inspected and tested at intervals not to exceed 12 months.
- BCDs, dry suits, or other variable volume buoyancy compensation devices must not be used as a lifting device in lieu of lift bags.

#### *Dive Computer*

- Each diver must have their own dive computer.
- The computer must be able to perform the necessary functions required for the dive (ex. If the diver is using Nitrox, the computer must be nitrox compatible).
- Each diver must be familiar with the computer they are diving in regards to how to operate it and understand the display.
- Each diver must check the functionality of the dive computer they are using prior to the dive including:
  - Battery
  - Set gas being used for the dive
- Any exceptions to this must be discussed with the DBSO.

### **3.30 Auxiliary Equipment**

#### *Handheld Underwater Power Tools*

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

### **3.40 Support Equipment**

#### *First Aid Supplies*

- A first aid kit and emergency oxygen appropriate for the diving being conducted must be available at the dive site.

#### *Diver's Flag*

- A diver's flag must be displayed prominently whenever diving is conducted under circumstances where required or where water traffic is probable.

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

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

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

### **3.50 Equipment Maintenance**

#### *Record Keeping*

Each equipment modification, repair, test, calibration, or maintenance service must be logged, including the date and nature of work performed, serial number of the item (if applicable), and the name of the person performing the work for the following equipment:

- Regulators
- Gauges (SPG, Depth Gauges, Timers, and Dive Computers)
- BCDs
- Dry suits
- Scuba cylinders and valves
- Full Face Masks
- Compressors, air filtration systems, gas control panels, and storage banks
- Surface supplied equipment
- Rebreather systems
- Additional equipment categories as determined by the DCB

*Compressor Operation and Air Test Records*

Gas analyses and air tests must be performed on each OM-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 must be entered in a formal log and be maintained.

### 3.60 Air Quality Standards

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

CGA Grade E	
Component	Maximum
Oxygen	20 - 22%/v
Carbon Monoxide	10 PPM/v
Carbon Dioxide	1000 PPM/v
Condensed Hydrocarbons	5 mg/m <sup>3</sup>
Total Hydrocarbons as Methane	25 PPM/v
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 the breathing apparatus to malfunction, a dew point not to exceed -50°F (63 pm v/v) or 10 degrees lower than the coldest temperature expected in the area is required.

*Remote Operations*

For remote site operations using gas sources not controlled by FAU, every effort should be made to verify breathing gas meets the requirements of this standard. If CGA Grade E gas is not verifiable, the DBB must develop a protocol to mitigate risk to the diver.

## SECTION 4.00 SCIENTIFIC DIVER CERTIFICATIONS AND AUTHORIZATIONS

This section describes the training and performance standards for AAUS Scientific Divers. These standards represent the minimum required level of knowledge and skills presented in a generalized format. All diver authorizations under the auspices of FAU are described in [Section 4.30](#).

No person (whether an FAU employee or not) shall engage in diving on any FAU project, from any FAU vessel or small boat, or use FAU equipment unless that person is authorized to dive by the FAU Diving Safety Officer and according to the standards of this manual. Application for permit to dive must be made by the prospective diver to the FAU DBSO. Once the following prerequisites and standards are completed, the Diving Safety Officer through the authority of the FAU Diving and Boating Board may issue an appropriate authorization.

### 4.10 Prerequisites

#### *Administrative*

The applicant/candidate must complete all administrative and legal documentation required by Florida Atlantic University.

#### *Entry Level Diver Certification*

The applicant/candidate must, at minimum, show documented proof of entry-level diver certification from an internationally recognized training agency. As an alternative, Florida Atlantic University may train and certify entry-level divers under AAUS auspices under the guidelines presented in [Section 4.0](#). This training must meet the standards of the most current version of the RSTC/WRSTC and/or ISO entry-level diver standards. As a prerequisite to scientific diver training, no part of the entry level certification may be counted towards scientific diver training.

1. “Minimum Course Content for Open Water Diver Certification” – World Recreational Scuba Training Council (WRSTC), [www.wrstc.com](http://www.wrstc.com).
2. “Safety related minimum requirements for the training of recreational scuba divers – Part 2: Level 2 – Autonomous diver”. ISO 24801-2:2007-International Organization of Standardization (ISO) – [www.iso.org](http://www.iso.org).

#### *Medical Examination*

The applicant/candidate must be medically qualified for diving as described in [Section 5.0](#) of the Florida Atlantic University Standards for Scientific Diving. Medical standards set by AAUS and the University may not be waived.

#### *Swimming/Watermanship Evaluation*

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

- a) Swim underwater for a distance of 25 yards (23 meters) without surfacing.
- b) Swim 400 yards (366 meters) in less than 12 minutes.
- c) Tread water for 10 minutes, or 2 minutes without the use of hands.
- d) Transport a passive person of equal size a distance of 25 yards (23 meters) in the water.
- e) Basic snorkeling techniques including snorkel clearing and surface dives.

*Waiver*

Waiver and Release Form ([Appendix B](#)).

Exceptions:

- a) FAU employee may, in lieu of a signed waiver, provide proof through Human Resources of current employment status.
- b) FAU students may, in lieu of a signed waiver, be asked to provide proof of current status.
- c) Volunteers, in lieu of a signed waiver, must be registered and approved by Human Resources with the appropriate type depending in the work being performed.

*Approved Diving Equipment*

Approved Diving Equipment Form ([Appendix K](#)) Must include proof of SCUBA regulator, DBB, and computer service within the preceding 12 months.

**4.20 Entry Level Training Requirements**

The diver must successfully complete prerequisites, theoretical aspects, practical training, and examinations for a minimum cumulative time of 100 hours and a minimum of 12 open water dives. Theoretical aspects shall include principles and activities appropriate to the intended area of scientific study.

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

Any candidate who does not convince the DBB, through the DBSO, that they possess the necessary judgement, under diving conditions, for the safety of the diver and his/her buddy, may be denied FAU scientific diving privileges.

<b>Theoretical Training / Knowledge Development</b>	
<b>Required Topics:</b>	<b>Suggested Topics:</b>
Diving Emergency Care Training	Specific Dive Modes (methods of gas delivery)

<input type="checkbox"/> Cardiopulmonary Resuscitation (CPR) <input type="checkbox"/> AED <input type="checkbox"/> Standard or Basic First Aid <input type="checkbox"/> Recognition of DCS and AGE <input type="checkbox"/> Accident Management <input type="checkbox"/> Field Neurological Exam <input type="checkbox"/> Oxygen Administration	<input type="checkbox"/> Open Circuit <input type="checkbox"/> Hookah <input type="checkbox"/> Surface Supplied diving <input type="checkbox"/> Rebreathers (closed and/or semi-closed)
Dive Rescue <ul style="list-style-type: none"> <li>To include procedures relevant to OM specific protocols. (See water skills below)</li> </ul>	Specialized Breathing Gas <input type="checkbox"/> Nitrox <input type="checkbox"/> Mixed Gas
Scientific Method	Small Boat Operation
Data Gathering Techniques (Only items specific to area of study required) <input type="checkbox"/> Transects and Quadrats <input type="checkbox"/> Mapping <input type="checkbox"/> Coring <input type="checkbox"/> Photography <input type="checkbox"/> Tagging <input type="checkbox"/> Collecting <input type="checkbox"/> Animal Handling <input type="checkbox"/> Archaeology <input type="checkbox"/> Common Biota <input type="checkbox"/> Organism Identification <input type="checkbox"/> Behavior <input type="checkbox"/> Ecology <input type="checkbox"/> Site Selection, Location, and Re-location <input type="checkbox"/> Specialized Data Gathering Equipment	Specialized Environments and Conditions <input type="checkbox"/> Blue Water Diving <input type="checkbox"/> Altitude <input type="checkbox"/> Ice and Polar Diving (Cold Water Diving) <input type="checkbox"/> Zero Visibility Diving <input type="checkbox"/> Polluted Water Diving <input type="checkbox"/> Saturation Diving <input type="checkbox"/> Decompression Diving <input type="checkbox"/> Overhead Environments <input type="checkbox"/> Aquarium Diving <input type="checkbox"/> Night Diving <input type="checkbox"/> Kelp Diving <input type="checkbox"/> Strong Current Diving <input type="checkbox"/> Potential Entanglement/Entrapment <input type="checkbox"/> Live boating
<b>Required Topics:</b>	<b>Suggested Topics:</b>
Navigation	HazMat Training <ul style="list-style-type: none"> <li>Chemical Hygiene, Laboratory Safety (Use of Chemicals)</li> </ul>
HazMat Training <input type="checkbox"/> HP Cylinders	Specialized Diving Equipment <ul style="list-style-type: none"> <li>Full face mask</li> <li>Dry Suit</li> <li>Communications</li> <li>Dive Propulsion Vehicle (DPV)</li> <li>SMBs/Lift Bags</li> <li>Line Reels</li> </ul>
Decompression Management Tools <input type="checkbox"/> Dive Tables <input type="checkbox"/> Dive Computers <input type="checkbox"/> PC Based Software	
AAUS Scientific Diving Regulations and History <ul style="list-style-type: none"> <li>Scientific Dive Planning</li> <li>Coordination with other Agencies</li> <li>Appropriate Governmental Regulations</li> </ul>	
Hazards of breath-hold diving and ascents	
Dive Physics (Beyond entry level scuba)	Other Topics and Techniques as Determined by the DBB
Dive Physiology (Beyond entry level scuba)	
Dive Environments	
Decompression Theory and its Application	

<b>Practical Training / Skill Development</b>	
Confined Water	At the completion of training, the trainee must satisfy the DBSO or DBB-approved designee of their ability to perform the following, as a minimum, in a pool or in sheltered water: <input type="checkbox"/> Enter water fully equipped for diving

	<ul style="list-style-type: none"> <li><input type="checkbox"/> Clear fully flooded face mask</li> <li><input type="checkbox"/> Demonstrate air sharing and ascent using an alternate air source, as both donor and recipient, with and without a face mask</li> <li><input type="checkbox"/> Demonstrate buddy breathing as both donor and recipient, with and without a face mask</li> <li><input type="checkbox"/> Demonstrate understanding of underwater signs and signals</li> <li><input type="checkbox"/> Demonstrate ability to remove and replace equipment while submerged</li> <li><input type="checkbox"/> Demonstrate acceptable watermanship skills for anticipated scientific diving conditions</li> </ul>
Open Water Skills	<p>The trainee must satisfy the DBSO, or DBB-approved designee, of their ability to perform at least the following in open water:</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Surface dive to a depth of 10 feet (3 meters) without scuba*</li> <li><input type="checkbox"/> Enter and exit water while wearing scuba gear* ^^</li> <li><input type="checkbox"/> Kick on the surface 400 yards (366 meters) while wearing scuba gear, but not breathing from the scuba unit*</li> <li><input type="checkbox"/> Demonstrate proficiency in air sharing ascent as both donor and receiver*</li> <li><input type="checkbox"/> Demonstrate the ability to maneuver efficiently in the environment, at and below the surface* ^^</li> <li><input type="checkbox"/> Complete a simulated emergency swimming ascent*</li> <li><input type="checkbox"/> Demonstrate clearing of mask and regulator while submerged*</li> <li><input type="checkbox"/> Underwater communications^^</li> <li><input type="checkbox"/> Demonstrate ability to achieve and maintain neutral buoyancy while submerged*</li> <li><input type="checkbox"/> Demonstrate techniques of self-rescue and buddy rescue*</li> <li><input type="checkbox"/> Navigate underwater ^</li> <li><input type="checkbox"/> Plan and execute a dive^</li> <li><input type="checkbox"/> Demonstrate judgment adequate for safe scientific diving* ^^</li> </ul> <p>Rescue Skills:</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Rescue from depth and transport 25 yards (23 meters), as a diver, a passive simulated victim of an accident: surface diver, establish buoyancy, stabilize victim</li> <li><input type="checkbox"/> Demonstrate simulated in-water mouth-to-mouth resuscitation</li> <li><input type="checkbox"/> Removal of victim from water to shore or boat</li> <li><input type="checkbox"/> Stressed and panicked diver scenarios</li> <li><input type="checkbox"/> Recommendations For Rescue Of A Submerged Unresponsive Compressed-Gas Diver – <a href="#">Appendix 9</a></li> </ul> <p>Successfully complete a minimum of one checkout dive and at least eleven additional open water dives in a variety of dive sites, for a cumulative surface to surface time of 6 hours. Dives following the checkout dive(s) may be supervised by an active Scientific Diver holding the necessary depth authorization experienced in the type of diving planned, and with the knowledge and permission of the DBSO</p> <p>The eleven dives (minimum) following the initial checkout dive may be conducted over a variety of depth ranges as specified by the OM DBB. Depth progression must proceed shallower to deeper after acceptable skills and judgement have been demonstrated, and are not to exceed 100 feet (30 m) during the initial 12 dive cycle</p> <p>* Checkout dive element  ^^ Evaluated on all dives  ^ Evaluated at some point during the training cycle</p>

<b>Examinations</b>	
Equipment	<p>The trainee will be subject to examination/review of:</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Personal diving equipment</li> <li><input type="checkbox"/> Task specific equipment</li> </ul>



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

#### 4.30 Diver Certification and Authorizations

Florida Atlantic University requires that no person shall engage in scientific diving unless that person is authorized by an organizational member pursuant to the provisions of this standard. Only a person diving under the auspices of Florida Atlantic University that subscribes to the practices of AAUS is eligible for a scientific diver certification.

##### *Scientific Diver-In-Training (DIT) Authorization*

This is an authorization to dive, usable only while it is current and for the purpose intended. This permit signifies that a diver has completed and been certified as at least an entry level diver through an internationally recognized certifying agency or scientific diving program, and has the knowledge skills and experience necessary to continue training as a scientific diver under supervision, as approved by the DBB. DIT status must only be used when the diver is on their way to becoming certified as a scientific diver. While it is recommended for DITs to have hands-on scientific diver experience during their training, the DIT status is intended to be a temporary authorization, not a substitute for Scientific Diver Certification.

##### *Scientific Diver Certification*

This permit signifies a diver has completed all requirements in [Section 4.20](#) and is authorized by the Florida Atlantic University to engage in scientific diving without supervision, as approved by the DBB through the DBSO. Submission of documents and participation in aptitude examinations does not automatically result in certification. To be certified, the applicant must demonstrate to the DBB, through the DBSO, 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 dive team, may be denied FAU scientific diving privileges. Scientific Diver Certification is only active when required authorizations are in place and current.

### *Scientific Aquarium Diver Certification*

This permit is a certification authorizing the diver to participate in scientific diving solely in the aquarium environment.

All requirements set forth for Scientific Diver certification must apply, except follows:

- Practical training must include at least 12 supervised aquarium dives for a cumulative bottom time of 6 hours.
- Training requirements for navigation and 400-yard (366-meter) surface swim in scuba gear may be waived at the discretion of the DBB.

### *Temporary Diver Certification*

Only a diver not under the auspices of Florida Atlantic University may be granted a Temporary Diver Authorization. A temporary diver permit constitutes a waiver of the requirements of [Section 4.20](#) and is issued only following a demonstration of the required proficiency in diving. It is valid only for a limited time, as determined by the Diving Safety Officer. This permit is not to be construed as a mechanism to circumvent existing standards set forth in this manual.

Selected requirements of [Section 4.20](#) 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 must be submitted to the Diving Safety Officer as a part of the dive plan. Temporary permits must be restricted to the planned diving operation and must comply with all other policies, regulations, and standards of this standard, including medical requirements.

## **4.40 Depth Authorizations**

### *Depth Authorizations and Progression to Next Depth Level*

Indicates the maximum depth in which a diver can conduct science and may supervise other divers holding a lesser depth authorization. A scientific diver requires a valid depth authorization to be considered active.

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

In the event a diver within FAU does not hold an authorization at the desired next level, the DBB may authorize a required progression or procedure for a diver to attain a deeper authorization. If local conditions do not conform to traditional AAUS depth progressions, the DBB may devise a

reasonable accommodation. However, the total number of dives to obtain a given authorization must follow the cumulative number of dives listed below.

- a) Authorization to 30 Foot Depth - Initial permit level, approved upon the successful completion of training listed in [Section 4.00](#). Cumulative minimum supervised dives: 12.
- b) Authorization to 60 Foot Depth - A diver holding a 30-foot authorization may be authorized 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. Cumulative minimum supervised dives: 24.
- c) Authorization to 100 Foot Depth - A diver holding a 60-foot authorization may be authorized to a depth of 100 feet after successfully completing, 6 dives to depths between 61 and 100 feet. The diver must also demonstrate proficiency in the use of the appropriate Dive Tables. Cumulative minimum supervised dives: 30.
- d) Authorization to 130 Foot Depth - A diver holding a 100-foot authorization may be authorized to a depth of 130 feet after successfully completing, 6 dives to depths between 100 and 130 feet. The diver must also demonstrate proficiency in the use of the appropriate Dive Tables. Cumulative minimum supervised dives: 36.

**Diving on air is not permitted beyond a depth of 130 feet unless authorized by the DBSO. Dives beyond 130 feet may require the use of mixed gas and additional training.**

- e) Authorization to 150 Foot Depth - A diver holding a 130-foot authorization may be authorized to a depth of 150 feet after successfully completing 6 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. Nitrox, decompression procedures, mixed gas, or double cylinders are all strongly recommended for dives beyond 130 feet. Cumulative minimum supervised dives: 42.
- f) Authorization to 190 Foot Depth - A diver holding a 150-foot authorization may be authorized to a depth of 190 feet after successfully completing, 6 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. Cumulative minimum supervised dives: 48.
- g) Authorization to 250 Foot Depth - A diver holding a 190-foot authorization may be authorized to a depth of 190 feet after successfully completing, 6 dives to depths between 190 and 250 feet. The diver must also demonstrate knowledge of the special problems of deep diving, and of special safety requirements.
- h) Authorization to 300 Foot Depth - A diver holding a 250-foot authorization may be authorized to a depth of 190 feet after successfully completing, 6 dives to depths between 250 and 300 feet. The diver must also demonstrate knowledge of the special problems of deep diving, and of special safety requirements.
- i) Authorization deeper than 300 Foot - A diver holding a 300-foot authorization may be

authorized deeper than 300ft in 50-foot depth/ 6 dive increments. The diver must also demonstrate knowledge of the special problems of deep diving, and of special safety requirements.

#### **4.50 Maintaining Active Status**

##### *Minimum Activity to Maintain Authorizations*

During any 12-month period, each certified scientific diver must log a minimum of 12 scientific, scientific training, or proficiency dives. In every 24 month period, each diver must log at least 2 scientific or scientific training dives. At least one dive must be logged near the maximum depth that the diver is authorized to during each 6- month period. Divers authorized 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 of certification or restriction of depth authorization.

##### *Requalification of Depth Authorization*

Once the initial certification requirements of [Section 4.00](#) are met, divers whose depth authorization has lapsed due to lack of activity may be re-qualified by procedures adopted by the DBB.

##### *Medical Examination*

All certified scientific divers must pass a medical examination at the intervals specified in [Section 5.0](#). A medically cleared diver experiencing any Conditions Which May Disqualify A Candidate From Diving ([Appendix 1](#)), must receive clearance to return to diving from a physician before resuming diving activities. The medical examination requirement cannot be waived for any diver.

##### *Emergency Care Training*

The scientific diver must hold current training in the following:

- Adult CPR and AED
- Emergency oxygen administration
- First aid for diving accidents

#### **4.60 Revocation of Certification**

An individual's scientific diving certificate may be revoked or restricted for cause by the Diving Safety Officer or the DBB. Authorizations associated with an individual's scientific diver certification may be restricted or suspended for cause by the DBSO. Restrictions or suspensions issued by the DBSO may be rescinded by the DBSO; these issues will be reported to and reviewed by the DBB, and the outcomes or actions resulting from this review will be documented in the diver's record. Violations of regulations set forth in this standard, or other governmental subdivisions not in conflict with the manual, may be considered cause. The Diving Safety Officer must 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.

#### **4.70 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 DBB may impose. The diver must be given an opportunity to present their case to the DBB before conditions for re-certification are stipulated.

## SECTION 5.00 MEDICAL STANDARDS

### 5.10 Medical Requirements

#### *General*

- a) The organizational member 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 must 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 any conditions contained in the list of conditions for which restrictions from diving are generally recommended. ([Appendix 1](#))

### 5.20 Frequency of Medical Evaluations

<i>Medical evaluation must be completed:</i>		
Before Age 40	After age 40 Before Age 60	After Age 60
Before a diver may begin diving, unless an equivalent initial medical evaluation has been given within the preceding 5 years	Before a diver may begin diving, unless an equivalent initial medical evaluation has been given within the preceding 3 years	Before a diver may begin diving, unless an equivalent initial medical evaluation has been given within the preceding 2 years
At 5-year intervals	At 3-year intervals	At 2-year intervals
Clearance to return to diving must be obtained from a healthcare provider following a medically cleared diver experiencing any Conditions Which May Disqualify Candidates From Diving ( <a href="#">Appendix 1</a> ), or following any major injury or illness, or any condition requiring chronic medication. If the condition is pressure related, the clearance to return to diving must come from a physician trained in diving medicine.		

### 5.30 Information Provided Examining Physician

FAU will provide a copy of the medical evaluation requirements of this standard to the examining physician. (Appendices 1, 2, and 3).

### 5.40 Content of Medical Evaluations

Medical examinations conducted initially and at the intervals specified in [Section 5.20](#) must consist of the following:

- a) Diving physical examination (required tests listed below and in [Appendix 2](#)). Modifications or omissions of required tests are not permitted.

- b) Applicant agreement for release of medical information to the Diving Safety Officer and the DBB ([Appendix 2](#)).
- c) Medical history ([Appendix 3](#)).

### 5.50 Physician's Written Report

After any medical examination relating to the individual's fitness to dive, the organizational member must obtain a written report prepared by the examining physician that contains the examining physician's opinion of the individual's fitness to dive, including any recommended restrictions or limitations. This report will be reviewed by the DBB.

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

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

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

- w) Asthma.
- x) Chronic pulmonary disease, including radiographic evidence of pulmonary blebs, bullae or cysts.
- y) Diabetes mellitus.
- z) Pregnancy.

### 5.70 Laboratory Requirements for Diving Medical Evaluation and Intervals

Initial examination under age 40:

- a) Medical History
- b) Complete Physical Exam, emphasis on neurological and otological components
- c) Urinalysis
- d) Any further tests deemed necessary by the physician.

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

- a) Medical History
- b) Complete Physical Exam, emphasis on neurological and otological components
- c) Urinalysis
- d) Any further tests deemed necessary by the physician

First exam over age 40:

- a) Medical History
- b) Complete Physical Exam, emphasis on neurological and otological components
- c) Detailed assessment of coronary artery disease risk factors using Multiple-Risk-Factor Assessment<sup>1,2</sup> (age, family history, lipid profile, blood pressure, diabetic screening, smoking history). Further cardiac screening may be indicated based on risk factor assessment.
- d) Resting EKG
- e) Chest X-ray
- f) Urinalysis
- g) Any further tests deemed necessary by the physician

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

- a) Medical History
- b) Complete Physical Exam, emphasis on neurological and otological components
- c) Detailed assessment of coronary artery disease risk factors using Multiple-Risk-Factor Assessment<sup>1</sup> (age, family history, lipid profile, blood pressure, diabetic screening, smoking history). Further cardiac screening may be indicated based on risk factor assessment.
- d) Resting EKG



- e) Urinalysis
- f) Any further tests deemed necessary by the physician

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

<sup>2</sup> Bove, A.A. 2011. The cardiovascular system and diving risk. *Undersea and Hyperbaric Medicine* 38(4): 261-269.

# Volume 2

Sections 6.00 through 12.00

**Florida Atlantic University Specialized Diving Modes**

Required only when conduction described diving activities

## SECTION 6.00 NITROX DIVING GUIDELINES

The following guidelines address the use of nitrox by scientific divers under the auspices Florida Atlantic University. 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, with mixtures between 22% and 40% oxygen.

### 6.10 Requirements for Nitrox Authorization

#### *Eligibility*

Only a certified Scientific Diver or Scientific Diver-In-Training ([Section 4.30](#)) diving under the auspices Florida Atlantic University 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 4.40](#).

#### *Application and Documentation*

Application for authorization to use nitrox must be made to the DCB. Submission of documents and participation in aptitude examinations does not automatically result in authorization to use nitrox. The applicant must convince the DBB through the DBSO that they are sufficiently knowledgeable, skilled, and proficient in the theory and use of nitrox for diving.

#### *Training*

The diver must complete additional theoretical and practical training beyond the Scientific Diver-In-Training air certification level, to the satisfaction of the DBSO and DBB. In lieu of writing/promulgating AAUS specific training standards, FAU Scientific Divers or Divers-In-Training can be trained in Nitrox as defined by the WRSTC and/or ISO

1. Under the auspices and standards of an internationally recognized diver training agency.
2. Under the auspices of AAUS using the minimum guidelines presented by the most current version of the RTC/WRSTC and/or ISO Nitrox diver training standards.

#### *References:*

"Minimum Course Content for Enriched Air Nitrox Certification" - World Recreational Scuba Training Council (WRSTC), [www.wrstc.com](http://www.wrstc.com).

"Recreational diving services- Requirements for training programs on enriches air nitrox (EAN) diving". ISO 11107:2009 - International Organization for Standardization (ISO), [www.iso.org](http://www.iso.org)

#### *Evaluations*

##### **Practical**

- Oxygen analysis of nitrox mixtures.

- Determination of MOD, oxygen partial pressure exposure, and oxygen toxicity time limits, for various nitrox mixtures at various depths.
- Determination of nitrogen-based dive limits status by EAD method using air dive tables, and/or using nitrox dive tables.
- Nitrox dive computer use including setting mix percentage and obtaining MOD.
- A minimum of two supervised open water dives using nitrox is required for authorization.

#### **Written**

- Function, care, use, and maintenance of equipment cleaned for nitrox use.
- Physical and physiological considerations of nitrox diving (ex: O<sub>2</sub> and CO<sub>2</sub> toxicity).
- Diving regulations, procedures/operations, and dive planning as related to nitrox diving.
- Equipment markings and maintenance requirements
- Dive table and/or dive computer usage
- Calculations of: MOD, pO<sub>2</sub>, and other aspects of nitrox diving as required by the DBB

### **6.20 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.

### **6.30 Operational Requirements**

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.

#### *Oxygen Exposure Limits*

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

#### *Calculations of Decompression Status*

- A set of DBB nitrox dive table should be available at the dive site

- Dive computers may be used to compute decompression status during nitrox dives. Manufacturers' guidelines and operation instructions should be followed.
- Dive computers capable of pO<sub>2</sub> limit and fO<sub>2</sub> adjustments should be checked by the diver prior to the start of each dive to ensure conformity to the mix being used.

#### *Gas Mixture Requirements*

- Only nitrox mixtures and mixing methods approved by the DBB may be used.
- FAU personnel mixing nitrox must be qualified and approved by the BDD for the method(s) used.
- If using partial pressure blending, oxygen used for mixing nitrox should meet the purity levels for "Medical Grade" (U.S.P.) or "Aviator Grade" standards.
- In addition to the AAUS Air Purity Guidelines outline in [Section 3.60](#), any air that may come in contact with oxygen concentrations greater than 40% (i.e., during mixing), must also have a hydrocarbon contaminant no greater than .01 mg/m<sup>3</sup>.
  - For remote site operations using compressors not controlled by FAU where this is not verifiable, the DBB must develop a protocol to mitigate risk to the diver.
  - When planning dives in areas when this is not verifiable, divers are expected to communicate with the DBSO in enough time to determine a course of action.

#### *Analysis Verification by User*

- Prior to the dive, it is the responsibility of each diver to analyze the oxygen content of their 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.
- Individual dive log reporting forms should report fO<sub>2</sub> of nitrox used, if different than 21%.

### **6.40 Nitrox Diving Equipment**

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

- Labeled SCUBA Cylinders
- Oxygen Analyzers
- Oxygen compatible equipment as applicable

#### *Requirement for Oxygen Service*

- All equipment, which during the dive or cylinder filling process is exposed to concentrations greater than 40% oxygen at pressure above 150 psi, should be cleaned and maintained for oxygen service.
- Any equipment used with oxygen or mixture containing over 40% by volume oxygen must be designed and maintained for oxygen service. Oxygen systems over 125 psig must 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.

*Compressor system*

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

## SECTION 7.00 Surface Supplied Diving Technologies

Surface Supplied: Dives where the breathing gas is supplied from the surface by means of a pressurized umbilical hose.

### 7.10 Prerequisites

All surface supplied and hookah divers must be certified scientific divers or divers in training and have completed system specific training as authorized by the DBSO.

### 7.20 Surface Supplied Diving

**Definition:** A mode of diving using open circuit, surface supplied, compressed gas delivered 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.

#### Procedures

Divers using surface supplied diving must follow current FAU and AAUS standards: "Other Diving Technology- Surface Supplied Diving" (American Academy of Underwater Sciences).

- a) Each diver must be continuously tended while in the water.
- b) When diving is conducted in enclosed or physically confined spaces, a diver must be stationed at the underwater point of entry.
- c) Divers using surface supply systems must be equipped with a diver-carried independent reserve breathing gas supply sufficient to return safely to the surface, including decompression
- d) For dives deeper than 100fsw (30m) or outside the no-decompression limits, a standby diver must be available while a diver is in the water.
  - Each surface supplied diver must be hose tended by a separate dive team member.
  - A standby diver must be available while a diver is in the water.
- e) A divers using surface supply may rely on surface personnel to keep the diver's depth, times, and diving profile.
- f) Surface supplied diving must not be conducted at depths greater than 190 feet.
- g) 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.

#### Manning Requirements

The minimum number of personnel comprising a surface supplied dive team is three. They consist of: a Designated Person-In-Charge (DPIC), a Diver, and a Tender. Additional dive team members are required when a diving operation or dive site is considered complex, or when the task loading of a dive team member is deemed excessive. Personnel planning research involving surface supplied

diving will discuss the project with the DBSO to determine the possibility of expanding the dive team dependent on the project requirements.

## Equipment

- The diver will wear a positive buckling device on the safety harness to which the umbilical hose will be secured. The attachment must be of sufficient strength to prevent any strain on the helmet/full face mask hose connections and equipment must be configured to allow retrieval of the diver by the surface tender without risk of interrupting air supply to the diver.
- Each diver must be equipped with a diver-carried independent reserve breathing gas supply containing sufficient volume to complete the ascent to the surface, including all required decompression and safety stops.
- Masks and Helmets
  - Surface supplied and mixed gas masks and helmets must have:
    - A non-return valve at the attachment point between the mask/helmet and hose which must close readily and positively; and
    - An exhaust valve
  - Surface-supplied masks and helmets must have a minimum ventilation rate capability of 4.5 actual cubic feet per minute (acfm) at any depth at which they are operated or the capability of maintaining the diver's inspired carbon dioxide partial pressure below 0.02 atmospheres absolute (ATA) when the diver is producing carbon dioxide at the rate of 1.6 standard liters per minute
  - Helmets or masks connected directly to the dry suit or other buoyancy-changing equipment must be equipped with an exhaust valve
- Air supplied to the diver must meet the air quality standards outlined in [Section 3.60](#).

## Surface Supplied in Aquariums

- In an aquarium habitat where the maximum depth is known, a pneumofathometer is not required.
- The maximum obtainable depth of the aquarium may be used as the diving depth
- One tender may line-tend multiple divers, provided the tender is monitoring only one air source, there is mutual assistance between divers, there are no overhead obstructions or entanglements, or other restrictions.
- Personnel planning surface supplied dives in aquariums must contact the DBSO to discuss additional operational protocols prior to making any dives.

## 7.30 Hookah

While similar to surface supplied systems 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 their own depth, time, and diving profile.

Surface supplied diving Hookah systems are a form of light weight surface supplied air diving technology, involving deck mounted or floating gas supplies (low pressure compressor or compressed gas cylinder), elongated intermediate pressure hoses to divers, and a SCUBA second stage regulator held in a diver's mouth. This technology is usually applied in less than 30 feet, but can be extended to 60 feet. This configuration has been used to supply breathing gas from a diving bell, habitat, or submersible/submarine. Advantages of hookah systems include fewer burdens on divers, increased gas supply, and a physical connection to the surface. Disadvantages include possible entanglement, risk of gas supply loss, and increased drag and hindrance from hoses in the water column.

Below 60 feet, traditional surface supply systems must be employed unless otherwise discussed with DBSO.

### **Equipment Requirements**

- The air supply hose must be rated for a minimum operating pressure of 130psi.
- Air supplied to the hookah diver must meet the air quality standards outline in [Section 3.60](#).
- Hookah divers must follow buddy diving protocols.
- Hookah supply systems must be capable of supplying all divers breathing from the system sufficient gas for comfortable breathing for the planned depth and workload.
- Hookah system second stage should be capable of being attached to the diver in a way to avoid pulling stress on the second stage mouthpiece and affords easy release if the diver must jettison the regulator and hose.
- An equipped safety diver capable of safely reaching the divers at the planned depth must be on standby at the surface.
- An independent reserve breathing gas supply will be carried by each hookah diver:
  - When the diver does not have direct access to the surface or
  - At depths or distances from alternate breathing gas source determined by the DBB.
- Divers must comply with all applicable sections of this manual regarding Scientific Diver training and authorization, equipment inspection and maintenance, air quality testing, record keeping, and operational control.
- The compressor engine must not be loaded with fuel until it has been shut off and cooled down for at
- The fresh air intake must not be located near the compressor exhaust in order to prevent carbon monoxide from being supplied to divers.

### **Operational Requirements**

- Hookah diving must not be conducted beyond depths or distance from alternate breathing gas source as determined by the DBB.
- A diver's independent reserve breathing gas supply, if worn, must contain sufficient volume to allow the diver(s) to exit to the surface or alternate breathing gas source
- Hookah divers not supported by diving bell, or underwater habitat must not be exposed to dives that require staged decompression.

## **Hookah Diving in Aquariums**

- In an aquarium habitat where the maximum depth is known and planned for, a depth gauge is not required.
- The maximum obtainable depth of the aquarium may be used as the maximum diving depth.
- A hookah configured diver may operate without an in-water buddy in an aquarium provided the diver is tended from the surface; has visual, line pull, or voice communication with the tender; the diver carries an independent reserve breathing gas source containing sufficient volume to allow the diver to exit to the surface or alternate breathing gas source; and under other operational conditions as determined by the DBB.

## SECTION 8.00 STAGED DECOMPRESSION DIVING

Decompression diving is 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 must be observed when conducting dives requiring planned decompression stops.

### 8.10 Minimum Experience and Training Requirements

#### *Prerequisites*

1. Scientific Diver qualification according to [Section 4.00](#).
2. Minimum of 100 logged dives with experience in the depth range where decompression dives will be conducted.
3. Demonstration of the ability to safely plan and conduct dives deeper than 100 feet.
4. Nitrox certification/authorization according to AAUS [Section 6.00](#).

#### *Training*

Training must be appropriate for the conditions in which dive operations are to be conducted.

Minimum Training must include the following:

1. A minimum of 6 hours of classroom training to ensure theoretical knowledge to include: physics and physiology of decompression; decompression planning and procedures; gas management; equipment configurations; decompression method, emergency procedures, and omitted decompression.
2. 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.
3. At least 6 open-water training dives simulating/requiring decompression must be conducted, emphasizing planning and execution of required decompression dives, and including practice of emergency procedures.
4. Progression to greater depths must be by increments and depth intervals as specified in [Section 4.40](#).
5. No training dives requiring decompression shall be conducted until the diver has demonstrated acceptable skills under simulated conditions.
6. 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
7. Divers must demonstrate to the satisfaction of the DBSO or the DBSO's qualified designee proficiency in planning and executing required decompression dives appropriate to the conditions in which diving operations are to be conducted.
  8. Upon completion of training, the diver must be authorized to conduct required decompression dives with DBSO approval.

## **8.20 Minimum Equipment Requirements**

1. When double cylinders are used, the valve and regulator systems for primary (bottom) gas supplies must 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.
2. Cylinders with volume and configuration adequate for planned diving operations
3. One of the second stages on the primary gas supply must be configured with a hose of adequate length to facilitate effective emergency gas sharing in the intended environment.
4. Minimum dive equipment should include:
  - a) Diver location devices adequate for the planned diving operations and environment.
  - b) Compass
5. Redundancy in the following components may be required at the discretion of the DBB:
  - a) Decompression Schedules
  - b) Dive Timing Devices
  - c) Depth gauges
  - d) Buoyancy Control Devices
  - e) Cutting devices
  - f) Lift bags and line reels

## **8.30 Minimum Operational Requirements**

1. The maximum pO<sub>2</sub> to be used for planning required decompression dives is 1.6 for open circuit. It is recommended that a pO<sub>2</sub> of less than 1.6 be used during bottom exposure.
2. Decompression dives may be planned using dive tables, dive computers, and/or PC software approved by the DBB.
3. Breathing gases used while performing in-water decompression must contain the same or greater oxygen content as that used during the bottom phase of the dive.
4. The dive team prior to each dive must review emergency decompression procedures appropriate for the planned dive.
5. If breathing gas mixtures other than air are used for required decompression, their use must be in accordance with those regulations set forth in the appropriate sections of this Manual.
6. Use of additional nitrox and/or high-oxygen fraction decompression mixtures as travel and

decompression gases to decrease decompression obligations is recommended.

7. Use of alternate inert gas mixtures to limit narcosis is recommended for depths greater than 130 feet.
8. The maximum depth for required decompression using air as the bottom gas is 130 feet.
9. If a period of more than 6 months has elapsed since the last decompression dive, a series of progressive workup dives defined by the DBB to return the diver(s) to proficiency status prior to the start of project diving operations are required.
10. Mission specific workup dives are recommended for any mission involving decompression diving.

## SECTION 9.00 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.

### 9.10 Minimum Experience and Training Requirements

#### *Prerequisites*

1. Nitrox authorization ([Section 6.00](#)).
2. If the intended use entails required decompression stops, divers will be previously authorized in decompression diving ([Section 8.00](#)).
3. Divers must demonstrate to the DBB's satisfaction skills, knowledge, and attitude appropriate for training in the safe use of mixed gases.
4. Minimum of 100 logged dives.

#### *Classroom training including*

1. Review of topics and issues previously outlined in nitrox and required decompression diving training as pertinent to the planned operations
2. The use of helium or other inert gases, and the use of multiple decompression gases
3. Equipment configurations
4. Mixed gas decompression planning
5. Gas management planning
6. Thermal considerations
7. END determination
8. Mission planning and logistics
9. Emergency procedures
10. Mixed gas production methods
11. Methods of gas handling and cylinder filling
12. Oxygen exposure management
13. Gas analysis
14. Mixed gas physics and physiology

#### *Practical Training*

1. Confined water session(s) in which divers demonstrate proficiency in required skills and techniques for proposed diving operations.
2. A minimum of 6 open water training dives.
3. At least one initial dive must be in 130 feet or less to practice equipment handling and emergency procedures.
4. Subsequent dives will gradually increase in depth, with a majority of the training dives being

conducted between 130 feet and the planned operational depth.

5. Planned operational depth for initial training dives must not exceed the diver's authorization limit with a maximum depth of 260 feet.

## **9.20 Equipment and Gas Quality Requirements**

1. Equipment requirements must be developed and approved by the DBB. Equipment must meet other pertinent requirements set forth elsewhere in this Manual.
2. The quality of inert gases used to produce breathing mixtures must be of an acceptable grade for human consumption.

## **9.30 Minimum Operational Requirements**

1. All applicable operational requirements for nitrox and staged decompression diving must be met.
2. The maximum  $pO_2$  to be used for planning required open circuit decompression dives is 1.6. It is recommended that a  $pO_2$  of less than 1.6 be used during bottom exposure.
3. Divers decompressing on high-oxygen concentration mixtures must closely monitor one another for signs of acute oxygen toxicity.
4. If a period of more than 6 months has elapsed since the last decompression dive, a series of progressive workup dives defined by the DBB to return the diver(s) to proficiency status prior to the start of project diving operations are required.
5. Mission specific workup dives are recommended for any mission involving mixed gas diving.

## **SECTION 10.00 SPECIALIZED DIVING ENVIRONMENTS**

Certain types of diving require specialized equipment or procedures that require training; some have specialized standards which have been developed, and continue to be developed, by AAUS and other agencies. Florida Atlantic University Scientific Divers, in addition to all other standards contained in this manual, must comply with all diving procedures and training requirements defined by the DBSO and DBB for specialized diving techniques as defined in this Section.

Prior to diving with equipment or procedures listed below, the diver must be approved by the FAU Diving Safety Officer. All current AAUS standards must be followed and certification may require additional courses and testing. Divers must comply with all scuba procedures and standards in this manual unless specifically waived by the DBSO.

### **10.10 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).

### **10.20 Ice and Polar Diving**

Divers planning to dive under ice or in polar conditions should use the following: “PESH-POL\_2000.08 Standards for the Conduct of Scientific Diving”, National Science Foundation, Division of Polar Programs, 2015.

### **10.30 Overhead Environments**

Overhead environments include water filled Caverns, Caves, Flooded Mines and Ice diving, as well as portions of Sunken Shipwrecks and other manmade structures.

For the purposes of this *Manual*, Ice diving is a specialized overhead environment addressed in [Section 10.20](#) and supplemented by requirements and protocols established by the OM’s DBB.

Cavern, Cave, or Flooded Mine Diving see [Section 12](#).

It is the responsibility of the OM’s DBB to establish the requirements and protocol under which diving will be safely conducted in overhead environment portions of sunken shipwrecks and other manmade structures.

### **10.40 Saturation Diving**

If conducting saturation diving operations, divers must comply with the saturation diving guidelines of the OM.

### **10.50 Aquarium Diving**

An aquarium is an artificial, 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 *Manual*. In those circumstances it is the responsibility of



the OM's DBB to establish the requirements and protocol under which diving will be safely conducted.

#### **10.60 Night Diving / Decreased Visibility**

Night diving is defined as any diving that takes place between sunset and sunrise. Divers may be authorized to dive at night through the DBSO. To be authorized, a FAU diver must complete a night checkout dive with the DBSO demonstrating understanding of night diving procedures and techniques, and use of night diving specific equipment.

#### **10.70 Altitude Diving**

Altitude diving is any dive that takes place at an elevation of 1,000 ft (333 m) or more above sea level. Reduced surface pressure requires divers to adjust their dive plan. Divers planning research dives at altitude must provide the DBSO and DBB with a written dive plan that includes at least number of dives, breathing gas, and any pre- and post- dive ascents.

## SECTION 11.0 REBREATHERS

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

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

Application of this standard is in addition to pertinent requirements of all other sections of the FAU Standards for Scientific Diving.

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

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

In all cases, trainers must be qualified for the type of instruction to be provided. Training must be conducted by agencies or instructors approved by the DBSO and DBB.

### 11.10 Definition

- A. Rebreathers are defined as any device that recycles some or all of the exhaled gas in the breathing loop and returns it to the diver. Rebreathers maintain levels of oxygen and carbon dioxide that support life by metered injection of oxygen and chemical removal of carbon dioxide. These characteristics fundamentally distinguish rebreathers from open-circuit life support systems, in that the breathing gas composition is dynamic rather than fixed.
- B. There are three classes of rebreathers:
  1. Oxygen Rebreathers: Oxygen rebreathers recycle breathing gas, consisting of pure oxygen, replenishing the oxygen metabolized by the diver. Oxygen rebreathers are generally the least complicated design but are limited in depth of use due to the physiological limits associated with oxygen toxicity.
  2. Semi-Closed Circuit Rebreathers: Semi-closed circuit rebreathers (SCR) recycle the majority of exhaled breathing gas, venting a portion into the water and replenishing it with a constant or variable amount of a single oxygen-enriched gas mixture. Gas addition and venting is balanced against diver metabolism to maintain safe oxygen levels.
  3. Closed-Circuit Rebreathers: Closed-circuit mixed gas rebreathers (CCR) recycle all of the exhaled gas. Electronically controlled CCRs (eCCR) replace metabolized oxygen via an electronically controlled valve, governed by oxygen sensors. Manually controlled CCR (mCCR) rely on mechanical oxygen addition and diver monitoring to control oxygen partial pressure (ppO<sub>2</sub>). Depending on the design, manual oxygen addition may be available on eCCR units as a diver override, in case of electronic system failure. Systems are equipped with two cylinders; one with oxygen, the other with a diluent gas source used to make up gas volume with depth increase and to dilute oxygen levels. CCR systems operate to maintain a constant ppO<sub>2</sub> during the dive, regardless of depth.

## 11.20 Prerequisites for use of any rebreather

1. Active scientific diver status, with depth authorization sufficient for the type, make, and model of rebreather, and planned application.
2. Completion of a minimum of 50 open-water dives on open circuit SCUBA. The DBB may require increased dive experience depending upon the intended use of the rebreather system for scientific diving.
3. For SCR or CCR, a minimum 60-foot-depth authorization is generally recommended, to ensure the diver is sufficiently conversant with the complications of deeper diving. If the sole expected application for use of rebreathers is shallower than this, a lesser depth authorization may be allowed with the approval of the DBB.
4. Nitrox training. Training in use of nitrox mixtures containing 25% to 40% oxygen is required. Training in use of mixtures containing 40% to 100% oxygen may be required, as needed for the planned application and rebreather system.

## 11.30 Training

1. Divers entering the program with prior rebreather training and experience must at minimum show proof of training and at least 12 open water dives totaling a minimum of 720 minutes underwater regardless of rebreather platform.
2. Specific training requirements for use of each rebreather model must be defined by DBB on a case-by-case basis. Training must include factory-recommended requirements, but may exceed this to prepare for the type of mission intended (e.g., staged decompression or heliox/trimix CCR diving). (See training section for details.)
3. Successful completion of training does not in itself authorize the diver to use rebreathers. The diver must demonstrate to the DBB or its designee that the diver possesses the proper attitude, judgment, and discipline to safely conduct rebreather diving in the context of planned operations.
4. Post training supervised dives are required before the scientific rebreather diver is authorized to use rebreather for research dives; training dive guidelines are outlined in [Section 11.60](#).

### *Individual Equipment Requirements*

Individual Equipment Requirements			
Key: X = include, IA = If Applicable			
	O <sub>2</sub>	SCR	CCR
DBB approved rebreather make and model	X	X	X
Bottom timer, and depth gauge	X	X	X
Dive computer (separate from rebreather unit)		X	X
Approved dive tables		IA	IA
SMB (surface marker buoy) and line reel or spool with sufficient line to deploy an SMB from the bottom in the training environment	IA	IA	IA
Access to an oxygen analyzer	X	X	X
Cutting implement	X	X	X
BCD capable of floating a diver with a flooded loop and/or dry suit at the Surface	X	X	X
Bailout gas supply of sufficient volume for planned diving activities	X	X	X

Approved CO <sub>2</sub> absorbent and other consumables	X	X	X
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## 11.40 Equipment Requirements

- A. General
  1. Only those models of rebreathers specifically approved by DBB shall be used.
  2. Rebreathers should meet the quality control/quality assurance protocols of the International Organization for Standardization (ISO) requirements: ISO 9004: 2009 or the most current version, AND successful completion of CE (Conformité Européenne) or DBB approved third party testing.
  3. Rebreather modifications (including consumables and operational limits) that deviate from or are not covered by manufacturer documentation should be discussed with the manufacturer and approved by the DBB prior to implementation.
- B. Equipment Maintenance Requirements
  1. Rebreathers should be maintained in accordance with manufacturer servicing recommendations.
  2. Field repairs and replacement of components covered in rebreather diver training is not annual maintenance and may be performed by the rebreather diver in accordance with DBB policy.
  3. A maintenance log will be kept and will minimally include:
    - a) Dates of service
    - b) Service performed
    - c) Individuals or company performing the service

## 11.50 Operational Requirements

- A. Dive Plan
 

In addition to standard dive plan components, at a minimum all dive plans that include the use of rebreathers must include:

  - a) Information about the specific rebreather model(s) to be used
  - b) Type of CO<sub>2</sub> absorbent material
  - c) Composition and volume(s) of supply gasses
  - d) Bailout procedures
  - e) Other specific details as required by the DBB
- B. Particular attention should be paid to using rebreathers under conditions where vibration or pulsating water movement could affect electronics or control switches and systems.
- C. Particular attention should be paid to using rebreathers under conditions where heavy physical exertion is anticipated.
- D. Respired gas densities should be less than 5 g·L<sup>-1</sup>, and should not exceed 6 g·L<sup>-1</sup> under normal circumstances.
- E. User replaceable consumable rebreather components should be replaced per manufacture recommendations or as defined by the DBB.
- F. If performed, periodic field validation of oxygen cells should be conducted per DBB designated procedure.
- G. Diver carried off-board bailout is not required under conditions where the onboard reserves are adequate to return the diver to the surface while meeting proper ascent rate and stop requirements, and the system is configured to allow access to onboard gas. These calculations must take into consideration mixed mode operations where an open circuit diver could require assistance in an out of gas situation.
- H. Use and reuse of CO<sub>2</sub> scrubber media should be per manufacture recommendations or as defined by the DBB.
- I. Planned oxygen partial pressure in the breathing gas must not exceed 1.4 atmospheres at depths greater than 30 feet, or 1.6 at depths less than 30 feet.

- J. Both CNS and Oxygen Tolerance Units (OTUs) should be tracked for each diver. Exposure limits should be established by the DBB.
- K. Divers must use a rebreather checklist for the assembly and functional testing of equipment prior to diving (divers may use the checklist in Appendix M). Functional testing including a pre-breathe for at least 3 minutes is required prior to every dive.
- L. All rebreathers must be disinfected at appropriate time intervals using a multi-spectrum disinfectant such as HBQuat.
- M. All rebreather divers must perform a pre-breathe of at least 3 minutes prior to submersion.
- N. **Mixed mode** diving is when two or more divers are using different diving modes or technologies, for example a rebreather diver diving with an open circuit diver.
  - Mixed mode diving may be permitted at FAU under some circumstances as approved by the DBSO.
  - Training and approval is outlined in the Cross-Training for Mixed Modes form found in Appendix N
- O. Dives performed using rebreathers will follow the same depth authorization guidelines as found in [Section 4.40](#).
- P. In order to maintain authorization as a FAU scientific rebreather diver, divers must follow all the minimum procedures set forth in [Section 4.50](#), which includes a minimum 12 rebreather dives per year, minimum cumulative rebreather dive time of 12 hours, and at least one rebreather dive during every 6-month period. To count, dives should be no less than 30 min in duration. A required element of maintaining proficiency is the periodic performance and reevaluation of skills related to in-water problem recognition and emergency procedures. At minimum, demonstrated skills included in the required training elements for the level of rebreather operation must be performed and reevaluated.
- Q. If a diver is not a current authorized FAU rebreather diver, the diver may be required to participate in pre-operation workup dives. These dives should include the review and practice of emergency recognition and response skills, and management of task loading are required for operations defined by the DBB as beyond the scope of normal operating conditions.

## 11.60 Rebreather Training Section

### A. *Entry Level Training*

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

## Rebreather Entry Level Training Requirements

Key: X = include, IA = If Applicable, ISE = If So Equipped			
	O <sub>2</sub>	SCR	CCR
<b>Required Training Topic</b>			
<b>Academic</b>			
<b>History of technology</b>	X	X	X
<b>Medical &amp; physiological aspects of:</b>			
Oxygen toxicity	X	X	X
Chemical burns & caustic cocktail	X	X	X
Hypoxia – insufficient O <sub>2</sub>	X	X	X
Hypercapnia – excessive CO <sub>2</sub>	X	X	X
Arterial gas embolism	X	X	X
Middle Ear Oxygen Absorption Syndrome (oxygen ear)	X	X	X
Hygienic concerns	X	X	X
Nitrogen absorption & decompression sickness		X	X
CO <sub>2</sub> retention	X	X	X
Hyperoxia-induced myopia	X	X	X
<b>System design, assembly, and operation, including:</b>			
Layout and design	X	X	X
Oxygen control systems	X	X	X
Diluent control systems		ISE	ISE
Use of checklists	X	X	X
Complete assembly and disassembly of the unit	X	X	X
Canister design & proper packing and handling of chemical absorbent	X	X	X
Decompression management and applicable tracking methods		ISE	X
Oxygen and high pressure gas handling and safety	X	X	X
Fire triangle	X	X	X
Filling of cylinders	X	X	X
Pre-dive testing & trouble shooting	X	X	X
Post-dive break-down and maintenance	X	X	X
Trouble shooting and manufacturer authorized field repairs	X	X	X
Required maintenance and intervals	X	X	X
Manufacturer supported additional items (ADV, temp stick, CO <sub>2</sub> monitor, etc.)	ISE	ISE	ISE
<b>Dive planning:</b>			
Operational planning	X	X	X
Gas requirements	X	X	X
Oxygen exposure and management	X	X	X
Gas density calculations		X	X
Oxygen metabolizing calculations	X	X	X
Scrubber limitations	X	X	X
Mixed mode diving (buddies using different dive modes)	X	X	X
Mixed platform diving (buddies using different rebreather platforms)	X	X	X
<b>Problem Recognition &amp; Emergency Procedures:</b>			
Applicable open circuit emergency procedures for common gear elements	X	X	X
Loss of electronics	ISE	ISE	X
Partially flooded loop	X	X	X

Fully flooded loop	X	X	X
Cell warnings		ISE	X
Battery warnings	ISE	ISE	X
High O <sub>2</sub> warning	ISE	ISE	X
Low O <sub>2</sub> warning	ISE	ISE	X
High CO <sub>2</sub> warning	ISE	ISE	ISE
Recognizing issues as indicated by onboard scrubber monitors	ISE	ISE	ISE
Recognizing hypercapnia signs and symptoms in self or buddy	X	X	X
Excluded O <sub>2</sub> cell(s)	ISE	ISE	ISE
Loss of Heads Up Display (HUD)	ISE	ISE	ISE
Loss of buoyancy	X	X	X
Diluent manual add button not functioning		ISE	ISE
O <sub>2</sub> manual add button not functioning	ISE	ISE	ISE
Exhausted oxygen supply	X	X	X
Exhausted diluent supply		ISE	ISE
Lost or exhausted bailout	ISE	ISE	ISE
Handset not functioning	ISE	ISE	ISE
Solenoid stuck open	ISE	ISE	ISE
Solenoid stuck closed	ISE	ISE	ISE
ADV stuck open	ISE	ISE	ISE
ADV stuck closed	ISE	ISE	ISE
Isolator valve(s) not functioning	ISE	ISE	ISE
Oxygen sensor validation	ISE	ISE	X
CO <sub>2</sub> sensor validation	IA	IA	IA
Gas sharing	X	X	X
Diver assist and diver rescue	X	X	X
Other problem recognition and emergency procedures specific to the particular unit, environment, or diving conditions	X	X	X
<b>Practical Training and Evaluations</b>			
<b>Demonstrated skills must include, at a minimum:</b>			
Use of checklists	X	X	X
Carbon dioxide absorbent canister packing	X	X	X
Supply gas cylinder analysis and pressure check	X	X	X
Test of one-way valves	X	X	X
System assembly and breathing loop leak testing	X	X	X
Oxygen control system calibration	ISE	ISE	X
Proper pre-breathe procedure	X	X	X
In-water bubble check	X	X	X
Proper buoyancy control during descent, dive operations, and ascent	X	X	X
System monitoring & control during descent, dive operations, and ascent	X	X	X
Proper interpretation and operation of system instrumentation	X	X	X
Proper buddy contact and communication	X	X	X
Use of a line reel or spool to deploy an SMB from planned dive depth and while controlling buoyancy in the water column	X	X	X
Proper management of line reel or spool, and SMB during ascents and safety or required stops	X	X	X
Unit removal and replacement on the surface	X	X	X
<b>Bailout and emergency procedures for self and buddy, including:</b>			

System malfunction recognition and solution	X	X	X
Manual system control	ISE	ISE	ISE
Flooded breathing loop recovery	IA	IA	IA
Absorbent canister failure	X	X	X
Alternate bailout options	X	X	X
Manipulation of onboard and off board cylinder valves	X	X	X
Manipulation of bailout cylinders (removal, replacement, passing and receiving while maintaining buoyancy control)	ISE	ISE	ISE
Manipulation of quick disconnects, isolator valves, and manual controls specific to the unit and gear configuration	ISE	ISE	ISE
<b>Proper system maintenance, including:</b>			
Breathing loop disassembly and disinfection	X	X	X
Oxygen sensor replacement	ISE	ISE	ISE
Battery removal and replacement or recharging	ISE	ISE	ISE
Other tasks as required by specific rebreather models	X	X	X
<b>Written Evaluation</b>	X	X	X
<b>Supervised Rebreather Dives</b>	X	X	X
<b>Entry Level Training – Minimum Underwater Requirements</b>			
	<b>Pool/Confined Water</b>	<b>Training / Supervised Open Water Dives</b>	
<b>O2</b>	1 Dive, 90 minutes	6 dives, 240 minute cumulative	
<b>SCR</b>	1 Dive, 90 minutes	8 dives, 240 minute cumulative	
<b>CCR</b>	1 Dive, 90 minutes	12 dives, 720 minute cumulative	

**B. Rebreather Required Decompression, Normoxic, and Hypoxic Mix Training**

1. Required Decompression and Normoxic Training may be taught separately or combined.

2. Prerequisites:

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

b) Mixed Gas:

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

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

3. Who may teach: Individuals authorized as a CCR/SRC required decompression and/or Normoxic and/or Hypoxic Mix instructor by the DBB or their designee (this is in addition to the original authorization from [Section 11.60](#))

4. Maximum Student/Instructor Ratio: 2 to 1. This ratio is to be reduced as required by environmental conditions or operational constraints

5. Upon completion of practical training, the diver must demonstrate proficiency in pre-dive, dive, and post-dive operational procedures for the particular model of rebreather to be used

6. Supervised dives target activities associated with the planned science diving application. Supervisor for these dives is the DBSO or designee, experienced with the make/model rebreather being used



# Rebreather Required Decompression, Normoxic & Hypoxic Mix Training Requirements

Key: X = include, IA = If Applicable, ISE = If So Equipped

	Deco	Normoxic	Hypoxic Mixes
<b>Required Training Topic</b>			
<b>Academic</b>			
Review of applicable subject matter from previous training	X	X	X
<b>Medical &amp; physiological aspects of:</b>			
Hypercapnia, hypoxia, hyperoxia	X	X	X
Oxygen limitations	X	X	X
Nitrogen limitations	X	X	X
Helium absorption and elimination		X	X
High Pressure Nervous Syndrome (HPNS)			X
<b>System design, assembly, and operation, including:</b>			
Gear considerations and rigging	X	X	X
Gas switching	X	X	X
<b>Dive planning:</b>			
Decompression calculation	X	X	X
Gradient Factors	X	X	X
Scrubber duration and the effects of depth on scrubber function	X	X	X
Gas requirements including bailout scenarios	X	X	X
Bailout gas management – individual vs team bailout	X	X	X
Gas density calculations	X	X	X
Operational Planning	X	X	X
Equivalent narcosis depth theory		X	X
Gas selection, gas mixing and gas formulas		X	X
<b>Problem Recognition &amp; Emergency Procedures:</b>			
Applicable open circuit emergency procedures for common gear	X	X	X
Flooded loop	X	X	X
Cell warnings	X	X	X
Battery warnings	X	X	X
Hypercapnia, hypoxia, hyperoxia	X	X	X
<b>Practical Training and Evaluations</b>			
<b>Demonstrated skills must include, at a minimum:</b>			
Proper demonstration of applicable skills from previous training	X	X	X
Proper manipulation of DSV and/or BOV	X	X	X
Proper descent and bubble check procedures	X	X	X
Proper monitoring of setpoint switching and pO <sub>2</sub> levels	X	X	X
Proper interpretation and operation of system instrumentation	X	X	X
System monitoring & control during descent, dive operations, and ascent	X	X	X
Demonstrate the ability to manually change setpoint and electronics settings during the dive	ISE	ISE	ISE
Demonstrate buoyancy control; ability to hover at fixed position in water column without moving hands or feet	X	X	X

Demonstrate controlled ascent with an incapacitated diver including surface tow at least 30 meters / 100 feet with equipment removal on surface, in water too deep to stand	X	X	X
Onboard and off board valve manipulation for proper use, and reduction of gas loss	X	X	X
Diagnosis of and proper reactions for a flooded absorbent canister	X	X	X
Diagnosis of and proper reactions for CO2 breakthrough	X	X	X
Diagnosis of and proper response to Cell Errors	X	X	X
Diagnosis of and proper reactions for Low oxygen drills	X	X	X
Diagnosis of and proper reactions for Flooded Loop	X	X	X
Diagnosis of and proper reactions for High Oxygen Drills	X	X	X
Diagnosis of and proper reactions for electronics and battery failure	X	X	X
Operation in semi-closed mode	X	X	X
Properly execute the ascent procedures for an incapacitated dive	X	X	X
Proper buddy contact and communication	X	X	X
Use of a line reel or spool to deploy an SMB from planned dive depth and while controlling buoyancy in the water column	X	X	X
Proper management of line reel or spool, and SMB during ascents and safety or required stops	X	X	X
Demonstrate the ability to maintain minimum loop volume	X	X	X
Demonstrate comfort swimming on surface and at depth carrying a single bailout/decompression cylinder/bailout rebreather	X		
Demonstrate ability to pass and retrieve a single bailout/decompression cylinder or bailout rebreather while maintaining position in the water column	X		
Demonstrate ability to pass and receive multiple bailout/decompression cylinders or bailout rebreather while maintaining position in the water column	IA	X	X
Demonstration of the ability to perform simulated decompression stops at pre-determined depths for scheduled times	X	X	X
Demonstration of the ability to perform decompression stops at pre-determined depths for scheduled times	X	X	X
Demonstrate competence managing multiple bailout cylinders, including drop and recovery while maintaining position in the water column	IA	X	X
Demonstrate appropriate reaction to simulated free-flowing deco regulator	X	X	X
Gas share of deco gas for at least 1 minute	X	X	X
Demonstrate oxygen rebreather mode at appropriate stop depth		X	X
Complete bailout scenarios from depth to include decompression obligation on open circuit	X	X	X

<b>Written Evaluation</b>		X	X	X
<b>Supervised Rebreather Dives</b>		X	X	X
<b>Minimum Underwater Requirements</b>				
	<b>Pool/Confined Water</b>	<b>Supervised Open Water Dives</b>		
<b>Deco</b>	1 Dive / 60 min	11 Dives / 660 min		
<b>Normoxic</b>	1 Dive / 60 min	11 Dives / 660 min		
<b>Deco/Normoxic Combined</b>	1 Dive / 60 min	11 Dives / 660 min First 3 of 11 dives will use normoxic mixtures		
<b>Hypoxic Mixes</b>	1 Dive / 60 min	11 Dives / 660 min		

### **Rebreather Crossover Training**

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

## SECTION 12.00 SCIENTIFIC CAVE AND CAVERN DIVING

This section defines specific considerations regarding the following issues for Scientific Cavern and Cave diving:

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

Application of this standard is in addition to pertinent requirements of all other sections of this *Manual*.

For cavern or cave dives that also involve staged decompression, rebreathers, and/or mixed gas diving, all requirements for each of the relevant diving techniques, modes, or gases must be met.

No diver must conduct planned operations in caverns, caves, or other overhead environments without prior review and approval of the DCB or designee. The diver must demonstrate that he/she possesses the proper attitude, judgment, and discipline to safely conduct cave and cavern diving in the context of planned operations.

If a conflict exists between this section and other sections in this *Manual*, the information set forth in this section only takes precedence when the scientific diving being conducted takes place wholly or partly within an underwater cave or cavern environment.

### 12.10 Definition

A dive team must be considered to be cave or cavern diving if at any time during the dive they find themselves in a position where they cannot complete a direct, unobstructed ascent to the surface because of rock formations. In addition to blocking direct access to surfacing, underwater caves have additional environmental hazards including but not limited to:

- The absence of natural light.
- Current or flow that vary in strength and direction. Of particular note is a condition known as siphoning. Siphoning caves have flow or current directed into the cave. This can cause poor visibility as a result of mud and silt being drawn into the cave entrance.
- The presences of silt, sand, mud, clay, etc. that can cause visibility to be reduced to nothing in a very short time.
- Restrictions – Any passage through which two divers cannot easily pass side by side while sharing air make air sharing difficult.
- Cave-Ins – Cave-Ins are a normal part of cave evolution; however, experiencing a cave-in during diving operations is extremely unlikely.

## 12.20 Prerequisites

Prerequisites	Cavern: OC or Rebreather	Cave	Rebreather Cave
Active scientific diver status, with depth qualification sufficient for proposed training location(s)	X	X	X
Completion of a minimum of 25 dives.	X		
Cavern Diver Authorization		X	X

## 12.30 Training

Training	Cavern: OC or Rebreather	Cave OC	Rebreather Cave
Key: X = include, R = Review, IA = If Applicable, OC = Open Circuit			
Trainers must be qualified for the type of instruction to be provided. Training must be conducted by agencies or instructors approved by the DCB or their designee	X	X	X
<b>Academic</b>			
Policy for diving overhead environments	X	X	X
Environment and environmental hazards	X	X	X
Accident analysis	X	X	X
Psychological considerations	X	X	X
<b>Required equipment and equipment configuration</b>			
Single cylinder with H or Y Valve	IA	IA	
Doubles with Isolation Manifold	IA	IA	
Side Mount		IA	IA
No Mount		IA	IA
Stage Cylinder(s)		IA	IA
Off-board Bailout	IA		X
Communications	X	X	X
<b>Diving techniques</b>			
Body control	X	X	X
Navigation and guidelines	X	X	X
Entry and Exit Protocols (Right of Way)	X	R	R
Use of line arrows and cookies	X	X	X
Line Systems Applicable to the Area and/or Cave System	X	R	R
		Line Jumps	X
		Circuits	X
<b>Dive planning</b>			
Rule of Sixths	X	R	R
Rule of Thirds	X	R	R
Gas Matching	IA	X	X
Decompression Theory	R	R	R
Dive Tables	R	R	R
Mixed Mode Diving	IA	IA	IA
Cave geology	X	R	R
Cave hydrology	X	R	R
Cave biology	X	X	X

Emergency procedures	X	X	X
<b>Practical Training and Evaluation</b>			
<b>Land Drills</b>			
Line Reel Use	X	R	R
Techniques and Considerations for Laying a Guideline	X	X	X
Guideline Following	X	R	R
Buddy Communication	X	R	R
Team Positioning for Normal Entry and Exit	X	X	X
Zero Visibility Drills			
Line Reel Use	X	R	R
Line and Line Arrow Identification and Following	X	R	R
Bump and Go (Skills description)		X	X
Emergency Procedures			
How Far Can You Go Out Of Gas?(Skills description)	X	X	X
Team Positioning for Emergency Situations	X	X	X
<b>In-Water</b>			
<b>Demonstrated skills must include, at a minimum:</b>			
A minimum of four (4) cavern dives, preferably to be conducted in a minimum of two (2) different caverns	X		
A minimum of twelve (12) cave dives, preferably to be conducted in a minimum of four (4) different cave sites with differing conditions		X	X
Safety drill (S-drill) – Performed on every dive			
Review of Dive Plan and Turn Pressures	X	X	X
Essential Gear Identification, Positioning, and Function Check	X	X	X
Proper Valve Position Check	X	X	X
Bubble Check	X	X	X
Proper Buoyancy Compensator Use	X	X	X
Proper Trim and Body Positioning	X	X	X
Hovering and Buoyancy With Hand Tasks	X	X	X
Specialized Propulsion Techniques and Anti-Silting Techniques (modified flutter kick, modified frog kick, pull and glide, ceiling walk or shuffle)	X	X	X
Proper Light and Hand Signal Use	X	R	R
Proper Reel and Guideline Use	X	X	X
Ability to Deploy a Primary Reel and Tie Into a Main Line Under Different Conditions (Flow, Visibility, Bottom/Silt, etc.)	X	X	X
Proper Line Placement and Etiquette	X	X	X
Proper Use of Safety Reel		X	X
Proper Use of Jump/Gap Reel(s)		X	X
<b>Use of Drop/Stage Cylinders</b>			
Proper Placement and Retrieval of Cylinder(s) With Minimal Disturbance of Environment and Visibility		IA	IA
Ability to Deploy and Retrieve Cylinders With Minimal Loss of Forward Progress		IA	IA
Surveying	IA	IA	IA
Ability to Properly Critique Their Dives and Performance	X	X	X
Zero Visibility Drills	IA	X	X
Line Reel Use	X	R	R
Buddy Communication	X		
Line and Line Arrow Identification and Following	X	R	R

Bump and Go (Skills Description)		X	X
Emergency Procedures			
Team Positioning for Emergency Situations	X	X	X
Lost Line (Skills Description)		X	X
Lost Buddy	X	X	X
Gas Sharing While Following Guideline (Conducted with and without visibility, As Donor and Receiver)	X	X	X
Gas Sharing in a Minor Restriction Using a Single File Method As Donor and Receiver		X	X
Valve Manipulation	X	X	X
Proper Attitude, Judgment, and Discipline To Safely Conduct Dives In An Overhead Environment	X	X	X
<b>Written Examination</b>			
A written evaluation approved by the DCB with a predetermined passing score, covering concepts of both classroom and practical training	X	X	X

## 12.40 Equipment Requirements

Equipment used for SCUBA in cave or cavern diving is based on the concept of redundancy. Redundant SCUBA equipment must be carried whenever the planned penetration distances are such that an emergency swimming ascent is not theoretically possible.

Minimum Equipment	Cavern OC	Rebreather Cavern	Cave OC	Rebreather Cave
Key: X = include, R = Review, IA = If Applicable, OC = Open Circuit				
At a minimum, a single cylinder with adequate volume and configured to allow divers to exit from farthest/deepest penetration while supporting self and dive buddy equipped with a “K” valve; standard OC regulator configuration ( <a href="#">Section 3.20</a> ); and BCD	X			
At minimum, a single cylinder equipped with an “H” or “Y” valve Or an alternate gas supply with adequate volume and configured to allow divers to exit from farthest/deepest penetration while supporting self and dive buddy			IA	
Off-board/bailout gas supply of sufficient volume and configured to allow diver to exit from farthest/deepest penetration	IA	X		X
A BCD capable of being inflated from the cylinder	X	X	X	X
Slate and pencil	X	X	X	X
A functioning primary light with sufficient burn time for the planned dive			X	X
Two functioning battery powered secondary lights	X	X	X	X
Two cutting devices	X	X	X	X
One primary reel of at least 350 feet (106 m) for each team	X	X	X	X
Safety reel with at least 150 feet (45.6 m) of line			X	X
Directional Line Markers			X	X
Cylinders with dual orifice isolation valve manifold Or independent SCUBA systems* with enough volume for			X	

the planned dive plus required reserve				
Two completely independent regulators, at least one of each having submersible tank pressure gauge and a low pressure inflator for the BCD			X	
One regulator to be configured with a five foot or longer second stage hose			X	
Rebreather		X		X
Off-board Bailout of sufficient capacity for the diver to exit to the surface		X		X
*Independent SCUBA systems must be configured to allow for monitoring of gas pressures in each cylinder				

## 12.50 Operational Requirements and Safety Protocols

Operational Requirements and Safety Protocols	Cavern	Cave
Diving must not be conducted at penetration distance into the overhead environment greater than 200 feet (60 m) from the water's surface, with a depth limit of 100 feet (30 m)	X	
Dive teams must perform a safety drill prior to each dive that includes equipment check, gas management, and dive objectives	X	X
Each team within the overhead zone must utilize a continuous guideline appropriate for the environment leading to a point from which an uninterrupted ascent to the surface may be made	X	X
Gas management must be appropriate for the planned dive with special considerations made for; DPV's, siphon diving, rebreathers, etc.	X	X
The entire dive team is to immediately terminate the dive whenever any dive team member calls (terminates) the dive	X	X



## **SECTION 13.00 SNORKELING OR SWIMMING**

### *Florida Atlantic University Standards for Snorkelers*

Personnel conducting these activities must adhere to the following standards and procedures.

#### **13.10 Definitions**

Snorkeler - Any person who is wholly or partially submerged in the water and is equipped with a face plate (face mask or swim goggles) with or without swim fins or snorkel.

Swimmer - Any person wholly or partially submerged in water without a face plate (face mask or swim goggles) but may be using other types of swim aids such as fins.

#### **13.20 General Guidelines**

- a) Refer to FAU's Surface-Water Activities Manual for snorkeling and swimming regulations.

## SECTION 14.00 DIVING FROM VESSELS

### *Florida Atlantic University Standards for Diving from Vessels*

More information regarding scientific boating at FAU can be found in the Boating Safety Manual or by contacting the Diving and Boating Safety Officer.

#### **13.10 Diving from FAU Vessels**

- a) An FAU Float Plan must be submitted and approved along with the Dive Plan.
- b) The vessel operator or captain is ultimately responsible for the safe conduct of all diving operations. The Dive Supervisor or Lead Diver must provide the vessel operator or captain with all information requested to assure safety of divers during dive operations.
- c) No FAU vessel operator may allow diving or snorkeling operations to be conducted from a boat or vessel under their authority without a dive or snorkel plan approved by the Diving Safety Officer.
- d) No divers shall exit or enter the water without permission from the vessel operator or designee. Boat engines must be turned off when discharging or retrieving divers.
- e) If motoring into an area where divers are in the water, vessel must be slowed to idle speed and if available watches should be posted on the bow to look for bubbles.
- f) It is the responsibility of the vessel operator to conduct a head count prior to departing the area of dive operations and assure that all divers and other personnel have been accounted for.
- g) A legal diver's down flag or Alpha flag if in international waters must be displayed from the support vessel at all times when divers are in the water.
- h) The support vessel must be equipped with an SSB and/or VHF radio and/or cell phone or satellite phone, first-aid kit, and emergency oxygen resuscitator.
  - Any change to this must be discussed with and approved by the FAU DBSO.
- i) When diving in currents, if the vessel is at anchor, a tag line with a float must be streamed approximately 100' behind the vessel. During drift dives a surface float will be towed by the dive party.
- j) When diving from a mother vessel, a small support vessel must be readied for immediate launch, or preferably in the water to retrieve fatigued or incapacitated divers.
- k) A boat operator must remain aboard the support vessel at all times during the dive unless this requirement is waived by the Diving Supervisor under certain circumstances, such as shallow dives in calm conditions or use of permanently moored buoys.
- l) Scuba diving during submersible operations must be approved by the on-board Dive Supervisor and Operations Director; must maintain radio contact with the mother vessel; and must maintain a boat operator on board the support vessel during the dive.

- m) If more than 4 divers are in the water at the same time, the Lead Diver should appoint one person to remain aboard and monitor divers in the water.
- n) Divers must carry a whistle and inflatable emergency tube (diver sausage); for offshore diving, an air-powered horn and safety flares are recommended.
- o) Prior to the dive, the dive team must record the coordinates or location of the dive site, time of start of dive, and planned time for end of dive. This log should remain on board with the boat operator.

### *Missing Diver Protocols*

- a) The Diver Supervisor or Lead Diver must notify the vessel operator or captain immediately if at any time a diver becomes missing.
- b) A float should be anchored at the last known point where the diver was present and a second float should be deployed and allowed to drift with the current.
- c) The vessel operator should recall and recover any remaining divers and begin a search beginning at the dive site and working down current considering the rate of drift.
- d) The vessel operator or captain should establish contact with the Coast Guard (Channel 16 in US).
- e) The vessel operator should issue a general PAN call on Channel 16 and all commonly used channels with the statement: “PAN, PAN ... all vessels please be on the lookout for missing divers, state name and description of your vessel, location, depth, how many divers, and the time they should have surfaced.

### **13.20 Diving from Non-FAU Vessels**

- a) A dive plan must be submitted and approved.
- b) An official FAU float plan does not need to be submitted and approved.
- c) Someone must stay aboard the vessel at all times.
- d) An unofficial PFD float plan can be submitted with a responsible person if the divers would like.
- e) Emergency equipment must be aboard the vessel (i.e. First Aid kit and O<sub>2</sub> kit).
- f) Any change to this must be discussed with and approved by the FAU DBSO.
- g) The vessel must meet the specifications set by the FAU Boating Safety Manual.
- h) The vessel operator must meet the specifications set by the FAU Boating Safety Manual.
  - Any exception to this must be approved by the DBSO and documented appropriately.
- i) If the vessel is under the auspices of another institution/organization, the more stringent policies must be followed.

- j) The vessel operator or captain is ultimately responsible for the safe conduct of all diving operations.

# Appendices

# APPENDIX 1 DIVING MEDICAL EXAM OVERVIEW FOR THE EXAMINING PHYSICIAN

## TO THE EXAMINING PHYSICIAN:

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

\_\_\_\_\_  
Organizational Member

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

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

\_\_\_\_\_  
Date

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

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

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

### CONDITIONS WHICH MAY DISQUALIFY CANDIDATES FROM DIVING

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

## SELECTED REFERENCES IN DIVING MEDICINE

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

- Elliott, D.H. ed. 1996. *Are Asthmatics Fit to Dive?* Kensington, MD: Undersea and Hyperbaric Medical Society.
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- Edmonds, C., Lowry, C., Pennefather, J. and Walker, R. 2002. *DIVING AND SUBAQUATIC MEDICINE*, Fourth Edition. London: Hodder Arnold Publishers.
- Bove, A.A. ed. 1998. *MEDICAL EXAMINATION OF SPORT SCUBA DIVERS*, San Antonio, TX: Medical Seminars, Inc.
- NOAA DIVING MANUAL, NOAA. Superintendent of Documents. Washington, DC: U.S. Government Printing Office.
- U.S. NAVY DIVING MANUAL. Superintendent of Documents, Washington, DC: U.S. Government Printing Office, Washington, D.C.

## APPENDIX 2

### AAUS MEDICAL EVALUATION OF FITNESS FOR SCUBA DIVING REPORT

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

\_\_\_\_\_  
Date of Medical Evaluation (Month/Day/Year)

**To The Examining Physician:** Scientific divers require periodic scuba diving medical examinations to assess their fitness to engage in diving with self-contained underwater breathing apparatus (scuba). Their answers on the Diving Medical History Form may indicate potential health or safety risks as noted. Scuba diving is an activity that puts unusual stress on the individual in several ways. Your evaluation is requested on this Medical Evaluation form. Your opinion on the applicant's medical fitness is requested. Scuba diving requires heavy exertion. The diver must be free of cardiovascular and respiratory disease (see references, following page). An absolute requirement is the ability of the lungs, middle ears and sinuses to equalize pressure. Any condition that risks the loss of consciousness should disqualify the applicant. Please proceed in accordance with the AAUS Medical Standards (Sec. 5.00). If you have questions about diving medicine, please consult with the Undersea Hyperbaric Medical Society or Divers Alert Network.

#### TESTS: THE FOLLOWING TESTS ARE REQUIRED:

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

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

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

- Chest x-ray (Required only during first exam over age 40)
- Resting EKG
- Assessment of coronary artery disease using Multiple-Risk-Factor Assessment<sup>1</sup>  
(age, lipid profile, blood pressure, diabetic screening, smoking)

Note: Exercise stress testing may be indicated based on Multiple-Risk-Factor Assessment<sup>1</sup>

#### PHYSICIAN'S STATEMENT:

I have evaluated the above mentioned individual according to the tests listed above. 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.

\_\_\_\_\_ 1 - I find no medical conditions that may be disqualifying for participation in scuba diving.

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

\_\_\_\_\_ 2 - Diver **IS NOT** medically qualified to dive: \_\_\_\_\_ Permanently \_\_\_\_\_ Temporarily.

\_\_\_\_\_  
Signature MD or DO \_\_\_\_\_  
Date

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

\_\_\_\_\_  
Address

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

\_\_\_\_\_  
E-Mail Address

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

My familiarity with diving medicine is: \_\_\_\_\_



## APPENDIX 2b

### AAUS MEDICAL EVALUATION OF FITNESS FOR SCUBA DIVING REPORT

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

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

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

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

---

#### REFERENCES

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

# APPENDIX 3 DIVING MEDICAL HISTORY FORM

(To Be Completed By Applicant-Diver)

Name \_\_\_\_\_ DOB \_\_\_\_ Age \_\_\_\_ Wt. \_\_\_\_ Ht. \_\_\_\_

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

**TO THE APPLICANT:**

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

This form must be kept confidential by the examining physician. If you believe any question amounts to invasion of your privacy, you may elect to omit an answer, provided that you must subsequently discuss that matter with your own physician who must then indicate, in writing, that you have done so and that no health hazard exists.

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

	Yes	No	Please indicate whether or not the following apply to you	Comments
1			Convulsions, seizures, or epilepsy	
2			Fainting spells or dizziness	
3			Been addicted to drugs	
4			Diabetes	
5			Motion sickness or sea/air sickness	
6			Claustrophobia	
7			Mental disorder or nervous breakdown	
8			Are you pregnant?	
9			Do you suffer from menstrual problems?	
10			Anxiety spells or hyperventilation	
11			Frequent sour stomachs, nervous stomachs or vomiting spells	
12			Had a major operation	
13			Presently being treated by a physician	
14			Taking any medication regularly (even non-prescription)	
15			Been rejected or restricted from sports	
16			Headaches (frequent and severe)	
17			Wear dental plates	
18			Wear glasses or contact lenses	
19			Bleeding disorders	
20			Alcoholism	
21			Any problems related to diving	
22			Nervous tension or emotional problems	

	Yes	No	Please indicate whether or not the following apply to you	Comments
23			Take tranquilizers	
24			Perforated ear drums	
25			Hay fever	
26			Frequent sinus trouble, frequent drainage from the nose, post-nasal drip, or stuffy nose	
27			Frequent earaches	
28			Drainage from the ears	
29			Difficulty with your ears in airplanes or on mountains	
30			Ear surgery	
31			Ringing in your ears	
32			Frequent dizzy spells	
33			Hearing problems	
34			Trouble equalizing pressure in your ears	
35			Asthma	
36			Wheezing attacks	
37			Cough (chronic or recurrent)	
38			Frequently raise sputum	
39			Pleurisy	
40			Collapsed lung (pneumothorax)	
41			Lung cysts	
42			Pneumonia	
43			Tuberculosis	
44			Shortness of breath	
45			Lung problem or abnormality	
46			Spit blood	
47			Breathing difficulty after eating particular foods, after exposure to particular pollens or animals	
48			Are you subject to bronchitis	
49			Subcutaneous emphysema (air under the skin)	
50			Air embolism after diving	
51			Decompression sickness	
52			Rheumatic fever	
53			Scarlet fever	
54			Heart murmur	
55			Large heart	
56			High blood pressure	
57			Angina (heart pains or pressure in the chest)	
58			Heart attack	

	Yes	No	Please indicate whether or not the following apply to you	Comments
59			Low blood pressure	
60			Recurrent or persistent swelling of the legs	
61			Pounding, rapid heartbeat or palpitations	
62			Easily fatigued or short of breath	
63			Abnormal EKG	
64			Joint problems, dislocations or arthritis	
65			Back trouble or back injuries	
66			Ruptured or slipped disk	
67			Limiting physical handicaps	
68			Muscle cramps	
69			Varicose veins	
70			Amputations	
71			Head injury causing unconsciousness	
72			Paralysis	
73			Have you ever had an adverse reaction to medication?	
74			Do you smoke?	
75			Have you ever had any other medical problems not listed? If so, please list or describe below;	
76			Is there a family history of high cholesterol?	
77			Is there a family history of heart disease or stroke?	
78			Is there a family history of diabetes?	
79			Is there a family history of asthma?	
80			Date of last tetanus shot? Vaccination dates?	

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

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

---

Signature

Date

## APPENDIX 4 DEFINITION OF TERMS

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

*DPIC* – See Designated Person-In-Charge.

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

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

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

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

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

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

*FSW* - Feet of seawater.

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

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

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

*Hookah* - While similar to Surface Supplied in that the breathing gas is supplied from the surface by means of a pressurized hose, the supply hose does not require a strength member, pneumofathometer hose, or communication line. Hookah equipment may be as simple as a long hose attached to a standard scuba cylinder supplying a standard scuba second stage. The diver is responsible for the monitoring his/her own depth, time, and diving profile.

*Hyperbaric Chamber* - See Recompression chamber.

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

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

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

*Life Support Equipment* – Underwater equipment necessary to sustain life.

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

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

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

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

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

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

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

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

*OTU* - Oxygen Toxicity Unit

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

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

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

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

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

*Pressure Vessel* - See cylinder.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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



## APPENDIX 5 AAUS REQUEST FOR DIVING RECIPROCITY FORM



### VERIFICATION OF DIVER TRAINING AND EXPERIENCE

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

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

This letter serves to verify that the above listed person has met the training and pre-requisites as indicated below, and has completed all requirements necessary to be certified as a Scientific Diver/Diver in Training as established by the Florida Atlantic University Diving Safety Manual, and has demonstrated competency in the indicated areas. Florida Atlantic University 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 FAU:

(Date)

\_\_\_\_\_ Original diving authorization  
\_\_\_\_\_ Written scientific diving examination  
\_\_\_\_\_ Last diving medical examination      Medical examination expiration date \_\_\_\_\_  
\_\_\_\_\_ Most recent checkout dive  
\_\_\_\_\_ Scuba regulator/equipment service/test  
\_\_\_\_\_ CPR training (Agency) \_\_\_\_\_      CPR Exp. \_\_\_\_\_  
\_\_\_\_\_ Oxygen administration (Agency) \_\_\_\_\_      O<sub>2</sub> Exp. \_\_\_\_\_  
\_\_\_\_\_ First aid for diving \_\_\_\_\_      F.A. Exp. \_\_\_\_\_  
\_\_\_\_\_ Date of last dive \_\_\_\_\_ Depth \_\_\_\_\_

Number of dives completed within previous 12 months? \_\_\_\_\_      Depth Certification \_\_\_\_\_ fsw

Total number of career dives? \_\_\_\_\_

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

Please indicate any pertinent specialty certifications or training:

#### Emergency Information:

Name: \_\_\_\_\_ Relationship: \_\_\_\_\_  
Telephone: \_\_\_\_\_ (work) \_\_\_\_\_ (home)  
Address: \_\_\_\_\_

This is to verify that the above individual is currently a certified scientific diver at Florida Atlantic University.

#### Diving Safety Officer:

\_\_\_\_\_  
(Signature)      (Date)

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

Florida Atlantic University is an Organizational Member in good standing with the American Academy of Underwater Sciences.

# APPENDIX 6 EMERGENCY ACTION PLAN

## Introduction

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

## General Procedures

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

1. Make appropriate contact with victim or rescue as required.
2. Establish (A)irway (B)reathing (C)irculation or (C)irculation (A)irway (B)reathing as appropriate
3. Stabilize the victim
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. 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.
5. Call appropriate Diving Accident Coordinator for contact with diving physician and recompression chamber, etc.
6. Notify DBSO or designee according to the Emergency Action Plan of the OM.
7. Complete and submit Incident Report Form ([www.aaus.org](http://www.aaus.org)) to the DCB of the organization and the AAUS ([Section 2.70 Required Incident Reporting](#)).

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(revised 8/12/2019)

## EMS CALL-IN DATA REQUIREMENTS

In the event of a Diving Accident, the following data should be available if possible when EMS contact is initiated. And, should be given to EMS transport to be delivered to hyperbaric treatment personnel.

Name of Diver \_\_\_\_\_

Emergency Contact Name and Phone Number  
\_\_\_\_\_

### Details of last dive:

Name of buddy diver \_\_\_\_\_

Depth \_\_\_\_\_

Bottom time \_\_\_\_\_

Breathing gas (air, Nitrox, mix) \_\_\_\_\_

Decompression table or dive computer used \_\_\_\_\_

Time at end of dive \_\_\_\_\_

Time at onset of symptoms \_\_\_\_\_

### Details of previous repetitive dive:

Date/Time \_\_\_\_\_

Surface Interval \_\_\_\_\_

Depth \_\_\_\_\_

Bottom time \_\_\_\_\_

Name of buddy diver \_\_\_\_\_

Decompression table or dive computer used \_\_\_\_\_

Breathing gas \_\_\_\_\_

### Describe symptoms in detail:

What \_\_\_\_\_

Where \_\_\_\_\_

Intensity \_\_\_\_\_

Record any changes in symptoms and time \_\_\_\_\_  
\_\_\_\_\_

**Results of neurological exam, vital signs, and secondary assessment:**

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**Diver's medical history:**

Allergies \_\_\_\_\_

Current medication \_\_\_\_\_

Recent illness \_\_\_\_\_

Previous decompression sickness or embolism \_\_\_\_\_

**Describe any treatment of diver:**

Medication \_\_\_\_\_

Record time and volume of liquid intake and output \_\_\_\_\_

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Oxygen (time on/off, %) \_\_\_\_\_

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**Recompression chamber:**

Test of pressure results \_\_\_\_\_

Treatment table \_\_\_\_\_

Time and duration \_\_\_\_\_

Name of operator \_\_\_\_\_

Change in symptoms \_\_\_\_\_

**Comments:** \_\_\_\_\_

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## Introduction

The FAU Dive Accident Management Appendix adapted from the Harbor Branch Oceanographic Institute's Diving Safety and Standards Manual, and is a compilation of basic information on how to identify and stabilize a diving accident victim and how to get a diver into the hyperbaric trauma care system (diving physician and recompression chamber). It is meant for use as a guide by FAU divers, Diving Supervisors, Divers-in-Charge and evacuation personnel who have little understanding of hyperbaric (diving) medicine.

Portions of this manual have been excerpted from the following sources:

American Heart Association, 1992. Cardiopulmonary Resuscitation CPR. Fourth Edition. CPR Publishers, Inc./ Tulsa, OK, 56 pp.

Cory, J., 1989. Student Workbook for Emergency Oxygen Administration and Field Management of Scuba Diving Workshop. National Association of Underwater Instructors. 65 pp.

Daugherty, C.G., 1992. Field Guide for the Diver Medic. Coastal Aquatics Publications, Austin TX, 177 pp.

Davis, J. (ed.), 1986. Medical Examination of Sport Divers. Best Publ. Co., P.O. Box 1978, San Padre, CA 90733.

Divers Alert Network, 1993. DAN Underwater Diving Accident Manual. Divers Alert Network, Duke University Medical Center, Durham, NC, 69 pp.

Divers Alert Network, 1993. DAN Oxygen First Aid in Dive Accidents. Divers Alert Network, Duke University Medical Center, Durham, NC, 63 pp.

Hendrick, W. and A. Zaferes, 1991. The Field Neurological for Diving Emergencies. Lifeguard Systems, Inc., 28 pp.

NURP, 1987. Diving Operations and Procedures Manual. National Oceanic and Atmospheric Administration, National Undersea Research Program at Univ. North Carolina at Wilmington, 93 pp.

Harbor Branch Oceanographic Manual, 2009. Diving Standards and Safety Manual, Ft. Pierce, FL, 160pp.

Rutowski, D., 1991. Recompression Chamber Life Support Manual. Rosentiel School of Marine and Atmospheric Science, Univ. of Miami, 110 pp.

Woods Hole Oceanographic Institution, 1983. Diving Safety Manual, 89 pp.

## General Procedures

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 treatment is initiated as soon as possible. A comprehensive list of emergency phone numbers and contacts for diving physicians and recompression centers can be found in [Appendix 7](#) and in conjunction with this section should be used as a guide to on-site response to diving emergencies, and in preparing the Diving Accident Emergency Management Plan sheet of the FAU Dive Plan ([Appendix E](#)).

### Preparedness

- All diving personnel must be prepared to respond in the event of a diving accident.
- Periodic retraining and routine practice are essential elements in emergency preparedness; emergency drills are encouraged.

### On-Site Accident Management Procedures

- The Diver-in Charge or Diving Supervisor shall take charge at the scene of the accident and delegate tasks to other responsible individuals.
- Stabilize life-sustaining functions and follow the Accident Management Flow Chart.
- Establish radio communications through the Master of the Vessel, or phone contact with local EMS, with the predetermined medical facility.
- Transmit the following information to the physician:
  1. Accident Call-in Data
  2. Neurological Exam Checklist
  3. Checklist for Secondary Assessment of Injury
- All diving equipment of accident victim must be kept intact and tagged for later inspection and analysis.
- In certain cases or circumstances, recompression treatment may be conducted in onboard recompression chambers. In such circumstances, the medical standing orders shall follow the protocol of FAU/HBOI's Recompression Chamber Manual, Daugherty's Field Guide for the Diver's Medic (1992), and the U.S. Navy Diving Manual (1993).

### Emergency Evacuation

- If afloat, the Master of Vessel should contact the U.S. Coast Guard (radio HF-2182, VHF Channel 16) or other appropriate authorities.
- If on land, contact local EMS and follow EMS directions.
- Follow medical evacuation procedures.
- Follow helicopter procedures, as necessary.

### Notification of Authorities

- After any serious diving incident, The Lead Diver or Diving Supervisor must notify the Diving Safety Officer, or as soon as possible and provide the following:
- Complete AAUS Incident Report Form
  - Name, address, phone numbers of the principal parties.
  - Summary of experience of divers involved.
  - Location, description of dive site and description of conditions that led up to the incident.
  - Description of symptoms, including depth and time of onset.
  - Description and results of treatment.
  - Disposition of the case.



- Recommendations to avoid repetition of incident.
- The FAU DBB will investigate and document any incident of pressure-related injury and prepare a report which is to be forwarded to the AAUS during the annual reporting cycle. This report must be first reviewed and released by the FAU DBB.
- After any diving incident resulting in any injuries or symptoms, a written report (using the AAUS Accident or Incident Reporting Form), shall be submitted within one week by the Diver-In-Charge to the DBSO.

### **Medical Procedures**

Depending on the nature of the diving accident, stabilize the patient, administer oxygen, and contact the diving physician, and contact air transport and also recompression chamber, if necessary. Explain the following steps to evacuation teams, medics and physicians. Do not assume that they understand why oxygen may be required for all diving accident victims or that recompression treatment may be necessary.

- Administer CPR, if required.
- Keep air-way open and prevent aspiration of vomitus.
- Protect victim from excessive heat or cold and treat for shock, if necessary.
- Administer 100% oxygen by tight-fitting mask at the highest possible oxygen concentration.
- Do not remove oxygen unless necessary to reopen air-way or victim shows signs of convulsions.
- If convulsion occurs, do not forcefully restrain but hold loosely to prevent self-injury. Resume oxygen administration after convulsions subside.
- Do not give pain killing drugs.
- Give conscious patients non-alcoholic liquids such as fruit juices or water. Try to achieve urine output of 1-2 ounces (30-60 cc)/hour. Discontinue fluids if victim is unable to urinate.
- For conscious or seriously injured victims, qualified medical personnel may administer intravenous electrolyte solutions, e.g., Ringer's lactate or normal saline (100cc/hour). Do not use 5% dextrose in water.
- Administer rapid neurological exam, check for secondary injuries, and fill out medical logs, if time and circumstances permit.
- Contact physician experienced in diving medicine or Divers Alert Network, and state information recorded.
- If recompression treatment is required, contact recompression facility before sending victim.
- If air evacuation is required, instruct the flight crew that cabin pressure must be maintained as close to sea level as possible and below 800 feet.
- Transport with victim the information recorded above and also the diving buddy, if possible.
- The victim's depth gauge, tank, regulator and other diving equipment must be kept intact and tagged for later inspection and analysis.

In any diving accident, certain questions should be resolved quickly in order to best ascertain course of action. Most important of all, did the victim breathe compressor air at depth? If not the accident should not in fact be treated as a dive accident at all. This is an important consideration for emergency medical personnel and physicians to know when a victim is to be transported to a treatment facility. Next, are the symptoms severe (life threatening), or mild (can wait until medical help is reached)



CPR HCP

## Scene Safety Assessment

- S** Stop
- A** Assess Scene
- F** Find Oxygen Kit, First Aid Kit, AED and take to injured person
- E** Exposure Protection

## Initial Assessment

- Assess responsiveness, presence of normal breathing and a definite pulse (carotid)
- If unresponsive and not breathing normally, call 911
- Begin CPR — start with chest compressions

## CPR — Adult (One rescuer)

Do not delay CPR to wait on an AED or other equipment .

- Use nipple line to find landmark at center of the chest for compressions
- Deliver 30 compressions. (at least 100-120 per minute)
- Deliver 2 normal breaths, about 1 second, using barrier device
- Continue CPR cycles of 30:2

### Two Rescuers

- One rescuer does chest compressions.
  - Pause compressions for ventilations; resume immediately following rescue breaths
- Second rescuer provides rescue breaths
- Switch roles every 2 minutes or after 5 cycles of 30:2

## Using an AED

- Continue chest compressions while AED is set up
- Turn the unit on, and follow prompts provided by the unit.
- Bare and dry the person's chest.
  - Cut away clothing or shave off chest hair if necessary.
- Apply pads firmly to the person's bare chest. Follow illustrations on pads for placement.
- Allow AED to analyze heart rhythm
- If the AED indicates 'shock advised',
  - Clear the scene both verbally and visually.
  - State: "I'm clear, you're clear, all clear";
- Deliver shock when indicated.
- **Immediately** following the shock, resume chest compressions.
- Deliver 2 minutes of CPR; leave AED pads in place until EMS arrives
  - Follow prompts of the AED unit for reassessment.

(Do not pause compressions to reassess person unless he moves or breathes.)

Victim	One Rescuer	Two Rescuers	How to Compress	Depth
Adult	30:2	30:2	Two hands	2-2.5 inches (5-6 centimeters)
Child	30:2	15:2	One or two hands	2 in. (5 cm) or 1/3 chest depth
Infant	30:2	15:2	Two or three fingers	1 1/2 in. (3.5 cm) or 1/3 chest depth

NOTE: The rate of compressions is 100-120 per minute for all ages.

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## CPR: Health Care Provider

CPR-HCP

### CPR for Children (one rescuer)

- Assess responsiveness -tap collar bone and loudly ask "are you ok?"
- Check for presence of normal breathing and a definite pulse (carotid)
- If unresponsive and not breathing normally, begin CPR starting with chest compressions using heel of one hand
- After 2 minutes of CPR, call EMS if someone has not already done so
- If available, use AED as with an adult; use pediatric pads if available

#### Two Rescuers

- One rescuer performs compressions, second rescuer performs rescue breaths
- Use same technique as describe above
- Compression to ventilation ratio changes to 15:2
- Pause compression for rescue breaths

### CPR for Infants (one rescuer)

- Assess responsiveness-tap sole of foot and loudly ask "are you ok?"
- Check for presence of normal breathing and a definite pulse (inside upper arm)
- If unresponsive and not breathing normally, begin CPR
  - Place 2-3 fingers in the center of the chest between the nipples
- Compress about 1/3 the diameter of the chest
- After 2 minutes of CPR, take the infant with you to call EMS if not already done
- If available, use AED placing pads in center of both chest and back (use pediatric pads if available)

#### Two Rescuers

- One rescuer performs compressions, second rescuer performs rescue breaths
- Compression to ventilation ratio changes to 15:2
  - Rescuer performing compression can switch to 'hands circling the chest and 2 thumbs compressing'
- Pause compression for rescue breaths

### Foreign Body Airway Obstruction (adults and children)

- Locate navel and place balled fist, thumb in, against stomach above navel
- Place other hand over fist
- Pull sharply inward and upward until obstruction is released
- If person becomes unconscious, begin CPR starting with compressions

#### Foreign Body Airway Obstruction (infants)

- Place the infant face down on your forearm cupping the head with your hand
- Deliver 5 back blows between shoulder blades
- Place other forearm over infant creating a sandwich and turn infant over, face up
- Deliver 5 chest thrust as with CPR
- Alternate infant's position face down-back blows/face up-chest thrusts until object is released

### First Aid

- Bleeding — apply firm, direct pressure to the wound until bleeding has stopped. Bandage.
- Apply a tourniquet for severe arterial bleeding.
  - Place 1-2" above the wound with windlass over bleeding artery. Turn windlass, secure.
  - Note "T" or "TK" on injured person's forehead.
  - Seek medical attention immediately, continue to monitor and provide verbal support.
- Shock — maintain normal body temperature, provide warmth or cooling as needed
- Splinting — Apply splint to injured limb, keep limb in position found, immobilizing joints above and below the injury.

### Suctioning

- Adults — no more than 15 seconds (back of mouth)
- Infants — no more than 5 seconds (mouth first then nose if necessary)

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## Emergency Oxygen for Scuba Diving Injuries

### Scene Safety Assessment

- S** Stop.
- A** Assess scene.
- F** Find oxygen unit, first aid kit and AED, and take to injured person.
- E** Exposure protection.

### Initial Assessment

- Assess responsiveness and normal breathing
  - Tap the individual's collar bone and loudly ask "Are you OK?"
  - State your name and desire to help.
- If the individual responds, have him remain in the position found.
- If unresponsive but breathing normally, place in recovery position
- If not breathing normally, begin CPR.
  - Shout for help or send a specific person to call EMS.

### Steps to Initiate Oxygen Delivery

- Turn the unit on with one full turn.
- Check the pressure gauge on the tank to assure cylinder is full.
- Ask the injured diver for permission to assist:
  - "This is oxygen. It may help you feel better. May I help you?"
  - If the diver is unresponsive, permission is assumed.

### Breathing Diver – Demand Valve

- Constant flow setting should be in the OFF position.
- Place an oronasal mask on the demand valve.
- Take a breath from the oronasal mask and exhale away from the mask.
- Place the mask over the injured diver's mouth and nose.
- Adjust the elastic strap to assure a snug fit.
  - Check for leaks.
  - Instruct the injured diver to hold the mask.
- Instruct the injured diver to breathe normally from the mask.

### Breathing Diver – Non-Rebreather Mask

- Stretch oxygen tubing to remove kinks.
- Attach tubing to constant flow outlet.
- Set constant flow control at 10-15 lpm.
- Prime mask reservoir bag.
- Place mask over injured diver's mouth and nose.
- Adjust nose clip and elastic strap to ensure a (snug) seal.
- Adjust flow up or down to meet the needs of the injured diver.
  - If reservoir bag deflates completely, increase flow.
  - If flow has been increased to maximum lpm and bag still deflates, switch to demand valve.

OXYGEN

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## Emergency Oxygen for Scuba Diving Injuries

OXYGEN

### Non-Breathing Diver – Bag Valve Mask (BVM)

**First rescuer** begins CPR.

**Second rescuer** prepares oxygen equipment, maintains airway and seal then monitors oxygen supply.

- Stretch tubing to remove kinks.
- Connect tubing to constant flow outlet.
- Set constant flow to 15 lpm; allow reservoir bag to fill.
- Position mask over injured diver's mouth and nose.
- Open airway using head tilt-chin lift, lifting jaw into mask and creating seal.
- **First rescuer** ventilates injured diver by gently squeezing the bag about one-third of volume causing chest to rise.
  - Deliver two ventilations for 1 second each.
  - Watch for chest to rise then fall between ventilations.
- Continue CPR cycles of 30:2.

If oxygen supply runs out, continue to ventilate using room air.

### Non-Breathing Diver – Manually Triggered Ventilator (MTV)

**First rescuer** begins CPR.

**Second rescuer** prepares oxygen equipment, maintains airway and seal then monitors oxygen supply.

- Check MTV safety valve to ensure proper function.
  - Press resuscitation button, block outlet – flow should stop.
  - Do not use if it does not function properly.
- Connect oronasal resuscitation mask to MTV.
- Position mask over injured diver's mouth and nose, adjust elastic strap to assure snug fit.
- Open airway using head tilt-chin lift, lifting jaw into mask and creating seal.
- **First rescuer** ventilates injured diver by pressing resuscitation button.
  - Deliver 2 ventilations for 1 second each.
  - Watch for chest to rise then fall between ventilations.
- Continue CPR cycles of 30:2.

If oxygen supply runs out, switch to another ventilation method.

### General Guidelines

- Monitor oxygen supply.
- Monitor injured diver for changes in level of consciousness and signs of circulation.
- Never leave injured diver alone.
- Activate emergency assistance plan if not already initiated.

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# Neurological Assessment

## History

Date \_\_\_\_\_ Time \_\_\_\_\_

First Name \_\_\_\_\_ MI \_\_\_ Last Name \_\_\_\_\_

## Conduct F A S T (check areas of abnormal findings)

Facial Symmetry  Arms  Speech/Sudden Headache  Time (activate EMS)

## Complete S A M P L E (note responses in spaces provided)

Signs and Symptoms \_\_\_\_\_

Allergies \_\_\_\_\_

Medications \_\_\_\_\_

Pre-existing conditions \_\_\_\_\_

Last oral intake (what and time) \_\_\_\_\_

Events leading up to incident \_\_\_\_\_

## For Divers:

### Dives during previous 24 hours:

Last dive – Depth \_\_\_\_\_ Bottom Time \_\_\_\_\_ Breathing Gas \_\_\_\_\_  
Surface interval \_\_\_\_\_

Previous dive – Depth \_\_\_\_\_ Bottom Time \_\_\_\_\_ Breathing Gas \_\_\_\_\_  
Surface interval \_\_\_\_\_

Previous dive – Depth \_\_\_\_\_ Bottom Time \_\_\_\_\_ Breathing Gas \_\_\_\_\_  
Surface interval \_\_\_\_\_

Previous dive – Depth \_\_\_\_\_ Bottom Time \_\_\_\_\_ Breathing Gas \_\_\_\_\_  
Surface interval \_\_\_\_\_

Previous dive – Depth \_\_\_\_\_ Bottom Time \_\_\_\_\_ Breathing Gas \_\_\_\_\_

Unusual features of any dive \_\_\_\_\_

Did the diver use (check as applicable):  Computer  Dive Tables  Other

Location of any pain \_\_\_\_\_

Does movement change level of pain? (circle one) Yes No

NOTE: attach dive buddy and/or witness comments: \_\_\_\_\_

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

NEURO

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# Neurological Assessment

**Vital Signs** Pulse \_\_\_\_\_ Respiration rate \_\_\_\_\_

## Mental Function

### Consciousness (check one):

- Alert
- Verbal
- Pain
- Unresponsive

### Orientation (check erroneous answers):

- What is your name?
- Where are you?
- What is the day and time?
- Why are you here?

Ability to follow commands (check one)  Yes  No

“Stick out your tongue and close your eyes.”

Ability to repeat a simple phrase  Yes  No

Ex.: “no if, ands, or buts.”

Name 3 objects (able to complete – check one)  Yes  No

Abstract reasoning (able to explain relationship):  Yes  No

Ex.: Father/Son Student/Teacher Pencil/Paper

Calculations - count backwards from 100 by 7s (circle misses):

93 86 79 72 65 58 51 44 37 30 23 16 9 2

Memory - recall of 3 items identified earlier (check one):  Yes  No

## Cranial Nerves

Eyes (circle any direction unable to look): Left Right Up Down

Facial Symmetry “Close your eyes and smile”  Yes  No

Hearing Symmetrical from about 1 foot (circle one):  Yes  No

## Motor Function

Scale (note in blank next to area): Normal (N) Weak (W) Paralysis (P)

**Upper Body** Shoulders L\_\_\_ R\_\_\_ **Lower Body** Hip-Flexors L\_\_\_ R\_\_\_

Biceps L\_\_\_ R\_\_\_ Quadriceps L\_\_\_ R\_\_\_

Triceps L\_\_\_ R\_\_\_ Hamstrings L\_\_\_ R\_\_\_

Finger spread L\_\_\_ R\_\_\_ Foot – up L\_\_\_ R\_\_\_

Grip Strength L\_\_\_ R\_\_\_ Foot – down L\_\_\_ R\_\_\_

## Coordination and Balance

Able to complete: Finger – Nose – Finger (check one)  Yes  No

Walk (check one)  Normal  Wobbly  Unable

Romberg (check one)  Yes  No

## Exam Repeated

Time \_\_\_\_\_ Comments \_\_\_\_\_

Time \_\_\_\_\_ Comments \_\_\_\_\_

NEURO

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# First Aid for Hazardous Marine Life Injuries

## Scene Safety Assessment

- S** Stop.
- A** Assess the scene.
- F** Find oxygen unit, first aid kit and AED, and take to injured person.
- E** Exposure protection.

## Initial Assessment

- Assess responsiveness and normal breathing.
  - Tap the individual's collar bone and loudly ask, "Are you OK?"
  - State your name and desire to help.
- If the individual responds, have him remain in the position found.
- If the person is unresponsive but breathing normally, place him in the recovery position.
- If the person is not breathing normally, begin CPR.
  - Shout for help, or send someone to call EMS.

## CPR (Do not delay CPR to wait on an AED or other equipment.)

- Deliver 30 compressions followed by 2 ventilations.
- Continue CPR cycles of 30:2.
- Deploy AED if available.

## Shock Management

- Place person on his back or in position of comfort
- Consider elevating legs 6-12 inches (15-30 cm) if no neck, spine, or pelvic injuries
- Maintain normal body temperature.
- Monitor continuously.
- Do not give fluids.

## Spiny Envenomations (lionfish, stonefish, stingrays, seastars/urchins, crown-of-thorns)

### Signs and Symptoms

- Puncture or laceration
- Pain (intense, sharp, stinging)
- Protruding spines and/or tissue damage
- Local swelling
- Blisters
- Purple or black skin discoloration (possibly)
- Nausea and vomiting
- Shock (rare)
- Respiratory arrest (rare)
- Cardiac arrest (rare)

### First Aid

1. Thoroughly wash area.
2. Remove foreign material with tweezers. (Leave stingray spines in place for removal at medical facility.)
3. Control any bleeding.
4. Manage pain by immersing in non-scalding fresh water (112°F/45°C maximum) for 30-90 minutes. (Cold packs may also be used.)
5. Leave blisters intact.
6. Apply topical antibiotic ointment.
7. Monitor responsiveness.
8. Seek medical evaluation.
9. Use antivenin for stonefish, if indicated.
10. Monitor for allergic reaction and/or infection.

HML

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DAN





## First Aid for Hazardous Marine Life Injuries

### Stings (jellyfish, fire coral, anemones, hydroids)

#### Signs and Symptoms

##### Symptoms may progress rapidly.

- Pain (can be extreme, possibly with breathing)
- Muscle cramps (may be severe)
- Welts
- Burning and itching
- Localized redness and swelling
- Blisters (may be delayed forming)
- Nausea, fatigue, general malaise
- Shock (rare)

#### First Aid

##### Activate emergency medical services immediately if symptoms progress.

1. Inactivate: Irrigate with generous amounts of a mild vinegar solution.
2. Remove tentacles with tweezers. Wear gloves.
3. Wash/irrigate with seawater or sterile saline. Avoid rubbing or use of fresh water.
4. Symptomatic Treatment:
  - Pain relief (hot or cold packs); pain medications, anti-inflammatory agents, topical anesthetic agents
5. Monitor for allergic reaction and/or infection.

### Contact Injuries (sponges, corals, bristle worms)

#### Signs and Symptoms

- Sharp, stinging pain
- Localized redness
- Mild to severe itching
- Swelling
- Burning sensation, numbness
- Blisters
- Bleeding associated with cuts/scrapes

#### First Aid

1. Wash with soap and water.
2. Remove foreign material.
  - a. Cellophane tape may help with bristle removal.
  - b. Irrigate to dislodge debris.
3. Control any bleeding.
4. Leave blisters intact.
5. Eye contact — flush with fresh water; seek medical attention.
6. Monitor for infection.

### Pressure Immobilization Technique (blue-ring octopus, sea snakes and cone shells)

#### Signs and Symptoms

1. Keep injured person still.
2. Wash with soap and water.
3. Remove foreign material if present.
4. Apply dressing over bite.
5. Apply elastic bandage snugly but not excessively tight over the site.
  - Wrap at least 6 inches/15 cm on either side of the wound if possible.
6. Check for adequate circulation/pulse at fingers/toes (capillary refill).
7. Splint affected extremity.
8. Use a sling when the wound is on the hand or arm.
9. Do not remove until at a medical facility.
10. Transport immediately.

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## First Aid for Hazardous Marine Life Injuries

### Traumatic Injuries (control of external bleeding)

#### Signs and Symptoms

- Bites (teeth in wound)
- Severe scrapes

#### First Aid

1. Wash with soap and water.
2. Control bleeding with direct pressure.
3. Apply dressing and bandage.
4. Seek medical evaluation.
5. Monitor for signs of infection.

### Applying a Tourniquet

#### If bleeding is profuse and uncontrolled by direct pressure

- Apply 1-2 inches (2.5-5 cm) above the wound
- Place windlass over bleeding artery
- Turn windlass until bleeding stops and secure in place
- Note "T" or "TK" on injured person's forehead
- Continue to monitor and provide verbal support

### Life-Threatening Complications

#### Signs and Symptoms

- Anaphylactic shock (swelling, itching, airway narrowing, respiratory distress)
- Cardiogenic shock (pale, clammy skin; severe shortness of breath; weak pulse)
- Hypovolemic shock (pale, clammy skin; confusion; weakness; rapid breathing)

#### First Aid

**All are MEDICAL EMERGENCIES. Alert local emergency medical services immediately.**

1. Anaphylaxis: Assist with any prescribed allergy medications.
2. Cardiogenic: Have individual lay on back or in a position of comfort; monitor responsiveness.
3. Hypovolemic: Control any bleeding; lay individual on back or in position of comfort; monitor responsiveness.

### Seafood Poisoning

**Symptoms may progress rapidly with tetrodotoxin (TTX) poisoning. Activate emergency medical services immediately if neurological symptoms appear.**

#### Signs and Symptoms

- Abdominal pain, gastroenteritis
- Nausea, vomiting
- Diarrhea
- Numbness, tingling
- Itching
- Lack of muscle coordination
- Paralysis
- Reversal of hot and cold perception

#### First Aid

1. Monitor responsiveness.
2. Contact the local poison control center. Save fish or vomitus for analysis if available.
3. Seek evaluation from a medical professional when seafood poisoning is suspected.

Emergency Hotline +1-919-684-9111



## **Emergency Evacuation**

Once it has been established that the patient is a diving accident victim, and someone is caring for his immediate medical needs (vital signs, surface oxygen, shock, etc.), someone must also be initiating the evacuation protocol into the hyperbaric trauma system.

Because many divers and/or boaters fail to plan emergency evacuation procedures in advance, a great amount of critical time is often lost, causing needless suffering and possible loss of life. The most important part of any dive and/or boat trip is to know your procedure for emergency evacuation.

Many medical problems, including those resulting from diving accidents, could occur at any time at sea. Because some symptoms are delayed in their onset, it is not only necessary to know how to contact a hyperbaric trauma team at sea, but also on land. Many divers have been diving in one country and returned to another before symptoms occurred.

## **Communications**

If you have a radio on board, contact the Coast Guard Directly, 2182 HF or channel 16 VHF marine band. Declare an emergency and state the type of emergency, e.g., “This is a diving accident victim needing treatment in a recompression chamber”. Give your exact location by direction and distance from prominent land marks. Give all symptoms of the victim and dive history if applicable. State the condition of victim, i.e., can he walk, sit up, or is he unconscious. Describe any unusual circumstances, and the number of victims. Give a detailed description of your boat including any outstanding features for identification. Give weather, sea condition, wind direction and speed.

If you should change your location, keep all concerned advised of your new location and your intentions.

The coast guard does monitor CB, CH9. This is a very unreliable means of communications for many reasons. If you are unable to raise the Coast Guard via CB, contact someone else to relay your messages.

If you have no radio on your boat, if practical, hail a boat with a marine band radio and give them the information to relay to the Coast Guard. Keep them with you for further contacts. The International Convention of safety of life at sea requires the providing of assistance to vessels in distress.

If no other boats are immediately available, proceed immediately to the nearest inhabited dockage and telephone local par-medical or USCG services. Advise them of a diving accident, state your need for transportation and your EXACT location. Have someone remain at the telephone for further assistance. Insure that they are aware at this time that a recompression chamber will be needed.

If symptoms occur on land after diving, contact local para-medics or USCG. They should be able to assist or advise location of nearest recompression chamber.

When the rescue aircraft arrives in your area, wave, fire flares or smokes, LET THEM KNOW YOU ARE THE ONES WHO WANT ASSISTANCE. Do not assume the pilot will recognize you. He may waste valuable time searching for you unnecessarily.

## **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 speed into wind about 20 degree's n the port bow.
- Out all antennas down if possible, without losing communications.
- Secure all loose objects on/around decks.
- Always let the lifting device (stretcher) touch the boat before handling it to prevent electric shock.
- Place life jacket on the 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 insure flight crew has a copy of, or is instructed on medical procedures for diving accidents.
- If diving victim, insure flight crew delivers victim to hyperbaric trauma system (recompression chamber complex).

### **Recompression Chamber Requirements**

Diving accident management protocol suggests a recompression chamber that is a multi-lock and 6 atmospheres. Do not take critical diving accident victims to a chamber which is one-man, single lock, 3 atmospheres. There are two major reasons why.

1. Pressure may be sufficient to reduce bubble size (gas embolism requires 6 atmospheres).
2. Physicians have no way of getting hands on victim to:
  - a. Maintain vital signs.
  - b. Keep airway clear.
  - c. Perform neurological examinations necessary to determine proper treatment, or reoccurrence of symptoms.
  - d. Monitor vital signs during treatment.
  - e. Operations may have to be performed, such as intubation.
  - f. Pulmonary over-distention cases may have air leakage causing a tension pneumothorax which must be relieved, and monitored during decompression periods.
  - g. Oxygen convulsions may close off victim's glottis, and victim could develop an embolism while dropping pressure to relieve convulsions.
3. Mixed gas capabilities for saturation treatments.

Be very cautious about transporting patients in small one-lock chambers for the above reasons. It is often better to transport without chamber and maintain vital signs using surface oxygen.

### **The Underwater Diving Accident Victim**

Arterial gas embolism and decompression sickness are the two most frequent serious SCUBA related accidents. Arterial gas embolisms are blockages due to bubbles in arteries carrying blood up to the brain. Decompression sickness is the syndrome of joint pains (the bends), chest pains and shortness of breath, numbness, paralysis and other symptoms resulting from surfacing too rapidly from a dive. Both conditions can be fatal.

An underwater diving accident victim may be any person who has been breathing air underwater regardless of depth. Gas embolisms can occur in as little as four feet of water if one ascends holding their breath. Even a well-trained diver may encounter problems because of respiratory problems. Asthma,

brocholithiasis, congenital or acquired cysts, emphysema, fibrosis, tuberculosis, infection, and obstructive lung diseases may result in air-trapping during ascent. The expansion of trapped air may be sufficient to rupture air spaces and the escaping air may cause emphysema of the lungs, mediastinum or neck. More serious problems of pneumothorax or arterial air embolisms may also result.

Decompression sickness can occur in any individual who violates the decompression tables either willingly or unintentionally when surfacing from breathing compressed air under pressure.

To insure a successful treatment, instructors, dive masters, paramedics, emergency room personnel, and physicians must be able to recognize the problem and begin proper treatment while arranging entry into the hyperbaric trauma system.

In any situation suggesting an underwater diving accident, the primary question is “did the subject breath compressed air underwater?” If the answer is “yes”, or if the victim is unconscious then the subject must be regarded as a diving accident victim. The diving accident treatment procedure must be initiated immediately. This includes basic life support, administering oxygen, Trendelenburg position, and immediate evacuation to the recompression chamber complex.

### **Mild Symptoms**

Mild symptoms may respond to treatment at the scene using oxygen. Fatigue, skin rash, and weakness are considered a minor symptom, but frequently require recompression and are handled as a severe symptom in the Flow Chart. A neurological examination must be completed to determine presence of severe symptoms.

If a diver surfaces from a dive and behaves in an unusual manner, appears confused or has fatigue, weakness or skin rash, he may have early symptoms of an underwater accident.

Immediately place the diver on 100% oxygen. Refer to the Flow Chart and follow through. Oxygen treatment often relieves the symptoms or prevents them from getting worse. The victim will probably deny the possibility of having a problem and any refuse oxygen. Good judgment should prevail and the diver should receive treatment. If the symptoms appear relieved after an interval of oxygen treatment, do not remove the oxygen immediately as the symptoms may recur. The victim should continue to receive oxygen for thirty minutes. Follow the Flow Chart for further instructions.

### **Severe Symptoms**

Severe symptoms consisting of pain, weakness or paralysis, staggering, respiratory difficulties (chokes) or unconsciousness require immediate treatment and evacuation into the hyperbaric trauma system. Cardiopulmonary resuscitation will be required if the victim has no pulse or respiration. If a person at any time within 24 hours after a dive shows any of the severe symptoms indicated on the flow chart, immediately provide the victim with oxygen (100% or highest possible concentration). Monitor pulse and respiration and follow the instructions in the Flow Chart until evacuation to a recompression chamber has been accomplished.

It is important to remember that because these signs and symptoms can develop hours after diving, the patient may show up in a hospital emergency room or other medical facility in the community. For this

reason, it is important for paramedics and physicians to recognize the symptoms and to understand this problem so that the underwater diving accident procedure can be initiated. It is also extremely important that any person delivering an underwater diving accident patient to a medical facility PROVIDE THAT FACILITY WITH THIS MANUAL AND THE COMPLETE HISTORY RECORDED ON THE FORMS UNINCLUDED IN THIS MANUAL. The manual should stay with the patient until he reaches the Hyperbaric Trauma Center in order to provide those caring for the patient with full information concerning the accident.

### **Air Embolism**

As a diver surfaces without exhaling, air trapped in the lungs expands and may rupture lung tissue releasing gas bubbles into the circulatory system where they may be distributed to the body tissues. The ascending diver is normally in a vertical position and the bubbles tend to travel upward toward the brain, eventually reaching a small artery blocking circulation. The effects of halting circulation to the brain are critical and require immediate treatment. Symptoms of embolism may be present when the victim reaches the surface or within a few minutes afterward.

CAUSE:

1. Holding breath during ascent while breathing compressed gas.
2. Possible result of panic.
3. Lung disease resulting in air trapping.

SYMPTOMS:

1. Dizziness
2. Visual blurring
3. Bloody froth from mouth or nose
4. Paralysis or weakness
5. Unconsciousness

Note: Symptoms usually appear immediately after surfacing or within 15 minutes usually.

SIGNS:

1. Bloody froth from mouth or nose
2. Paralysis or weakness
3. Convulsions
4. Unconsciousness
5. Cessation of breathing

PREVENTION

1. Always exhale during ascent
2. Get a periodic medical examination by a physician knowledgeable in diving medicine.

TREATMENT: Place victim flat on back, slight head down for shock; turn head if vomiting. Administer oxygen at 100% or highest possible concentration and continue while transporting to a recompression chamber. UNDER NO CIRCUMSTANCES SHOULD THE VICTIM BE RETURNED TO THE WATER FOR TREATMENT.

### **Decompression Sickness**

Decompression sickness (bends, Caisson disease) is the result of inadequate decompression following exposure to increased pressure. While inadequate recompression is not usually a matter of life and death

as with air embolism, the quicker recompression is initiated the better the rate of recovery. The body tissue absorbs gas in proportion to the surrounding pressure and as long as the diver remains at pressure, the gas presents no problem. If the pressure is too quickly removed (as in rapid surfacing), the inert gas comes out of solution and forms in the tissues and blood stream.

CAUSE: Inadequate decompression

SYMPTOMS:

1. Extreme fatigue
2. Skin itch
3. Pain in arms and legs
4. Dizziness
5. Paralysis
6. Shortness of breath
7. Collapse or unconsciousness

NOTE: Symptoms and signs usually appear anywhere between 15 minutes and 24 hours after surfacing.

SIGNS:

1. Skin may show a blotchy rash
2. Paralysis
3. Staggering
4. Choking

PREVENTION:

1. Strict observance of NO DECOMPRESSION LIMITS
2. No diving if hung over, intoxicated or tired.

TREATMENT Decompression sickness requires recompression as soon as possible. Any symptoms except itching are considered serious, but even the mild symptoms suggest that the victim should be monitored very closely for the later development of a more serious problem. The victim should receive 100% oxygen during transportation to a recompression chamber.

### **Carbon Dioxide Excess**

CAUSE:

1. Loss of air supply
2. Improper use of closed-circuit SCUBA
3. Over-exertion
4. Skip breathing

SYMPTOMS

1. Sometimes none
2. Labored or rapid breathing
3. Headache, dizziness, weakness, nausea
4. Unconsciousness

PREVENTION

1. Diver should stop, rest, ventilate and surface if breathing becomes labored
2. Avoid causes listed above

TREATMENT

1. Give oxygen
2. CPR if not breathing

## **Pneumothorax**

Air enters chest cavity causing lungs to collapse.

- CAUSE: Holding breath during ascent
- SYMPTOMS
1. Shortness of breath
  2. Sharp pain in chest
- SIGNS:
1. Rapid shallow breathing
  2. Blueness of skin, lips, and fingernails
  3. Lungs sound different from one side to another
- Prevention: Exhale during ascent
- Treatment:
1. Do NOT use recompression without chest tube
  2. Physician will insert chest tube to withdraw air and reinflate lung
  3. 100% oxygen, medical attention, contact hyperbaric physician.

## **Mediastinal Emphysema**

Air released into tissues surrounding the heart.

- CAUSE: Holding breath during ascent
- SYMPTOMS:
1. Faintness
  2. Shortness of breath
  3. Pain under breastbone
- SIGNS:
1. Difficulty in breathing
  2. Change in voice
- PREVENTION: Exhale during ascent
- TREATMENT:
1. Do NOT use recompression unless complicated with air embolism or decompression sickness or life-threatening complications.
  2. Observe for other problems
  3. 100% oxygen, medical attention, hyperbaric physician.

## **Subcutaneous Emphysema**

Air trapped under skin (usually around neck)

- CAUSE: Holding breath during ascent
- SYMPTOMS:
1. Feeling of fullness around neck
  2. Change in voice
- SIGNS:
1. Swelling during ascent



2. Difficulty swallowing
3. Crackling sound when skin is pressed

PREVENTION: Exhale during ascent

- TREATMENT:
1. No real emergency
  2. Usually no treatment needed
  3. Observe for other problems
  4. 100% oxygen, medical attention, hyperbaric physician.

## IMMERSION HYPOTHERMIA AND COLD WATER NEAR-DROWNING

### BY Capt. M.J. Nemiroff, 1988 From NAUI Workbook

Immersion hypothermia and cold water near-drowning are often natural consequences of scuba diving accidents such as decompression sickness and air embolism. Hypothermia is a condition in which the body's core temperature has lowered below 95 degrees Fahrenheit. Cold water near-drowning is considered to be a submersion accident in water temperatures of 70 degrees Fahrenheit or less that often leads to unconsciousness or coma. A long submersion time is considered to be 4-6 minutes or longer.

The body loses heat to its environment by:

- Conduction: transfer of heat by direct contact with the water, air, or ground;
- Convection: transfer of heat by air or water that is moving away from the body;
- Radiation: transfer of energy by non-particulate means such as from an unprotected head;
- Evaporation: conversion or perspiration into water vapor thereby absorbing calories of heat; and
- Respiration: exhalation of water vapor carrying with it heat from the body.

### Immersion Hypothermia

Hypothermia may be mild, moderate, or severe. The victim may exhibit symptoms ranging from shivering and piloerection ("goosebumps") to profound confusion, irreversible coma, and death. Significant hypothermia begins at core body temperatures of 95 degrees Fahrenheit and below. The lowering of the body temperature occurs as the body is robbed of heat by the surroundings. Water conducts body heat away up to 26 times faster than air of the same temperature. Normal body functions slow down with decreasing heart, respiratory, and metabolic rates. Thought processes are impaired and speech becomes confused while reflexes are slowed and muscles become stiff and unusable. In the advanced stages of hypothermia, life-threatening heart rhythms develop which are difficult to reverse.

Upon submersion of the body in very cold water, response actions occur immediately. An involuntary gasp and sudden hyperventilation are followed by a varying amount of diving response. The diving response is more evident in the very young (infants and toddlers). It consists of a slowing of the heartbeat, a decrease or actual cessation of respiration, and a dramatic change in circulation with blood circulation to only the inner core of the body: heart, lungs, and brain. This individual appears dead to the casual observer who is seeing a cold, blue,

non-breathing victim. Cold water immersion victims have been fully resuscitated when treated carefully with a variety of rewarming techniques ranging from warm blankets to complete cardiopulmonary bypass in major hospitals.

The potential rescuer must remember that there are differences in cooling rates depending upon the age, sex, body weight, clothing, nutritional status, general health, and specific diseases of the victim as well as the water temperature, length of exposure, areas exposed to heat loss, nature of the water movement, circumstances of the immersion, and ultimately, the victim's "will to live".

Remember: Immersion hypothermia should be considered a factor in most diving accidents. The body loses its temperature in a variety of ways while the victim is still in the water, during management of the accident after removal from the water, and during transport. Cold water immersion victims may appear to be dead but may be resuscitatable.

## SIGNS AND SYMPTOMS

- |                             |                           |
|-----------------------------|---------------------------|
| 1. Shivering                | 6. Slurred speech         |
| 2. Lowered body temperature | 7. Confusion              |
| 3. Cold, blue skin          | 8. Muscle stiffness       |
| 4. Slow heartbeat           | 9. Cardiopulmonary arrest |
| 5. Slow respiration         |                           |

## TREATMENT

The basic goals of treatment are to prevent cardiopulmonary arrest, stabilize the core temperature, and carefully transport the victim to definitive medical care.

1. REMOVE THE VICTIM FROM THE COLD ENVIRONMENT.
2. ENSURE AIRWAY, BREATHING, CIRCULATION, AND DEGREES (ABCD).

As well as ensuring that the victim has an open airway, is breathing, and has heart beat, determine the victim's body temperature. Most clinical thermometers only measure temperatures as low as 94 degrees Fahrenheit. Low reading thermometers for hypothermia victims are commercially available and should be included in all diving first aid kits. As always, if the victim is not breathing and the heart not beating, standard cardiopulmonary resuscitation

(CPR) should be started immediately.

3. PREVENT FURTHER HEAT LOSS.

Remove wet clothing, gently dry the neck, and cover high heat loss areas of the body such as the head, neck, lateral thorax, and groin areas. The head and neck account for 50% of the body's heat loss.

4. HANDLE THE VICTIM GENTLY.

As the body rewarms, it initially becomes colder for a short time. This is known as *after drop*. During this period, the heart is extremely vulnerable to the development of life-threatening rhythm disturbances. The victim should be removed horizontally from the water and kept in a supine position. A litter or stretcher should be used to carry the victim since exercising, jumping,

climbing, or other exertion on the part of the victim may trigger the heart rhythm disturbance. Victims of hypothermia typically deny that are ill and tend to decline medical treatment. Many times they want to climb into the responding ambulance or helicopter without assistance. The victim's judgment may be clouded and the rescuer's should prevail! Afterdrop can be prolonged by certain "field treatments". A cigarette, hot cup of coffee, or a drink of alcohol which are all time-honored treatments, generally prolong the after drop exposing the victim to greater risk and do not help the hypothermic victim recover. They should not be provided to hypothermic individuals with core temperatures below 95 degrees Fahrenheit.

## Cold Water Drowning

Submersion accidents leading to unconsciousness in waters colder than 70 degrees Fahrenheit occur with regularity. The body's oxygen requirements are significantly reduced when the body is cold. Permanent brain damage from low oxygen states will not occur as quickly as when the body is warm. Successful resuscitations have been seen with victims submerged as long as sixty (60) minutes. Similar to victims suffering from hypothermia, the cold water near-drowning victim will generally appear blue and cold to the touch, exhibit no apparent respiration or heart beat, and have pupils which are fixed and dilated. The following factors affect the survivability of cold water near-drowning victims:

Age	:	The younger the better;
Length of Submersion:		The shorter the better;
Water Temperature	:	The colder the better;
CPR Quality	:	The cleaner the better;
Victim Struggle:		The more they struggle the worse the results; and,
Other Injuries	:	Burn and blast injuries as well as fractures reduce the chances of survival.

Remember: Cold water near-drowning is more survivable than previously thought. Victims who have been submerged as long as an hour may still be fully resuscitated. Cold water may be protective to some body systems since oxygen needs are markedly reduced.

## SIGNS AND SYMPTOMS

1. Cough with clear to frothy red sputum
2. Blue skin color
3. Shortness of breath
4. Confusion to coma
5. Respiratory arrest
6. cardiac arrest

## TREATMENT

1. REMOVE THE VICTIM FROM THE WATER.
2. DO NOT PERFORM ABDOMINAL THRUSTS (HEIMLICH MANEUVER) EXCEPT TO CLEAR A CONFIRMED, OBSTRUCTED AIRWAY.

Abdominal thrusts may induce vomiting and cause aspiration of vomitus and water into the lungs.

3. ENSURE AIRWAY, BREATHING, AND CIRCULATION (ABC).

Initiate cardiopulmonary resuscitation (CPR) as required.

4. PREVENT FURTHER HEAT LOSS.

Remove wet clothing, gently dry the skin, and cover high heat loss areas of the body such as the head, neck, lateral thorax, and groin areas. The head and neck account for 50% of the body's heat loss.

5. HANDLE THE VICTIM GENTLY.

6. ADMINISTER 100% OXYGEN.

Heated oxygen administration should only be attempted with cardiac monitoring in place and only by personnel capable of treating cardiac dysrhythmias. In selected cases, heated oxygen (105 – 108 degrees Fahrenheit) has been successfully used to stabilize body temperature and reduce further loss.

7. TRANSPORT TO NEAREST MEDICAL FACILITY.

The sooner a victim is transported to a medical facility the better he/she will probably resolve. Do not forget that a diving accident such as decompression sickness or air embolism may have led to the cold water near-drowning in the first place. A successful resuscitation may only be possible within a recompression chamber which will ultimately be necessary for treatment of the compressed-gas injuries.

## DIVER INJURY DIAGNOSIS KEY

<u>Symptom/Sign</u>	<u>Circumstances</u>	<u>Probable Injury</u>	<u>Management</u>
Bleeding/external ear	Ear pain during descent/ascent	Ruptured eardrum	Terminate diving; nothing in ear; avoid contamination; medical attention
Bleeding/external ear	Hit head	Fractured skull	Keep victim lying down and inactive; keep warm; <u>no fluid</u> ; do not elevate feet; constant attendance; immediate medical attention
Spitting blood	Ear pain during or following ascent	(1) Ruptured eardrum  (2) Middle ear	See Above (Ruptured Eardrum)  Terminate diving; medical attention if drainage/discomfort persist
Spitting/coughing blood; bloody froth	Emergency ascent	Pulmonary injury; possible air embolism	Observe for illness and signs of neurological damage (visual disturbances, paralysis, personality changes, etc.); head down; treat shock, 100% oxygen; medical attention; transport to recompression facility.
Bloody discharge/nose	Pain in sinuses during ascent/descent	Sinus squeeze (or reverse sinus squeeze)	Terminate diving; medical attention if drainage/discomfort persist.
Chest pain/ breathing	Emergency/ uncontrolled ascent; Chest congestion prior to dive	Pneumothorax/mediastinal /emphysema/sub-cutaneous emphysema	See Air Embolism
Neurological abnormalities including: loss of balance/coordination visual disturbance rigidity/numbness of extremities paralysis personality changes	Emergency/uncontrolled ascent; congestion prior to diving; smoker; symptoms dramatic & sudden; inadequate decompression	Air embolism or decompression sickness	100% oxygen; medical transport to recompression facility; CPR if indicated; never leave victim unattended

Bluish coloration	Emergency/uncontrolled ascent; chest congestion prior to dive; chest pain following dive	Pneumothorax/mediastinal emphysema	See Air Embolism
Swelling in neck area	Emergency/uncontrolled ascent; chest congestion prior to dive; chest pain following dive	Subcutaneous emphysema	See Air Embolism
Unconsciousness	Occurs while or shortly after surfacing from a dive	Air embolism or decompression sickness	See Air Embolism
Respiratory or cardiac arrest	Occurs while or shortly after surfacing from a dive	Air embolism or decompression sickness	See Air Embolism
Pain in joints or extremities	Occurs shortly after surfacing from a dive near or beyond no-decompression limits	Decompression sickness	See Air Embolism
Bluish coloration	Loss of consciousness during dive; closed circuit or mixed gas	CO <sub>2</sub> Excess or hypoxia	Surface; resuscitation; oxygen; medical attention; do not exclude air embolism
Reddish coloration	Loss of consciousness during or after dive	Carbon Monoxide (CO) Poisoning	See CO excess; oxygen until turned over to physician; monitor continuously
Respiratory distress with strong oil taste	Oil contamination of breathing supply	Oil pneumonia	Medical attention

## DIVING ACCIDENT / INCIDENT REPORT FORM

**NOTE:** FAU Scientific Divers shall use this form to report diving related accidents, injuries, and incidents including; near-drowning, decompression sickness, gas embolism, lung overexpansion, or injuries that require hospitalization as well as any incidents that compromised diver safety or might result in later hospitalization, therapy, or litigation. **FAU Dive Logs for all dives related to the accident / incident must also be submitted with this report.** Contact the FAU Dive Safety Officer at 561-297-3129 with questions about whether or not to report an incident.

### GENERAL INFORMATION ABOUT THE ACCIDENT/ INCIDENT VICTIM

DIVER NAME:		DATE & TIME OF INCIDENT:	
DIVE LOCATION:	DIVING CERTIFICATION LEVEL: <input type="checkbox"/> Scientific Diver <input type="checkbox"/> Diver-In-Training <input type="checkbox"/> Temporary Diver		CERTIFICATION DEPTH:
CURRENT MEDICATIONS:		CURRENT HEALTH PROBLEMS:	

**If the diver is not an FAU-certified diver, complete this section. FAU-certified divers skip to the next section.**

AGE:	SEX: (M/F)	DIVER'S AGENCY OR ORGANIZATION:	AGENCY OR ORGANIZATION DBSO NAME & TELEPHONE #:
# YEARS DIVING:	TOTAL # DIVES:	# DIVES LAST 6 MONTHS:	PREVIOUS DIVE INCIDENTS & DATES:

### DESCRIPTION OF THE ACCIDENT / INCIDENT:

Please describe accident / incident in detail. Include ANY factor which you believe may have contributed to, or minimized the accident / incident. If more than one accident / incident occurred, please fill out a separate form. Use extra paper if necessary.

What could have been done to prevent this accident / incident?

<p><b>Did the accident / incident cause harm:</b>                  Yes    <input type="checkbox"/> No    <input type="checkbox"/> Not known                  Specify:</p> <p><b>Did the accident / incident occur in training:</b>                  Yes    <input type="checkbox"/> No    <input type="checkbox"/> Not known                  Specify:</p>	<p><b>Diver's qualification: (may circle &gt;1)</b></p> <table style="width: 100%;"> <tr> <td>Diving student ..... DS</td> <td>Open water .....OW</td> </tr> <tr> <td>Advanced diver.....AD</td> <td>Divemaster .....DM</td> </tr> <tr> <td>Dive instructor..... DI</td> <td>Untrained ..... UT</td> </tr> <tr> <td>Professional. . . . .PD</td> <td>Technical diver....TD</td> </tr> <tr> <td>Not known.....NK</td> <td>CDAА:   Cavern.....CA</td> </tr> <tr> <td>Other.....O</td> <td>          Sinkhole...SI</td> </tr> <tr> <td></td> <td>          Cave.....CV</td> </tr> <tr> <td></td> <td>          Penetrat.....PN</td> </tr> </table>	Diving student ..... DS	Open water .....OW	Advanced diver.....AD	Divemaster .....DM	Dive instructor..... DI	Untrained ..... UT	Professional. . . . .PD	Technical diver....TD	Not known.....NK	CDAА:   Cavern.....CA	Other.....O	Sinkhole...SI		Cave.....CV		Penetrat.....PN
Diving student ..... DS	Open water .....OW																
Advanced diver.....AD	Divemaster .....DM																
Dive instructor..... DI	Untrained ..... UT																
Professional. . . . .PD	Technical diver....TD																
Not known.....NK	CDAА:   Cavern.....CA																
Other.....O	Sinkhole...SI																
	Cave.....CV																
	Penetrat.....PN																

**Contributing Factors (Check all that apply):**

Inadequate knowledge	Poor physical fitness
Unfamiliar diving environment/conditions	Feeling unwell
Unfamiliar diving equipment	Error in judgement
Inexperience in diving	Poor communication
Poor dive planning	Malfunction of equipment
Insufficient training in diving	Failure to understand equipment
Failure to check	Lack of servicing of equipment
Lack of a buddy check	Poor servicing of equipment
Haste	Lack of post dive equipment maintenance
Inattention	Inadequate supervision of diver
Fatigue	Sea sickness
Anxiety	Poor technique
Recent illness	Recreational drug/alcohol/hangover pre dive

**Did the accident / incident involve any of the following (Circle all that apply):**

Low air situation ..... LA Out	Problem at deco stop ..... DE
of air situation ..... OA	Poor buddy pairing ..... BP
Rapid ascent ..... RA	Poor buddy response ..... BR
Unable to slow rapid ascent ... US Out	Loss buddy contact ..... BC
of air ascent ..... OR	Marine animal ..... MA
Buddy breathing ..... BB	Equalization problem descent ... ED
Octopus breathing ..... OB	Equalization problem ascent ... EA
Pony bottle breathing ..... PB	Equipment ..... EP
Multiple ascents ..... AA	Poor visibility/silting ..... PV
Buoyancy problem ..... BP	Strong current ..... SC
Problem on ascent ..... PA	Flying <24hrs after diving .... FL
Problem at safety stop .... SS	Altitude >300ms after diving. AL
Deco stop missed ..... DS	Panic ..... PC
Not detected by buddy check ... ND	Anchor retrieval ... AR
Nausea, vomiting U/W ..... NV	Entanglement/trapped/guideline. ET

**First Aid:**

No O <sub>2</sub> available / limited O <sub>2</sub> supply	Lack of trained 1 <sup>st</sup> aid assistance
O <sub>2</sub> ran out	Lack of first aid supplies
O <sub>2</sub> used inappropriately	Poor first aid

**Gas Supply**

**Gas supply in use during dive:**  Air  Nitrox  Mixed gas  O<sub>2</sub>  No/poor analysis pre dive  
 Confusion gas mix during dive Air consumption greater than usual this dive:  Yes  No

**Equipment involved in the accident / incident (Check all that apply):**

<input type="checkbox"/> Hired <input type="checkbox"/> Borrowed <input type="checkbox"/> New <input type="checkbox"/> Misuse <input type="checkbox"/> Essential equipment lacking <input type="checkbox"/> Equipment forgotten			
<input type="checkbox"/> Torch	<input type="checkbox"/> Mask	<input type="checkbox"/> Depth gauge	<input type="checkbox"/> Mouthpiece
<input type="checkbox"/> Surface signal device	<input type="checkbox"/> BCD	<input type="checkbox"/> Dive computer	<input type="checkbox"/> Scooter
<input type="checkbox"/> Dive Flag	<input type="checkbox"/> Fins	<input type="checkbox"/> Regulator	<input type="checkbox"/> Reel or line
<input type="checkbox"/> Alternative air supply	<input type="checkbox"/> Snorkel	<input type="checkbox"/> Watch/Timer	<input type="checkbox"/> Shot/safety line
<input type="checkbox"/> Weight belt	<input type="checkbox"/> Wet suit	<input type="checkbox"/> Camera/trophy bag	<input type="checkbox"/> Gloves
<input type="checkbox"/> Weights	<input type="checkbox"/> Dry suit	<input type="checkbox"/> Rebreather	<input type="checkbox"/> Climbing equipment
<input type="checkbox"/> Ankle weights	<input type="checkbox"/> Lycra suit	<input type="checkbox"/> Exit ladder	<input type="checkbox"/> Other
<input type="checkbox"/> Tank/cylinder	<input type="checkbox"/> Knife	<input type="checkbox"/> Boat	Specify _____
<input type="checkbox"/> Compressor/ Hookah	<input type="checkbox"/> Contents gauge	<input type="checkbox"/> Surface buoy	



**Regulator and Gas Supply (Check all that apply):**

<input type="checkbox"/> Low to out of air <input type="checkbox"/> Contents not analyzed prior to dive or incorrectly <input type="checkbox"/> Air not turned on <input type="checkbox"/> Air not turned on fully <input type="checkbox"/> Air turned on then off prior to dive <input type="checkbox"/> Air supply turned off inappropriately <input type="checkbox"/> Didn't check contents gauge regularly	<input type="checkbox"/> Inaccurate contents gauge <input type="checkbox"/> Unable to read contents gauge <input type="checkbox"/> Contents gauge hose rupture/leak <input type="checkbox"/> Hose rupture/leak <input type="checkbox"/> Pillar valve problem <input type="checkbox"/> 1 <sup>st</sup> stage malfunction <input type="checkbox"/> 2 <sup>nd</sup> stage malfunction	<input type="checkbox"/> Free flowing 2 <sup>nd</sup> stage problem <input type="checkbox"/> Octopus 2 <sup>nd</sup> stage problem <input type="checkbox"/> 'O' ring problem <input type="checkbox"/> Regulator breathing resistance increased <input type="checkbox"/> Unable to purge 2 <sup>nd</sup> stage <input type="checkbox"/> Pony bottle problem <input type="checkbox"/> 'Octopus' reg snagged	<input type="checkbox"/> Unable to locate alternative air supply <input type="checkbox"/> Air used frequently to maintain buoyancy <input type="checkbox"/> Tape on pillar valve <input type="checkbox"/> 1 <sup>st</sup> stage attached incorrectly <input type="checkbox"/> Separation regulator parts <input type="checkbox"/> Swivel problem
--	--	---	---

**Miscellaneous Equipment (Check all that apply):**

<p><b>Weights and weight belts:</b></p> <input type="checkbox"/> Overweight <input type="checkbox"/> Underweight <input type="checkbox"/> Unable to release <input type="checkbox"/> Didn't know how to release <input type="checkbox"/> Quick release jammed <input type="checkbox"/> Tongue overlap stopped release <input type="checkbox"/> Snagged during release <input type="checkbox"/> Weight belt /weights dropped <input type="checkbox"/> Snagged causing release <input type="checkbox"/> BCD integrated weight problem <p><b>Wet/dry suit:</b> <input type="checkbox"/> Uncomfortable  <input type="checkbox"/> Tight - restricted breathing  <input type="checkbox"/> Changed buoyancy</p>	<p><b>Buoyancy Jacket (BCD):</b></p> <input type="checkbox"/> Unfamiliar with its use <input type="checkbox"/> Spontaneously inflated <input type="checkbox"/> Inflation device failed <input type="checkbox"/> Inflator hose leaked <input type="checkbox"/> Inflation device not connected <input type="checkbox"/> Incorrect inflator hose <input type="checkbox"/> Didn't know how to inflate BCD <input type="checkbox"/> Didn't know how to deflate vest <input type="checkbox"/> Inflator/octopus combination problem <input type="checkbox"/> Dump valve malfunction <input type="checkbox"/> Uncomfortable	<input type="checkbox"/> Inflated restricted breathing <input type="checkbox"/> Unable to deflate <input type="checkbox"/> BCD air cylinder problem <input type="checkbox"/> Unable to inflate <input type="checkbox"/> Unable to inflate due to low air <input type="checkbox"/> Provided inadequate buoyancy <input type="checkbox"/> Confusion deflate/inflate buttons <input type="checkbox"/> Buddy couldn't deflate vest <input type="checkbox"/> Buddy couldn't inflate vest <input type="checkbox"/> Leaked <input type="checkbox"/> Incorrect size <input type="checkbox"/> Other Specify :
<p><b>Mask</b></p> <input type="checkbox"/> Flooding/dislodged caused panic <input type="checkbox"/> Flooding/dislodged no panic <input type="checkbox"/> Strap broke <input type="checkbox"/> Unable to clear <input type="checkbox"/> Clearing caused panic <p><b>Dive tables</b></p> <input type="checkbox"/> Not used <input type="checkbox"/> Misread <input type="checkbox"/> Unable to understand	<p><b>Dive computer</b></p> <input type="checkbox"/> Not used <input type="checkbox"/> Inaccurate <input type="checkbox"/> Stopped working <input type="checkbox"/> Forgot to activate it <input type="checkbox"/> Unable to read/layout confusing <input type="checkbox"/> Battery problems <p><b>Fins</b></p> <input type="checkbox"/> Strap broke <input type="checkbox"/> Lost <input type="checkbox"/> Caused cramp <input type="checkbox"/> Incorrect size	<p><b>Depth gauge</b></p> <input type="checkbox"/> Not used <input type="checkbox"/> Inaccurate <input type="checkbox"/> Unable to read <input type="checkbox"/> Maxm depth indicator problem <input type="checkbox"/> Confusion units used <p><b>Tank/cylinder</b></p> <input type="checkbox"/> Out of test <input type="checkbox"/> Faulty <input type="checkbox"/> Changed buoyancy <input type="checkbox"/> Not secured in backpack <input type="checkbox"/> Size change between dives

**Tank Configuration Used:**

<p><b>SINGLE TANK</b></p> <input type="checkbox"/> Yes <input type="checkbox"/> No <p><b>Configuration not known</b> <input type="checkbox"/></p>	<p><b>TWIN TANKS</b></p> <input type="checkbox"/> Independent back mounted <input type="checkbox"/> Independent side mounted <input type="checkbox"/> Manifolder <input type="checkbox"/> (Isolator problem) <input type="checkbox"/> Not known	<p><b>SLING TANKS OR STAGES</b></p> <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Not known <input type="checkbox"/> One <input type="checkbox"/> Two <input type="checkbox"/> Not known <p><b>Configuration and contents if known:</b></p>
--	---	---

Report Prepared by:

Signature

Printed Name

Date

## APPENDIX 7

### AAUS STATISTICS COLLECTION CRITERIA AND DEFINITIONS

#### COLLECTION CRITERIA:

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

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

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

A Dive is defined as a descent underwater utilizing compressed gas and subsequent ascent/return to the surface with a minimum surface interval of 10 minutes.

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

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

Incident(s) that occur during the collection cycle: Only incidents that occurred 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 percentages different from those of air.
- Mixed Gas: Dives where the bottom gas used for the dive is a combination of oxygen, nitrogen, and helium (or other inert 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 monitor 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 monitoring his/her own depth, time, and diving profile.
- Rebreathers: Dives where the breathing gas is repeatedly recycled in a 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 measured in feet of seawater:

Feet	0-30	31-60	61-100	101-130	131-150	151-190	191-250	251-300	301+
Meters	0-10	>10-20	>20-33	>33-43	>43-50	>50-63	>63-83	>83-100	>100+

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: Open water diving where the bottom is generally greater than 200 feet deep and requires the use of multiple-tethers 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 must 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:

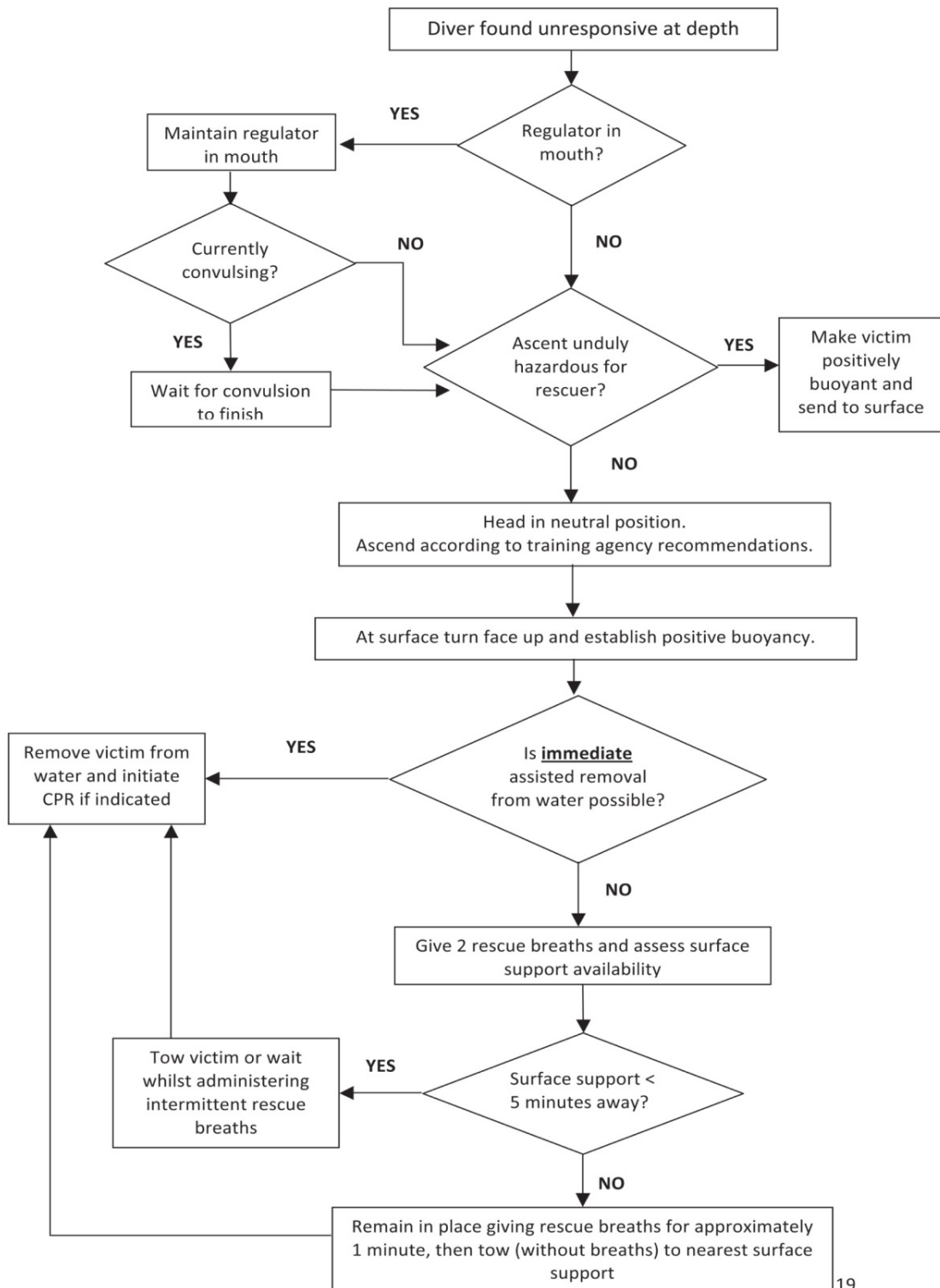
- Hyperbaric: Decompression Sickness, AGE, or other barotrauma requiring recompression therapy.
- Barotrauma: Barotrauma requiring medical attention from a physician or medical facility, but not requiring recompression therapy.
- Injury: Any non-barotrauma injury occurring during a dive that requires 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 8 Rescue Of A Submerged Unresponsive Compressed-Gas Diver

From: S.J. Mitchell et al., Undersea and Hyperbaric Medicine 2012, Vol. 39, No. 6, pages 1099-1108



## APPENDIX 9 DIVE COMPUTER GUIDELINES

1. Only those makes and models of dive computers specifically approved by the Diving and Boating 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 and Boating 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 their 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. If the dive computer fails, a diver should not dive for 18 hours before activating a new 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 A BLANK**

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## APPENDIX B RELEASE AND WAIVER OF LIABILITY



### FAU Diving and Boating Safety Program Release and Waiver of Liability

#### READ THIS DOCUMENT COMPLETELY BEFORE SIGNING.

In consideration of the permission granted to Releasor (named below) by the Florida Atlantic University Board of Trustees (FAU) to participate in certain activities which shall consist, in whole or in part, of diving, both SCUBA and snorkeling, or boating commencing on the date this document is executed, the receipt of which permission is hereby acknowledged, Releasor, for himself/herself and his/her personal representatives, heirs, next of kin, executors, administrators and assigns, hereby forever releases, holds harmless, waives, discharges and covenants not to sue the Florida Atlantic University Board of Trustees the State of Florida, and their respective trustees, officers, agents, employees, and volunteers (hereinafter referred to as "Releasee"), from any and all actions, causes of action, damages, claims, demands or liabilities, either in law or in equity, arising from or by reason of any bodily injury or personal injuries known or unknown, including death, and any property damage, either known or unknown, which may occur as a result of or in connection with Releasor's participation in these activities, whether caused by the negligence of Releasees or otherwise.

Releasor hereby acknowledges that he/she has been fully advised of and has actual knowledge and conscious appreciation of the particular risks and dangers involved in these activities including, but not limited to, those risks and dangers involved in traveling to locations, being around and learning to use scientific equipment, spending periods exposed to the sun and weather, possibly voyaging upon vessels with its concomitant risks of motion sickness and grounding, diving with SCUBA equipment, and all other risks and dangers naturally inherent in boating, diving, snorkeling and swimming activities, and Releasor hereby acknowledges that he/she elects voluntarily to fully assume all such risks and confront all such dangers and to release and hold harmless Releasees as stated above.

Releasor represents that he/she has no health-related problems or conditions which preclude his/her participation in these activities. Releasor further represents that he/she has adequate health insurance, or other financial capability, necessary to provide for and pay any non-employment related medical costs that may directly or indirectly result from his/her participation in these activities. Notwithstanding anything herein to the contrary, with respect to FAU employees, nothing here shall waive or release the Releasor's rights to any workers' compensation benefits, as applicable.

Releasor further understands that Releasees may record and/or photograph Releasor with a camera or other photographic, recording or electronic medium and consents to the use, publication or display of any such recordings for any promotional or educational purpose. Releasor waives all claims for compensation, liability or damage relating to any such use.

This document is governed by the laws of the State of Florida. Releasor expressly agrees that this document is intended to be as broad and inclusive as permitted by the law. Releasor hereby represents and warrants that he/she has carefully read this agreement and the FAU Diving and Boating Safety Manual, and agrees to abide by all standards therein. Releasor hereby represents and warrants that he/she is at least 18 years of age.

**I HAVE READ THIS AGREEMENT, UNDERSTAND THAT I AM GIVING UP SUBSTANTIAL RIGHTS BY SIGNING IT, AND VOLUNTARILY AGREE TO BE BOUND BY IT.**

**IF I AM AN FAU EMPLOYEE OR VOLUNTEER ACTING WITHIN THE COURSE AND SCOPE OF MY EMPLOYMENT OR VOLUNTEER RESPONSIBILITIES, MY RIGHTS WILL REMAIN PRESERVED.**

Dated this \_\_\_\_\_ day of \_\_\_\_\_, \_\_\_\_\_.

\_\_\_\_\_  
Name of "Releasor"

\_\_\_\_\_  
Releasor's Signature  
(I certify that I am 18 years of age or older)



## APPENDIX C FAU SCIENTIFIC DIVING PROGRAM DIVER APPLICATION FORM

Name:	Date of Birth:    /    /	Sex: M F
Campus:	Department:	
Home Phone: (    )                      Office:	Email:	
Are you currently scuba certified?    Y    N Certification organization? _____	Date of last physical? _____	
Diving Plans:  Project and department with which you will be diving at FAU: _____ _____		
Home Address:  Street: _____                      City: _____ Apt. No: _____                      Zip: _____		
Emergency Contact Information:  Name: _____                      Relationship: _____ Street: _____                      City: _____ State Home Telephone: (            ) _____ - _____    Work Phone: (            ) _____ - _____		
I wish to apply for entry into the Florida Atlantic University Scientific Diving Program. I agree to abide by the policies of the FAU Scientific Diving and Boating Board and to adhere to their policies and procedures concerning all scientific diving activities. Mail completed form to EH&S or fax to: (561) 297-2210.		
_____ Printed name		_____ Date
_____ Signature		

## Personal Diving Experience

### DIVE TRAINING:

Level	Certifying Agency	Location	Total Hours			Date of Completion	Instructor name and # if known
			Lecture	Pool	Water		

### OTHER RELATED TRAINING:

Date of Completion and Organization	
CPR	Water Safety Instructor
First Aid	Life Guard
EMT, DMT, or Paramedic	Swimming
Chamber Operator	CG Aux. Boating
Dive Accident Management	Oxygen First Aid

Brief description of other diving training (military, commercial, scientific, public safety): \_\_\_\_\_

---

### EXPERIENCE:

Total Number of Dives \_\_\_\_\_ Total Bottom Time \_\_\_\_  
 Maximum Depth \_\_\_\_\_ Date of Last Dive \_\_\_\_  
 Number of Dives (last year) \_\_\_\_\_ Maximum Depth (last year) \_\_\_\_\_

Indicate number of dives for each depth category and depth range that you have completed:

Equipment	0-30'	31-60'	61-100'	101-130'	131-150'	151-190'	>190'
Scuba							
Decompression Scuba							
Mixed Gas							
Surface Supply							
Closed Circuit							
Lock-out or Bell							
Saturation							
Hard Hat							
Dry Suit							
Nitrox							

Indicate with appropriate letter your degree of experience diving in the following conditions:

E = Extensive (>20 times)  
M = Moderate (5-20 times)

L = Limited (1-4 times)  
Leave blank if no experience

\_\_\_\_\_ Small Boat

\_\_\_\_\_ Ship

\_\_\_\_\_ Beach

\_\_\_\_\_ Rocky Shore

\_\_\_\_\_ Heavy Surf

\_\_\_\_\_ Current (>1/2 knot)

\_\_\_\_\_ Ice

\_\_\_\_\_ Cave

\_\_\_\_\_ Wreck

\_\_\_\_\_ Night

\_\_\_\_\_ Altitude (>2000')

\_\_\_\_\_ Blue Water

\_\_\_\_\_ Cold Water (<45°F)

\_\_\_\_\_ Turbid (<3' visibility)

\_\_\_\_\_ Fresh Water

\_\_\_\_\_ River

\_\_\_\_\_ Ocean

\_\_\_\_\_ Mud/Silt Bottom

\_\_\_\_\_ Kelp Forest

\_\_\_\_\_ Coral reef

\_\_\_\_\_ Vertical Wall

\_\_\_\_\_ Blue Hole

List geographical areas that you have dived: \_\_\_\_\_  
\_\_\_\_\_

Have you experienced nitrogen narcosis? \_\_\_\_\_ What depth? \_\_\_\_\_  
\_\_\_\_\_

Have you experienced any diving related injury? \_\_\_\_\_

Briefly describe each incident \_\_\_\_\_  
\_\_\_\_\_

Have you ever been treated in a recompression chamber? \_\_\_\_\_ What depth? \_\_\_\_\_  
\_\_\_\_\_

Indicate date, place, and physician \_\_\_\_\_  
\_\_\_\_\_

#### STATEMENT

I certify that the above information is correct. I agree to follow the safety regulations of the FAU "Diving and Boating Safety Manual" and to abide by whatever limitation and restriction may be imposed by FAU diving officials.

\_\_\_\_\_  
Print Name

\_\_\_\_\_  
Date

\_\_\_\_\_  
Signature

## **APPENDIX D BLANK**

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# APPENDIX E DIVE PLAN FORM



Florida Atlantic University  
Diving Safety Program

**FOR EH&S USE ONLY**

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

Grant/ Project#: \_\_\_\_\_

## DIVE PLAN SUBMISSION FORM

Proposed Expedition Dates: \_\_\_\_\_ through \_\_\_\_\_

General Dive Site Location: \_\_\_\_\_

Dive Plan Submitted by: \_\_\_\_\_

Principal Investigator: \_\_\_\_\_ Lead Diver: \_\_\_\_\_

Is this Dive Plan in Support of a Grant: \_\_\_\_\_ Grant No.:? \_\_\_\_\_

Proposed No. of Dives: \_\_\_\_\_ Proposed No. of Divers: \_\_\_\_\_

(Profile each dive if different)

(List each diver on info. Sheet)

### Will this Plan Involve:

- |  |   |
|--|---|
| <input type="checkbox"/> Boats or larger vessels | <input type="checkbox"/> Flying after diving  |
| <input type="checkbox"/> Multiple days of diving | <input type="checkbox"/> International travel |
| <input type="checkbox"/> Decompression diving    | <input type="checkbox"/> Non-FAU personnel    |
| <input type="checkbox"/> Specialty diving        |   |

### General Dive Plan Considerations

- Any diver has the right to refuse to dive without fear of penalty if s/he feels the conditions are unsafe or unfavorable **OR** the dive violates the precepts of their training **OR** the regulations of the FAU Diving Safety Program.
- It is the responsibility of each diver to terminate the dive, without fear of penalty, whenever s/he feels it is unsafe to continue the dive, unless it compromises the safety of another diver already in the water.
- All Dive plans **MUST** be based on the competency of the least experienced diver.
- All Divers-in-training must be buddied with a Scientific Diver.
- Absolutely No Solo Diving is allowed.**
- Depth certification levels may be extended only to the next deepest certification level and only if the diver with the limiting depth certification level is buddied with a diver certified to the deeper depth level.
- For all diving conducted under hazardous conditions a plan must be formulated to deal with such conditions.
- A Dive Profile **MUST** be completed for each proposed dive. (copy forms as needed)
- If dives are to be conducted from vessels, a Float Plan must also be completed.

An Emergency Plan **MUST** be completed for each expedition including the following: emergency contact information (including name, relation and telephone number) for each diver, nearest recompression chamber, nearest accessible hospital and anticipated means of transportation.

## DIVE PLAN

### Diving Roster

Name	Level	Depth Certification
1. _____	Lead Diver-Scientific Diver	fsw
2. _____	_____	fsw
3. _____	_____	fsw
4. _____	_____	fsw
5. _____	_____	fsw
6. _____	_____	fsw
7. _____	_____	fsw
8. _____	_____	fsw
9. _____	_____	fsw
10. _____	_____	fsw

**Any Non-FAU Personnel:** \_\_\_\_\_  
(include parent organization or auspices)

\_\_\_\_\_

**Purpose of Dives:** \_\_\_\_\_

\_\_\_\_\_

### Operational Plan

**Maximum Depth:** \_\_\_\_\_ ft      **Number of dives/diver/day:** \_\_\_\_\_

**Dive Tables and/or dive computers to be used:** \_\_\_\_\_

**Decompression schedules and repetitive dive plans:** \_\_\_\_\_  
(use dive profile worksheet for detailed plan)

\_\_\_\_\_

**Diving work plans:** \_\_\_\_\_  
(attach detailed explanation if necessary)

\_\_\_\_\_

**Specialty dives if planned:** \_\_\_\_\_  
(see DBSM Section 11.00)

**Nitrox, or mixed gases:** \_\_\_\_\_  
(include percentages)

**Tools or Specialized Equipment Used:** \_\_\_\_\_  
(diving sleds, scooters, drills, surface supply, hookah, tethers, etc.)

**Dive Site**

**Name of Boat or Vessel:** \_\_\_\_\_ **Reg. #:** \_\_\_\_\_  
 EAU                       Charter                       Personnel                       Other

**Beach or Other Site:** \_\_\_\_\_

**Safety Considerations**

**Any Hazardous Conditions Anticipated:** \_\_\_\_\_  
(ie: Cold water, night diving, extreme currents, extreme depths)

**Safety Precautions:** (ie: Chase vessel, dry suits) \_\_\_\_\_

First-Aid Kit

Emergency Oxygen Resuscitator

Dive flag

**International Travel**

**Contacts in country:** \_\_\_\_\_  
(include name and phone number)

**U. S. Consulate or Embassy:** \_\_\_\_\_  
(include phone, fax, address)

**For International Travel:** Attach a copy of all itineraries including flight times and accommodations with contact information which will be utilized.

## DIVE PROFILE WORKSHEET

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

**Location:** \_\_\_\_\_

**Dive No.:** \_\_\_\_\_

Note: Use one sheet per dive profile.

**Lead Diver:** \_\_\_\_\_

**Buddy Team 1:** \_\_\_\_\_ & \_\_\_\_\_

**Buddy Team 2:** \_\_\_\_\_ & \_\_\_\_\_

**Buddy Team 3:** \_\_\_\_\_ & \_\_\_\_\_

**Buddy Team 4:** \_\_\_\_\_ & \_\_\_\_\_

**Buddy Team 5:** \_\_\_\_\_ & \_\_\_\_\_

Weather: \_\_\_\_\_  
 Seas: \_\_\_\_\_  
 Current: \_\_\_\_\_  
 Visibility: \_\_\_\_\_  
 Temperature: \_\_\_\_\_  
 Substrate: \_\_\_\_\_

SI= \_\_\_\_\_ RG \_\_\_\_\_ RG \_\_\_\_\_

Depth \_\_\_\_\_ Safety stop \_\_\_\_\_ min

No-D \_\_\_\_\_

**Gas used:** \_\_\_\_\_ Limit \_\_\_\_\_ Time in: \_\_\_\_\_

Air \_\_\_\_\_

Nitrox \_\_\_\_\_ % O<sub>2</sub> RNT= \_\_\_\_\_ Time out: \_\_\_\_\_

BT= \_\_\_\_\_

Water Temp \_\_\_\_\_

TBT/EBT= \_\_\_\_\_

Multi-level			
DEPTH FT			
NO-D LIMIT MIN.			
BOTTOM TIME MIN.			
EFFECTIVE B.T. MIN.			
REPETITIVE GROUP			
DECOMPRESSION DEPTH	30 ft	20 ft	10 ft
DECOMPRESSION TIME			

TBT/EBT = BT + RESIDUAL NITROGEN TIME  
 = BT X RF (DCIEM)

Multi-level EBT = BT + RAT

If any Multi-level TBT/EBT equals the No-D limits, a 5 minute safety stop at 10 feet is required.

### Safety Dive Profile Planning

Use this table to plan contingency depths and times in the event planned depth or planned time profiles are exceeded.

PLANNED DEPTH (PD)	NO - D LIMIT	PT + 5MIN	NEW EBT	DECOMPRESSION TIME(S)		
				30'	20'	10'
PD + 10 ft.						
PD + 20 ft.						

\* Multi-level dive planning-substitute 2<sup>nd</sup> and 3<sup>rd</sup> depth for PD+10 and PD+20, respectively.

\*\*\* USE ADDITIONAL SHEETS AS NEEDED \*\*\*



## LEAD DIVER CHECKSHEET

(complete prior to departing to dive site)

It is the responsibility of the Lead Diver to assure that each of the following items has been checked and that all divers have all required gear.

### Administrative

- Dive Plan Signed by DBSO
- Emergency Response Plan Completed
- Dive Tables Available
- Float Plan if Diving from Vessel

### Dive Support

- First Aid Kit
- Oxygen Resuscitator
- Dive Flag
- Radio or Cell Phone
- Down Line
- Tag Line and Float

### All Divers Have:

- Regulator
- Octopus Regulator
- High Pressure
- Gauge
- Depth Gauge
- Mask
- Fins
- Snorkel
- Buoyancy Compensator
- Scuba Tank
- Scuba Tank Backpack
- Knife
- Weights and/or Weight Belt
- Compass
- Whistle
- Inflatable Emergency Tube (Diver's Sausage)

### Comments:

---

---

---

\_\_\_\_\_  
Lead Diver Print Name

\_\_\_\_\_  
Date

\_\_\_\_\_  
Signature

## DIVING ACCIDENT EMERGENCY MANAGEMENT PLAN

A diving accident victim is 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 the expedition's Dive master to develop procedures for such 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, and initiate the local Emergency Medical System (EMS) for transport to nearest medical facility. Explain the circumstances of the dive incident to the evacuation team, 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. If time allows, complete some or of the CALL-IN DATA SHEET.

1. **Rescue victim and/or position so the proper procedures may be initiated.**
2. **Establish (A)irway, (B)reathing and (C)irculation as required.**
3. **Administer 100% oxygen, if appropriate (in cases of Decompression Illness or Near Drowning).**
4. **Activate the local EMS for transport to the nearest appropriate medical facility. (the local EMS will vary from site to site – it must be stated in dive plan)**
5. **Contact the Diver's Alert Network as deemed necessary.**
6. **Contact Diving Safety Officer (DBSO) and Emergency Contact Person, as deemed necessary.**
7. **Complete and submit Incident Report Form (in manual) to DBSO.**

Expedition Emergency Contact Numbers:

- United States Coast Guard – Channel 16 on Marine VHF Radio
- Local EMS telephone number - \_\_\_\_\_  
(Appendix 7)

Nearest Medical Treatment Facility to Dive Site:

- Location: \_\_\_\_\_
- Telephone: \_\_\_\_\_  
(Appendix 7)

Nearest Recompression Facility to Dive Site:

- Location: \_\_\_\_\_
- Telephone: \_\_\_\_\_  
(Appendix 7)

Diver's Alert Network (DAN):

- 1-919-684-9111 or 1-800-446-2671**

24-hour medical advice—if necessary call collect and state “I have a Medical Emergency”—Use to locate closest recompression chamber or physician consultations.

**EMERGENCY CONTACT INFORMATION FOR EACH DIVER**

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

Emergency Contact: \_\_\_\_\_ Relation: \_\_\_\_\_

Work Telephone: \_\_\_\_\_ Home Telephone: \_\_\_\_\_

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

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

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

Emergency Contact: \_\_\_\_\_ Relation: \_\_\_\_\_

Work Telephone: \_\_\_\_\_ Home Telephone: \_\_\_\_\_

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

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

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

Emergency Contact: \_\_\_\_\_ Relation: \_\_\_\_\_

Work Telephone: \_\_\_\_\_ Home Telephone: \_\_\_\_\_

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

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

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

Emergency Contact: \_\_\_\_\_ Relation: \_\_\_\_\_

Work Telephone: \_\_\_\_\_ Home Telephone: \_\_\_\_\_

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

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

\*\*\* USE ADDITIONAL SHEETS AS NEEDED \*\*\*

## DIVE PLAN APPROVAL

I certify that this dive plan has been completed in compliance with the Florida Atlantic University Diving/ Boating Safety Subcommittee policies and procedures as well as 29 CFR 1910.401. I further certify that all information provided in this plan is true and correct to the best of my knowledge.

All dive plans should be returned to the Diving Safety Officer, or designee within one week following completion of the planned dives(s).

Principle Investigator: \_\_\_\_\_  
(Print Name)

(Signature) \_\_\_\_\_ (Date) \_\_\_\_\_

Dive Team Leader: \_\_\_\_\_  
(Print Name)

(Signature) \_\_\_\_\_ (Date) \_\_\_\_\_

### For EH&S Use Only

Dive Plan reviewed by: \_\_\_\_\_ (print name) \_\_\_\_\_ (title)

Approved:  Yes  No Date: \_\_\_\_\_

\_\_\_\_\_  
(Signature)



## APPENDIX G FAU SCIENTIFIC DIVER TRAINING COURSE

Name of Applicant:						Start Date:					
Date						Pool					
	Application to Diving Program						Swim Test				
	Liability Waiver						Swim Strokes				
	Statement of Gear Understanding						Snorkel Skills				
	Diving Physical						Self-rescue				
	CPR/First-Aid						Tows and Assists				
	DAN O2 Oxygen First-Aid						Rescue Skills				
	Gear Inspections						Carry's and Water Removals				
	Date of Scuba Certification						Basic Scuba Skills				
Academic Topics							Diver Assists and Tows				
	History of Scientific Diving						Rescue Skills				
	Diving Safety						Knot Tying				
	Rescue Diving						Gear Clip-on				
	HazMat Diving						Lift Bag Usage				
	Hazardous Materials						Wreck and finger Reel Usage				
	Test Score:						Transect/quadrats				
	FAU Diving and Boating Manual						Underwater Construction				
	Dive Hand Signals						Zero Visibility Swim				
	Test Score:						Full face masks and comms				
	Scientific Diving Methodology						Technical gear assembly and use				
	General Decompression Rules					O/W Rescue Evaluation/Checkout Dive					
	Dive Tables						Compass Usage				
	Dive Computers						Search and Recovery				
	Test Score:						Rescue Unconscious Diver				
	Diving Physiology						Strip Gear				
	Diving Accident Management						Assess				
	First-aid for Diving Injuries						Activate EMS				
	Hazardous Aquatic Animals						CPR/First Aid				
	Test Score:						O <sub>2</sub> First-Aid				
	Dive Physics						Checkout Dive				
	Equipment										
	Diving from Boats										
	Test Score:										
Cumulative Exam Score							Completion Date				
	Score:						Scientific Diving Certificate Issued				
Training Dive	2	3	4	5	6	7	8	9	10	11	12
Date											

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

Date \_\_\_\_\_

## APPENDIX H FAU CHECKOUT DIVE PROCEDURE

Anyone diving under the auspices of FAU may be required, at the discretion of the DBSO, to demonstrate proficiency in some or all of the following skills. If proficiency cannot be demonstrated, remedial training may be required before permission is granted to dive under FAU auspices.

Name of Applicant:		
Date	DBSO	Requirement/Skill
		Knowledge of FAU and AAUS diving standards and regulations
		Swim skills (Optional if evaluation is needed):
		Surface dive to 10 ft. without scuba gear
		Surface swim without swim aids (400 yd. <12min)
		Underwater swim without swim aids (25 yd. without surfacing)
		Tread water, swim aids (10 min.), or without use of hands 2 min.
		Transport another swimmer without swim aids (25yd)
		Demonstrate watermanship and snorkel skills
		Pre-dive Skills
		Dive planning, briefing, site orientation, and buddy check
		Use of dive tables and/or dive computer
		Equipment familiarity
		Entries (pool, boat, shore)
		Dive Skills
		Mask removal and clearing
		Regulator removal and clearing
		Surface swim with scuba; snorkel and regulator exchange (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
		Simulated decompression or safety stop
		Compass and underwater navigation
		Exits (pool, boat, shore)
		Situational Awareness
		Underwater signs and signals
		Proper buddy contact
		Monitor cylinder pressure, depth, bottom time
		Rescue Skills
		Self-rescue techniques
		Alternate air source breathing with and without mask (donor/receiver)
		Buddy breathing with and without mask (donor/receiver)
		Tows of conscious and unconscious victim
		Simulated in-water rescue breathing
		Rescue of submerged non-breathing
		Rescue breathing
		Diver equipment removal
		Recovery to boat or shore)

		Accident Management
		EMS Activation
		Search and recovery
		CPR/First-Aid
		Use of emergency oxygen on breathing and non-breathing victim
		Evacuation procedures

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

Date \_\_\_\_\_



## APPENDIX I DIVER'S FIRST AID KIT CHECKLIST

<input type="checkbox"/> 1" Adhesive Bandages (Band-aids)	30
<input type="checkbox"/> Butterfly Bandages	10
<input type="checkbox"/> Steri-pads, small	10
<input type="checkbox"/> Steri-pads, medium	10
<input type="checkbox"/> 2" x 126" (3.5 yd) Red Cross Bandage	1
<input type="checkbox"/> 4" x 126" (3.5 yd) Red Cross Bandage	1
<input type="checkbox"/> ½" x 180" (5 yd) First Aid Tape	1
<input type="checkbox"/> 1" x 180" (5 yd) First Aid Tape	1
<input type="checkbox"/> Triangular Bandage	2
<input type="checkbox"/> Ace Bandage	Optional
<input type="checkbox"/> Multi-Trauma Bandage	1
<input type="checkbox"/> Adaptic Non-adhering Dressing	2
<input type="checkbox"/> Ammonia Inhalants	1 box
<input type="checkbox"/> Cleansing Wipes	10
<input type="checkbox"/> Betadine Ointment or Solution	1 tube or bottle
<input type="checkbox"/> Cortisone Ointment	1 tube
<input type="checkbox"/> Neosporin Ointment	1 tube
<input type="checkbox"/> Aspirin	1 bottle
<input type="checkbox"/> Tylenol	1 bottle
<input type="checkbox"/> Sudafed	1 box
<input type="checkbox"/> Sea-sickness Pills	1 box
<input type="checkbox"/> Eye-Irrigating Solution	1 bottle
<input type="checkbox"/> Diluted Vinegar Solution	1 bottle
<input type="checkbox"/> Alcohol	1 bottle
<input type="checkbox"/> Cold Packs	2
<input type="checkbox"/> Hot Packs	2
<input type="checkbox"/> Bandage Scissors	1
<input type="checkbox"/> Pen Light	1
<input type="checkbox"/> Tweezers	1
<input type="checkbox"/> Tongue Depressors	1 box
<input type="checkbox"/> Oral Thermometer	1
<input type="checkbox"/> Oxygen Resuscitator (free-flow and demand)	1
<input type="checkbox"/> Pocket Mask with O <sub>2</sub> Fitting	1
<input type="checkbox"/> Space Blanket	1
<input type="checkbox"/> Stethoscope	Optional
<input type="checkbox"/> Blood Pressure Kit	Optional
<input type="checkbox"/> First Aid Book	1
<input type="checkbox"/> FAU "Diving and Boating Safety Manual"	1
<input type="checkbox"/> Emergency Phone Numbers List	1

# APPENDIX J FAU STANDARDS FOR COMMERCIAL DIVING

## Introduction

In 1982, OSHA exempted scientific diving from commercial diving regulations (OSHA 29 CFR Part 1910, Subpart T) under certain conditions which are outlined below. The final guidelines for the exemption became effective in 1985 (Federal Register, Vol. 50, No.6, p.1046). Sections 1.2 and 1.3 below define the differences between commercial and scientific diving activities. All diving activities conducted by FAU (Florida Atlantic University divers or under the auspices of Florida Atlantic University shall adhere to the OSHA Commercial Diving Operations Standards (29 CFR 1910.401 through 1910.440) unless qualified for the scientific diving or recreational diving exemptions explained below.

## Scientific Diving Definition

Scientific diving is defined (OSHA 29 CFR 1910.402) as diving performed solely as a necessary part of a scientific, research, or educational activity by employees whose sole purpose for diving is to perform scientific research tasks.

## Scientific Diving Exemption

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

1. The Diving Control Board consists of a majority of active scientific divers and has autonomous and absolute authority over the scientific diving program's operation.
2. The purpose of the project using scientific diving is the advancement of science; therefore, information and data resulting from the project are non-proprietary.
3. The tasks of a scientific diver are those of an observer and data gatherer. Construction and trouble-shooting tasks traditionally associated with commercial diving are not included within scientific diving.
4. Scientific divers, based on the nature of their activities, must use scientific expertise in studying the underwater environment and therefore, are scientists or scientists-in-training.

## Commercial Diving Definition

The OSHA Commercial Diving Operations Standards (OSHA 29 CFR 1910.401- 1910.440) applies to diving and related support operations conducted in connection with all types of work and employments, including general industry, construction, ship repairing, shipbuilding, shipbreaking, and longshoring. However, this standard does not apply to any diving operations: 1) performed solely for instructional purposes, using open circuit, compressed air scuba and conducted within the no-decompression limits; 2) performed solely for search, rescue, or related public safety purposes; or 3) defined as scientific diving as described above in [Sections 1.00](#).

## Operational Control

The Diving and Boating Board has autonomous and absolute authority over the FAU diving program. This includes operational authority of any diving activities (by employees, volunteers, students, visitors, contractors, etc.) in which FAU is connected including any of the following: diving on any FAU related projects, using any FAU equipment, diving from FAU vessels or small boats, or diving within the scope of employment. The FAU Diving and Boating Board shall set forth, review, revise and administer these diving standards. The FAU Diving Safety Officer (DBSO) shall have operational authority through the auspices of the FAU Diving and Boating Control Board.

- a) Contracted Commercial Divers – Non-FAU commercial divers diving under FAU auspices whether contracted or otherwise must submit the following minimum requirements to the FAU DBB and the University Risk Management attorney for evaluation. Additional requirements may be imposed by the DBB.
  1. A Contractor’s License valid in the State of Florida.
  2. Proof of adequate liability insurance.
  3. A dive plan for the proposed activities.

## Personnel Requirements

For all commercial diving activities that are under the auspices of FAU, the commercial dive team members shall be qualified in accordance with OSHA 29 CFR 1910.410 and also in accordance with FAU’s “Diving and Boating Safety Manual.”

## Operational Procedures, Specific Operations Procedures, Equipment Procedures, and Recordkeeping

The commercial divers when diving under the auspices of FAU shall adhere to the OSHA Commercial Diving Operations Standards (OSHA 29 CFR 1910.401- 1910.440). In addition, each dive team member shall comply with the FAU’s “Diving and Boating Safety Manual.” The OSHA diving standards in any case will supersede the HB diving standards where there is any discrepancy. At a minimum the dive team shall consist of two buddy divers and a standby diver.

## Commercial Diving Operations Standards (OSHA 29 CFR 1910.401 through 1910.440)

The most current copy of OSHA 29 CFR 1910 Subpart T, Appendices A, B, and C can be found at the U.S. Government Printing Office website under the Code of Federal Regulations, and is updated daily.

<http://www.gpoaccess.gov/>

## APPENDIX K FAU DBB APPROVED DIVING EQUIPMENT

In accordance with the American Academy of Underwater Sciences' (AAUS) "Standards for Scientific Diving," the FAU Diving and Boating Board is required to specifically approve regulators, dive tables and dive computers used by members of the FAU scientific diving program. Additionally, the AAUS Standards also state that divers must use "approved" depth gauges. (*Reference: Section 3.20, AAUS Standards for Scientific Diving*)

### Regulators

The FAU Diving and Boating Board specifically approves the use of all commercially available diving regulators, provided the following conditions are met.

1. The diver purchased the regulator "new" from a commercial outlet.
2. If the diver purchased the regulator "used" from a commercial or private entity, the regulator has been serviced by a certified technician and approved by the FAU Diving Safety Officer.
3. The regulator is inspected and tested prior to first use and every 12 months thereafter.
4. Regulators will consist of a primary second stage and an alternate air source (such as an octopus second stage or redundant air supply).
5. The regulator is not subject to a manufacturer's or a Consumer Product Safety Commission's recall. (See [www.cpsc.gov](http://www.cpsc.gov) search term "SCUBA dive" or "manufacturer's name")

### Dive Tables and Dive Computers

The FAU Diving and Boating Board specifically approves the use of the following dive tables and computers.

1. Navy, NAUI, NOAA, PADI, and SSI non-decompression dive tables.
2. Other dive tables as approved by the DBSO.
3. Dive computers from the following manufacturers:  
Aeris, AquaLung, Cressi-Sub, Cochran, Mares, Oceanic, and Uwatek,  
provided the specific model is not subject to a manufacturer's or a Consumer Product Safety Commission's recall:
4. Dive computers from manufacturers other than those listed above must be approved by the DBSO.

### Depth Gauges

The FAU Diving and Boating Board specifically approves the use of all commercially available depth gauges, provided the following conditions are met.

1. The diver purchased the depth gauge "new" from a commercial outlet.
2. If the diver purchased the depth gauge "used" from a commercial or private entity, the depth gauge has been inspected and approved by the FAU Diving Safety Officer.
3. The depth gauge must be tested at depth against a gauge(s) that is(are) known to be working prior to being placed in service and every 12 months thereafter.
4. The depth gauge is not subject to a manufacturer's or a Consumer Product Safety Commission's recall. (See [www.cpsc.gov](http://www.cpsc.gov) search term "SCUBA dive" or "manufacturers name")

**Diver’s Equipment Inspection Requirements**

Divers must ensure that the following equipment is inspected by a qualified technician at these minimum intervals and that service records are forwarded to the DBSO. However, divers must also forward copies of service records for any other diving equipment modification, repair, test, calibration, or maintenance service performed to the DBSO for inclusion in the diver’s file.

**Regulators:** Inspected and Serviced – 12 months

**Buoyancy Compensating Devices:** Inspected and Serviced – 12 months

**SCUBA Cylinders\*:** Internal Visual Inspection – 12 months;  
Hydrostatically tested – 5 years

*\* Records for cylinders not owned by divers or the University need not be submitted to the DBSO; however, divers must ensure that such cylinders are properly inspected and tested before use.*

**Diver’s Statement of Understanding Regarding Equipment Requirements**

I, \_\_\_\_\_, hereby acknowledge that I understand and will follow the equipment requirements as specified in the Florida Atlantic University Diving and Boating Safety Diving Manual and use only equipment specified on the Approved Equipment List. I will only dive with equipment with which I have been properly trained and with which I am comfortable. Furthermore, I will service my equipment periodically as required and at any time that the performance or integrity of the equipment is in question. I will not perform a dive without the proper complement of equipment appropriate to the dive conditions, nor will I use experimental equipment as my primary gear. I will always dive with an approved alternate air source, timing device, and dive buddy. I understand that I (or my lead diver) must always submit a dive plan to the Diving Safety Officer (DBSO) before diving and that the DBSO can may establish further additional requirements as deemed necessary for the particular diving environment.

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

# APPENDIX L FAU BOATING INCIDENT/ACCIDENT REPORT

Directions: All boating related incidents/accidents *whether or not an injury is involved*, must be reported as soon as possible after the event. Completed boating incident/accident report forms must be filed with the FAU Diving and Boating Safety Officer.

Y / N Was anyone injured requiring treatment beyond simple first-aid?

Y / N Is anyone deceased, or missing or unaccounted for in a manner which may indicate death?

Y / N Is there any major boat or personal property damage exceeding \$2000?

If yes to any of the above, the Florida FWC, the sheriff of the county in which the accident occurred, or the police chief of the municipality in which the accident occurred must be notified by the quickest means possible. In addition, the U.S. Coast Guard must be notified in writing within 48 hours [http://www.uscgboating.org/safety/accident\\_reporting.aspx](http://www.uscgboating.org/safety/accident_reporting.aspx).

Y / N Has there been a discharge or spill of any oil or hazardous materials?

If yes, report oil or hazardous substances spilled into the water immediately by calling the U.S. Coast Guard at 1-800-424-8802.

Y / N Has any damage to coral reefs occurred?

If yes, report vessel grounding or other coral reef injury in southeast Florida by calling FDEP at 1-786-385-3054.

Date of Incident/Accident \_\_\_\_\_ Time of Accident \_\_\_\_ : \_\_\_\_ am / pm

Name of Person Filing Report \_\_\_\_\_ Phone # (\_\_\_\_) \_\_\_\_\_

Location of Accident \_\_\_\_\_

Name or Description of Boat \_\_\_\_\_

Point of Departure \_\_\_\_\_

Vessel Operator \_\_\_\_\_ Department \_\_\_\_\_

Name(s) of Crew 1) \_\_\_\_\_ Phone# \_\_\_\_\_

2) \_\_\_\_\_ Phone# \_\_\_\_\_

Name(s) of Witnesses 1) \_\_\_\_\_ Phone# \_\_\_\_\_

2) \_\_\_\_\_ Phone# \_\_\_\_\_

Non-FAU personnel 1) \_\_\_\_\_ Phone# \_\_\_\_\_

Involved? N/A 2) \_\_\_\_\_ Phone# \_\_\_\_\_

Briefly describe the incident/accident:

Signature of Person Filing Report \_\_\_\_\_ Date \_\_\_\_\_

**Please use the back of this form to provide any additional information.**

Return this form when completed to FAU Environmental Health and Safety

email [ehs@fau.edu](mailto:ehs@fau.edu) fax 561.297.2210

## APPENDIX M REBREATHER CHECKLIST

Diver & Buddy		
Dive Site & Date		
<b>DIVE PLAN</b>		
Planned Depth 1 / Bottom Time 1		
Planned Total Runtime		
<b>CCR BACK ASSEMBLY</b>		
Pack Scrubber / Scrubber Time Remaining		
Install Scrims / Install Spider		
Install Scrubber Into Canister, Lube & Install O-Ring / Install		
Check Canister Head O-Ring / Install Canister Head		
Attach Blue Inhalation Hose / Attach Tan Exhalation Hose		
On-Board Oxygen Analysis O2% / Installed Right Side		
On-Board Diluent Analysis O2, HE% / Installed Left Side		
Attach O2 Supply Over Exhalation Hose / Secure Buzzer		
Inhalation Hose to T-Fitting / Exhalation Hose to T-Fitting		
<b>CCR FRONT ASSEMBLY</b>		
OCB Check / Breathing & 1-Way Directional Check		
Attach Mouthpiece Assembly / Mouthpiece Orientation		
Secure HUD / Secure OCB Hose to OCB		
Intermediate Pressure Check (O2: 7.5-8.0bar) / (Dil: 9.0-9.5bar)		
Attach Diluent Manual Add Valve / Attach O2 Manual Add Valve		
<b>REBREATHER UNIT CHECKS</b>		
Close OPV		
Positive Pressure Test / Negative Pressure Test		
Open OPV / Loop to Closed Circuit		
B1 Voltage / B2 Voltage		
Elapsed Time / Ambient Pressure		
C1 mV / C2 mV / C3 mV		
Sensors Calibration / Electronics Function Properly		
High Set Point / Switch Depth		
Low Set Point / Switch Depth		
Diluent % / Gradient Factors		
Set Backup Computer		

**Reminder: Must Pre-Breathe 3-5 Minutes Before Diving**

**APPENDIX N CROSS-TRAINING FOR MIXED MODES**



**CROSS-TRAINING FOR MIXED MODES / REBREATHER BUDDY DIVER**

Open Circuit (OC) Diver: \_\_\_\_\_

Closed Circuit Rebreather (CCR) Diver: \_\_\_\_\_

Closed Circuit Rebreather (CCR) Unit: \_\_\_\_\_

This letter affirms that \_\_\_\_\_ has been cross-trained to serve as a dive buddy in accordance with the Florida Atlantic University Diving Safety Manual for a CCR diver on the above-listed unit.

OC Diver: \_\_\_\_\_  
(print) (sign) (date)

CCR Diver: \_\_\_\_\_  
(print) (sign) (date)

DBSO: \_\_\_\_\_  
(print) (sign) (date)

Review of \_\_\_\_\_ rebreather for an open-circuit dive buddy.



(CCR Unit)

1. Location and operation of diluent and oxygen manual addition valves.
2. Location of pure oxygen cylinder (right side) and diluent cylinders (left side). In the case of a stuck solenoid, oxygen cylinder will be closed.
3. Location and operation of overpressure valve located on the exhalation counter lung on the right side. Gas must be purged from counter-lungs in addition to BC on ascent.
4. Displays:
  - a. The OC buddy should be aware of the rebreather's console. The OC buddy should be observant and aware of any red lights/alerts, making the CCR diver aware of any that may have been missed. The CCR diver should brief their OC buddy on what these alerts may look.
  - b. If the diver has a near eye remote display (NERD), this will be the primary display the CCR diver uses. Similar to the console, the OC diver should be aware and observant for any red lights/alerts.
  - c. If the diver has a heads-up display (HUD) it is designed with a 'buddy-side' warning light. It will go solid red if P02 goes  $<0.4$  or  $>1.5$  (i.e., includes both hypoxic and hyperoxic mixtures). When the red light first comes on, the rebreather should have plenty of time to deal with the issue (i.e., diluent flush) but the buddy is alerted to a potential problem.
5. In the case of any incident leaving the rebreather diver unconscious, buddy will ascend with diver while trying to keep mouthpiece secure. As with any dive, location of dump valves and inflators should be covered in the pre-dive buddy check. Over-inflation valve on counter lung will be positioned open.
6. **Hypercapnia** – Symptoms include headache, dizziness, loss of sensation, and nausea. The only way to solve that issue is for the rebreather diver to bail out offboard to open circuit.
7. **Hypoxia (within breathable limits)** diver will manually add oxygen and monitor if O2 readings come back to normal limits.
8. **Hypoxia (Not within breathable limits)** diver will bail out offboard to open circuit.
9. **Hyperoxia (within breathable limits)** diver will manually add diluent and monitor if O2 readings come back to normal limits.
10. **Hyperoxia (Not within breathable limits)** diver will bail out offboard to open circuit.

11. The rebreather is fitted with a Bail out Valve (BOV), so that the diver can switch to open circuit without having to remove the mouthpiece. While they will still want to bail out to off-board gas, this allows the CCR diver to immediately go off the loop while being able to breath and assess the next step.
12. Open circuit diver must carry a bail-out tank; capacity to be discussed with DBSO dependent on dive plan details such as depth and bottom time.

This confirms that \_\_\_\_\_ completed a review of the basic operations  
(OC diver)

of the \_\_\_\_\_ with \_\_\_\_\_ on \_\_\_\_\_.  
(CCR Unit) (CCR Diver) (Date)