South Carolina Aquarium
Dive Safety Manual

December 2018 version
Voted Official 4/5/19

FOREWORD

Since 1951 the scientific diving community has endeavored to promote safe, effective diving through self-imposed diver training and education programs. Over the years, manuals for diving safety have been circulated between organizations, revised and modified for local implementation, and have resulted in an enviable safety record.

This document represents the minimal safety standards for scientific diving at the present day. As diving science progresses so must this standard, and it is the responsibility of every member of the Academy to see that it always reflects state of the art, safe diving practice.

American Academy of Underwater Sciences

ACKNOWLEDGEMENTS

The Academy thanks the numerous dedicated individual and organizational members for their contributions and editorial comments in the production of these standards.

Revision History
Approved by AAUS BOD December 2018
Available at www.aaus.org/About/Diving Standards

TABLE OF CONTENTS

DIVING SAFETY MANUAL CHANGE REQUEST FORM 7

VOLUME 1

SECTION 1.00 GENERAL POLICY **9**
1.10 Purpose 9
1.11 Preservation Acts 9
1.12 Scientific Diving Definition 9
1.13 Scientific Diving Exemption 10
1.14 Association of Diving Contractors International - Commercial Dive Standards 10
1.15 Exemption from Federal OSHA Commercial Diving Standards 11
1.16 Recommendations for Changes to Manual 11
1.17 Liability 11
1.20 Operational Control 12
1.21 The South Carolina Aquarium Auspices Defined 12
1.22 The South Carolina Aquarium's Diving Safety Manual 12
1.23 The Diving Control Board 12
1.24 The Diving Safety Officer 14
1.25 Instructional Personnel 15
1.26 Dive Person in Charge 15
1.30 Reciprocity and Visiting Scientific Diver 16
1.40 Waiver of Requirements 16
1.50 Consequence of Violation of Regulations by SCA Divers 16
1.60 Consequence of Violation of Regulations by Organizational Members 16
1.70 Record Maintenance 16

SECTION 2.00 DIVING REGULATIONS FOR SCUBA (Open Circuit, Compressed Air) **18**
2.10 Introduction 18
2.20 Pre-Dive Procedures 18
2.21 Dive Plans 18
2.22 Emergency Plan 18
2.23 Diver Responsibility and Refusal to Dive 18
2.24 Pre-Dive Safety Checks 19
2.25 Pre-Dive Briefings 19
2.30 Diving Procedures 19
2.31 Solo Diving Prohibition 19
2.32 Termination of the Dive 20
2.33 Emergency Deviation from Standards 20
2.40 Post-Dive Procedures 20
2.41 Post Dive Safety Check 20

2.50 Emergency Procedures 20
2.51 Open Water Diving Emergency Procedures 20
2.52 Exhibit Diving Emergency Procedures: 21
2.60 Flying-After-Diving or Ascending to Altitude (Over 1000 feet) 23
2.70 Recordkeeping and Requirements 23
2.71 Personal Diving Log 23
2.72 Required Incident Reporting 23

SECTION 3.00 DIVING EQUIPMENT 25
3.10 General Policy 25
3.20 Equipment 25
3.21 Regulators 25
3.22 Breathing Full Face Masks and Helmets 25
3.23 SCUBA Cylinders 26
3.24 Diver's Dress 26
3.25 Harnesses 26
3.26 Weight Belts 26
3.27 Diver-Carried Reserve Breathing Supply 26
3.28 Hoses 27
3.29 Umbilicals 27
3.30 Flotation Devices 28
3.31 Timing Devices, Depth and Pressure Gauges During Open-Water Dives 28
3.32 Determination of Decompression 28
3.33 Dive Tables 28
3.34 Auxiliary Equipment 29
3.40 Support Equipment 30
3.41 First Aid Supplies 30
3.42 Diver's Flag 30
3.43 Compressor Systems - SCA Controlled 30
3.44 SCUBA Cylinder Fill Station 30
3.45 Oxygen System 30
3.46 Dive Computers 30
3.47 Diver Recall Devices 32
3.50 Equipment Maintenance 32
3.51 Recordkeeping 32
3.52 Compressor Operation and Air Test Records 32
3.60 Air Quality Standards 33

SECTION 4.00 SCIENTIFIC DIVER CERTIFICATION AND AUTHORIZATIONS 34
4.10 Prerequisites 34
4.20 Training 34
4.30 Diver Certifications and Authorization 38

4.40 Depth Authorizations 39
4.50 Maintaining Active Status 40
4.60 Revocation of Authorization 40

SECTION 5.00 MEDICAL STANDARDS 41
5.10 Medical Requirements of the South Carolina Aquarium Dive Team 41
5.20 Frequency of Medical Evaluations 41
5.30 Information Provided Examining Physician 41
5.40 Content of Medical Examinations 41
5.50 Physician's Written Report 41

VOLUME 2

SECTION 6.00 NITROX DIVING GUIDELINES 44
6.10 Requirements for Authorization to Use Nitrox 44
6.11 Prerequisites 44
6.12 Training 44
6.13 Practical Evaluations 44
6.20 Minimum Activity to Maintain Authorization 45
6.30 Operational Requirements 45
6.31 Oxygen Exposure Limits 45
6.32 Calculations of Decompression Status 45
6.33 Gas Mixture Requirements 45
6.34 Analysis Verification by User 45
6.40 Nitrox Diving Equipment 45
6.41 Required Equipment 45
6.42 Requirement for Oxygen Service 46
6.43 Compressor System 46

SECTION 7.00 SURFACE SUPPLY DIVING 47
7.10 Prerequisites 47
7.20 Surface Supply Diving 47
7.30 Hookah 48

SECTION 8.00 SPECIALIZED DIVING ENVIRONMENTS 50
8.10 Blue Water Diving 50
8.20 Overhead Environments 50
8.30 Aquarium Diving 50
8.40 Snorkel, Freedive, Breathhold Diving 50

SECTION 9.00 GUEST IMMERSION DIVERS 51

APPENDICES

1	OSHA GUIDELINES FOR SCIENTIFIC DIVING	53
2	DIVING MEDICAL EXAM OVERVIEW FOR THE EXAMINING PHYSICIAN	56
3	MEDICAL EVALUATION OF FITNESS FOR SCUBA DIVING REPORT	58
4	DIVING MEDICAL HISTORY FORM	60
5	RECOMMENDED PHYSICIANS WITH EXPERTISE IN DIVING MEDICINE	64
6	DEFINITION OF TERMS	65
7	REQUEST FOR DIVING RECIPROCITY/VERIFICATION OF DIVER	68
8	DIVING EMERGENCY MANAGEMENT PROCEDURES	70
9	ACCIDENT OR INCIDENT REPORT FORMS	71
10	ASSUMPTION OF RISK AND LIABILITY RELEASE AGREEMENT	73
11	APPLICATION FOR THE SOUTH CAROLINA AQUARIUM DIVE CERTIFICATION	74
12	ACCIDENT MEDICAL COVERAGE ACKNOWLEDGMENT FORM	75
13	STATISTICS COLLECTION CRITERIA AND DEFINITIONS	76
14	RECOMMENDATIONS FOR RESCUE OF SUBMERGED UNRESPONSIVE COMPRESSED-GAS DIVER	79

THE SOUTH CAROLINA AQUARIUM
DIVING SAFETY MANUAL CHANGE REQUEST FORM

Any changes recommended to this manual should be submitted on this form and returned to the Dive Safety Officer and Dive Control Board. Changes can include updated information, suggestions or comments about the manual, and changes that will make it work better. Additional pages may be attached if necessary.

Your ideas and comments are greatly appreciated.

MANUAL SECTION: _____

PAGE #:_____ PARAGRAPH: _____

WHAT IS PRESENTLY STATED IN THIS SECTION? _____

_____

_____

_____

WHAT IS THE CHANGE YOU ARE RECOMMENDING? _____

_____

_____

_____

HOW WILL THIS IMPROVE THE MANUAL? _____

_____

_____

_____

YOUR NAME: _____ GROUP: _____

Volume 1

Sections 1.00 through 6.00

SECTION 1.00 GENERAL POLICY

1.10 Purpose

The purpose of this manual is to ensure that all diving affiliated with The South Carolina Aquarium (SCA) is conducted in a manner that will maximize protection of divers from accidental injury and/or illness. It sets forth standards for The South Carolina Aquarium diving program, the organization for the conduct of this program, standards for training and the basic regulations and procedures for safety in all diving operations. This manual conforms to OSHA 29 Code of Federal Regulations Part 1910 Subpart T.

This manual combines both OSHA commercial diving guidelines and American Academy of Underwater Sciences (AAUS) scientific diving standards, and both the location and task are the basis for which standard is to be used. This manual was developed and written by The South Carolina Aquarium by compiling the policies set forth in the diving manuals and practices of OSHA, AAUS, NOAA, Association of Diving Contractors International (ADCI) Association of Zoos and Aquariums (AZA), Association of Dive Program Administrators (ADPA), various partner aquariums, as well as several universities, private, and governmental scientific diving programs. Many of 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.

Historical Perspective

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.

1.11 Preservation Acts

It is declared that in any emergency situation requiring the rescue and saving of volunteers, staff, and guests, all designated dive safety officers, team leaders, or dive person(s) in charge may act in variance of the dive operation procedures established in this manual. Any diver may deviate from the requirements of this manual to the extent necessary to prevent or minimize a situation that is likely to cause death, physical harm, or major environmental damage. A written report of such actions must be submitted to the Diving Control Board via the Diving Safety Officer explaining the circumstances and justifications.

1.12 Scientific Diving Definition

Scientific diving is defined (29 CFR 1910.402) as diving performed solely as a necessary part of a scientific, research, or educational activity by staff (both paid and unpaid) whose sole purpose for diving is to perform scientific research tasks. For dives classified under the Scientific Exemption, SCA uses American Academy of Underwater Sciences (AAUS) for 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 standards.

1.13 Scientific Diving Exemption

OSHA has granted an exemption for scientific diving from commercial diving regulations under the following guidelines (29 CFR Part 1910 Subpart T Appendix B):

- 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.
- The purpose of the project using scientific diving is the advancement of science; therefore, information and data resulting from the project are non-proprietary.
- 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.
- Scientific divers, based on the nature of their activities, must use scientific expertise in studying the underwater environment, and therefore are scientists or scientists-in-training.

In addition, The two elements that a diving program must contain as defined by OSHA in 29 CFR 1910 Subpart T 1910.401(a)(2)(iv) are:

- 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.
- Diving control (safety) 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.

(See Appendix 1 OSHA Guidelines for Scientific Diving)

1.14 Association of Diving Contractors International - Commercial Diving Standards

Included in the OSHA commercial diving standards revision dated August 11, 2006, OSHA and the U.S. Coast Guard officially recognize the Association of Diving Contractors International (ADCI) standards as the "best established industry practices." The official statement is as follows:

OSHA recognizes the ADCI Consensus Standards for Commercial Diving and Underwater Operations as meeting the general requirements of 29 CFR 1910.420 for a safe practices manual. The contents of this document meet or exceed the requirements of 29 CFR 1910, Subpart T. For diving-related operational, maintenance, and testing matters that are not addressed by OSHA standards, OSHA recognizes ADCI standards as the best established industry practice.

OSHA's recognition of the ADCI standards is consistent with the position taken by the U.S. Coast Guard. In a letter from the U.S. Coast Guard, Chief, Office of Compliance, to the ADCI dated February 9, 2005, the U.S. Coast Guard stated, "Of significance, ADCI's Consensus Standards for Commercial Diving and Underwater Operations fully meet and exceed the Coast Guard's regulatory requirements for commercial diving operations found in 46 CFR 197. Now in its fifth edition, the ADCI Consensus Standards are considered commercial diving industry best practices and are recognized and used by the United States Coast Guard as our comprehensive guidance document."

1.15 Exemption from Federal OSHA Commercial Diving Standards

29 CFR Part 1910, Subpart T, Appendix B (FEDERAL AND STATE AUTHORITY)

Federal OSHA's commercial diving standard covers private-sector employers in federal enforcement States, and employers who dive in association with maritime standards (i.e., shipyard employment, longshoring, and marine terminals) when these operations are not covered by a State with an OSHA-approved State-Plan State and local government employees are covered by the commercial diving standard only in States with State-Plans.

Twenty-one States and one Territory have OSHA-approved State-Plans covering both private and public sector employment: Alaska, Arizona, California, Hawaii, Indiana, Iowa, Kentucky, Maryland, Michigan, Minnesota, Oregon, Nevada, New Mexico, North Carolina, Puerto Rico, South Carolina, Tennessee, Utah, Vermont, Virginia, Washington and Wyoming.

Three States and one Territory (Connecticut, New Jersey, New York and the U.S. Virgin Islands) have approved plans covering State and local government employment only.

California, Michigan, Oregon, and Washington have promulgated State diving standards which differ from the federal standards. The other State-Plans have promulgated diving standards identical to the federal standards at 29 CFR Part 1910, Subpart T.

California, Minnesota, Vermont, and Washington cover certain private sector maritime operations (i.e., shore-based shipyard employment and marine terminals) under their State-Plans. State coverage is set out in the text of this directive and in the appropriate subparts of 29 CFR Part 1952, and is generally limited to shore-based activities not on the navigable waters (graving docks and marine railways are part of navigable waters). For specific guidance, see Section XV, paragraph 9(c) of this directive. Also, Oregon covers commercial diving from all shore-side locations (for definition of dive location see Section XV, paragraph B.11), even in maritime operations such as shipyard employment and marine terminals.

1.16 Recommendations for Changes to the Manual

An annual report and review of diving activities must be prepared and submitted to the Diving Control Board (DCB) by The South Carolina Aquarium Diving Safety Officer. At this time any recommendations for modifications of these standards must be submitted to the DCB for consideration. As part of each organizational member's annual report, any recommendations for modifications of the scientific standards must be submitted to the AAUS for consideration.
(See South Carolina Aquarium Dive Safety Manual Change Request Form page 7)

1.17 Liability

In adopting the policies set forth in this manual, The South Carolina Aquarium assumes no liability not otherwise imposed by law. Outside of those South Carolina Aquarium staff members diving in the course of their employment, each diver is assumed under this policy to be voluntarily performing activities for which he/she assumes all risks, consequences, and potential liability.

(See Appendix 10 Liability Release and Assumption of Risk)

1.20 Operational Control

1.21 The South Carolina Aquarium Auspices Defined

For the purposes of these standards, the auspices of The South Carolina Aquarium includes any diving operation in which The South Carolina Aquarium is connected because of ownership of any equipment used, locations selected, or relationship with the individual(s) concerned. This includes all cases involving the operations of employees of The South Carolina Aquarium, where such employees are acting within the scope of their employment, the operations of The South Carolina Aquarium volunteers and other persons who are engaged in diving with The South Carolina Aquarium.

It is The South Carolina Aquarium's responsibility to adhere to the OSHA guidelines set forth in the South Carolina Aquarium Dive Safety Manual. The South Carolina Aquarium will appoint a Diving Safety Officer, and a Diving Control Board to oversee all diving operations. The administration of the diving program will reside with the Diving Control Board (DCB). The decisions of the Diving Control Board shall be final.
The regulations herein must be observed at all locations where diving is conducted.

1.22 The South Carolina Aquarium's Diving Safety Manual

The South Carolina Aquarium must develop and maintain a diving safety manual that provides for the development and implementation of policies and procedures that will enable it to meet requirements of local environments and conditions as well as to comply with OSHA dive guidelines. The South Carolina Aquarium's diving standards must include, but not be limited to:

- OSHA commercial dive guidelines
- The AAUS Scientific Standards
  - Meeting AAUS minimum standards is a requirement for organizational membership in the Academy. Each OM must develop and maintain a diving safety manual that includes wording on how the OM defines specific policies and procedures required for the proper function of a scientific diving program. The OM manual must address environmental and working conditions unique to the program's operations. The OM diving manual must meet or exceed the AAUS standards.
  - AAUS standards must be the foundation for the development of an OM's scientific diving safety manual. The order and formatting of the OM manual does not have to conform to the AAUS template. The information contained in Volume 1, Sections 1.00 through 5.00 and the Appendices are required for all manuals. Volume 2, Sections 6.00 through 12.00 are required only when the OM conducts the specifically referenced diving mode or activity. Deviations or significant changes to AAUS minimum standards may require justification before approval is granted by the AAUS Standards Committee.

1.23 The Diving Control Board

The Diving Control Board (DCB) must consist of a majority of active divers. Voting members must include the Diving Safety Officer, the responsible administrative officer, or his/her designee, and should include other representatives of the diving program such as qualified divers and members selected by procedures established by The South Carolina Aquarium. A chairperson and a secretary may be chosen from the membership of the board according to local procedure. The DCB will meet annually unless merited by extenuating circumstances.

South Carolina Aquarium voting members must include:

- Director of Husbandry and Facilities
- DSO
- Paid Husbandry staff diver
- 3 Active Volunteer diver representatives
- Curator
- Medical Advisor
- Assistant Dive Safety Officer (ADSO)

The Diving Control Board:

- Has autonomous and absolute authority over the diving program's operation.
- Must approve and monitor diving projects.
- Must review and revise the diving safety manual.
- Must assure compliance with the manual.
- Must certify the depths to which a diver has been trained.
- Must take disciplinary action for unsafe practices.
- Must assure adherence to proper staffing requirements for all diving.
- Is the final board of appeal to consider diver-related problems.
- Recommends the issue, re-issue, or the revocation of diving certificates.
- Recommends changes in policy and amendments to The South Carolina Aquarium Diving Safety Manual as the need arises.
- Establishes and/or approves training programs through which the applicants for certification can satisfy the requirements of this manual.
- Must suspend diving programs that it considers to be unsafe or unwise.
- Must establish criteria for equipment selection and use.
- Must recommend new equipment or techniques.
- Must establish and/or approve facilities for the inspection and maintenance of diving and associated equipment.
- Must ensure that The South Carolina Aquarium's air station(s) meet air quality standards as described in Section 3.60 of this manual.
- Must periodically review the Diving Safety Officer's performance and program.
- Must sit as a board of investigation to inquire into the nature and cause of diving accidents or violations of this manual.
- Is committed to and recognizes that open water diving requirements are different from that of confined water (exhibit) diving and always maintains a clear distinction between the two.

- Understands and promotes the benefits of diver supervision (as outlined in this manual) but believes that ultimate responsibility for diving competency and proper (safe) dive planning and execution lies with the individual diver or team.
- Understands that "entry-level" diver training only qualifies a diver to engage in open water diving activities under supervision, provided the diving activities, methods/techniques, sea/weather conditions, equipment, and areas dived approximate those in which the diver has been trained.
- The DSO of The South Carolina Aquarium, or his/her designee, must act as the official representative of The South Carolina Aquarium DCB in matters concerning the diving program.

The DCB may delegate operational oversight for portions of the program to the DSO; however, the DCB may not abdicate responsibility for the safe conduct of the diving program.

1.24 The Diving Safety Officer (DSO)

The Diving Safety Officer (DSO) serves as a member of the Diving Control Board. He/She should have broad technical and scientific expertise in related diving.

Qualifications:

- Must be an active underwater SCUBA diving instructor certified through an internationally recognized dive training agency.
- Must be appointed by the Executive Director of the South Carolina Aquarium or his/her designee, with the advice and counsel of the Diving Control Board (DCB). Reports to the DCB for issues pertaining to daily diving activities, record keeping, diver training and safety.
- Must be a paid staff member.
- Must qualify as a Full Voting Member of AAUS as defined by AAUS Bylaws:
    - "(a) Holds a diving certification from a recognized national certifying agency or equivalent, and
    - (b) Has engaged in sustained or successive scientific diving activities during the past two years, or
    - (c) Has completed a course in scientific diving that meets the requirements as specified by the most current edition of the AAUS Standards for Scientific Diving."
- Must attend an AAUS DSO Orientation within one year of accepting a position at an AAUS approved OM, unless he/she has served as a DSO for another current AAUS OM within the last year.

Duties and Responsibilities:

- Must be responsible, through the DCB, to the Executive Director of the South Carolina Aquarium or his/her designee, for the conduct of the diving program of the South Carolina Aquarium. The routine operational authority for this program, including the conduct of training and certification, approval of dive plans, maintenance of diving records, and

ensuring compliance with this manual and all relevant regulations of The South Carolina Aquarium, rests with the Diving Safety Officer.

- May permit portions of this program to be carried out by a qualified delegate, although the Diving Safety Officer may not delegate responsibility for the safe conduct of the local diving program.
- Must be guided in the performance of the required duties by the advice of the DCB, but the Diving Safety Officer will retain operational responsibility for the conduct of the local diving program.
- Must suspend diving operations that he/she considers to be unsafe or unwise.
- Must develop, in conjunction with the Diving Control Board chair, the agenda for the DCB meetings and file yearly reports.

1.25 Instructional Personnel

Qualifications:

- All personnel involved in diving instruction under the auspices of The South Carolina Aquarium must be qualified for the type of instruction being given.

Selection:

- The Diving Safety Officer or his/her designee, who will solicit the advice of the DCB in conducting preliminary screening of applicants for instructional positions, will select instructional personnel. All instructional personnel must be active and insured with their respective diver training organization.

1.26 Dive Person in Charge

For each dive, one paid staff individual must be designated as the Dive Person in Charge (DPIC). He/she must be at the location during the diving operation.

The DPIC must be responsible for:

- Coordination with other known activities in the vicinity that are likely to interfere with diving operations.
- Ensuring all dive team members possess current certification and are qualified for the type of diving operation.
- Planning dives in accordance with Section 2.21
- Ensuring that all divers make the required safety stop upon ascent.
- Ensuring safety and emergency equipment is in working order and at the dive site.
- Briefing the dive team members on:
  - Dive objectives.
  - Unusual hazards or environmental conditions likely to affect the safety of the dive.
  - Modifications to diving or emergency procedures necessitated by the specific diving operation.

- Suspending diving operations if in his/her opinion conditions are not safe.
- Reporting to the DSO and DCB any physical problems or adverse physiological effects including, but not limited to, symptoms of pressure-related injuries.

1.30 Reciprocity and Visiting Scientific Diver

Two or more AAUS Organizational Members engaged jointly in diving activities, or engaged jointly in the use of diving resources, must designate one of the participating Diving Control Boards to govern the joint dive project.

A diver from The South Carolina Aquarium 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 7. (Letter of Reciprocity) signed by the Diving Safety Officer, Assistant Dive Safety Officer, or Chairperson of the South Carolina Aquarium Diving Control Board.

A visiting diver may be asked to demonstrate his/her knowledge and skills for the planned diving. An example of items to be demonstrated is presented in Section 5.20.

If a host Organizational Member denies a visiting diver permission to dive, the host Diving Control Board must notify the visiting diver and his/her Diving Control Board with an explanation of all reasons for the denial.

1.40 Waiver of Requirements

The South Carolina Aquarium Diving Control Board may grant a waiver for specific requirements of training, examinations, depth certification, and minimum activity to maintain certification. Medical examination requirements may not be waived.

1.50 Consequences of Violations of Regulations by SCA Divers

Failure to comply with the regulations of The South Carolina Aquarium's Diving Manual may be cause for the revocation or restriction of the diver's diving privilege by action of The South Carolina Aquarium's Diving Control Board.

1.60 CONSEQUENCES OF VIOLATION OF REGULATIONS BY ORGANIZATIONAL MEMBERS

Failure to comply with the regulations of this Manual may be cause for the revocation or restriction of The South Carolina Aquarium's recognition by the AAUS and potential OSHA violations.

1.70 RECORD MAINTENANCE

Each OM must maintain consistent records for its diving program and for each participant. These records include but are not limited to: diving safety manual; equipment inspection, testing, and maintenance records; dive plans (project and/or individual); records of dive (project and/or individual); medical approval to dive; diver training records; diver

authorization(s); individual dive log; dive incident reports; reports of disciplinary actions by the DCB; and other pertinent information deemed necessary by the South Carolina Aquarium.

Availability of Records:
Medical records must be available to the attending physician of a diver or former diver when released in writing by the diver.

The South Carolina Aquarium must retain records and documents required by this standard for the following period:

1. Diving safety manual – Current document only.
2. Equipment inspection, testing, and maintenance records – Minimum current entry or tag.
3. Records of Dive – minimum of 1 year, except 5 years where there has been an incident of pressure-related injury.
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. Pressure-related injury assessment - 5 years.
8. Reports of disciplinary actions by the DCB – Minimum of 1 year beyond the life of the diver's program participation.

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

2.10 Introduction

No person shall engage in diving operations under the auspices of The South Carolina Aquarium diving program unless he/she holds a current certificate issued pursuant to the provisions of this manual.

2.20 Pre-Dive Procedures

2.21 Dive Plans

Before conducting any diving operations under the auspices of the South Carolina Aquarium, a dive plan for the proposed project or dive must be formulated and submitted for approval by the DCB or designee. Dives should be planned around the competency of the least experienced diver. The dive plan (project or individual) should include the following:

- Diving Mode(s) and Gas(es)
- Divers' authorizations
- Approximate number of proposed dives
- Location(s) of proposed dives
- Estimated depth(s) and bottom time(s) anticipated
- Decompression status and repetitive dive plans, if required
- Proposed work, equipment, and boats to be employed
- Any hazardous conditions anticipated

2.22 Emergency Action Plan (Appendix 8)

In water details of the dive plan should include:

- Dive Buddy assignments and tasks
- Goals and objectives
- Maximum depth(s) and bottom time
- Gas management plan
- Entry, exit, descent and ascent procedures
- Perceived environmental and operational hazards and mitigations
- Emergency and diver recall procedures

2.23 Diver Responsibility and Refusal to Dive

The decision to dive is that of the diver. The ultimate responsibility for safety rests with the individual diver. It is the diver's responsibility and duty to refuse to dive, without fear of penalty, if in his/her judgment, conditions are unsafe or unfavorable, or if he/she would be violating the precepts of regulations in this Manual.

No dive team member will be required to be exposed to hyperbaric conditions against his/her will.

No dive team member may dive for the duration of any known condition, which is likely to adversely affect the safety and health of the diver or other dive team members.

2.24 Pre-dive Safety Checks

- Prior to commencing the dive, the team must assure that every team member is healthy, fit, and trained for the type of dive that is being attempted.
- Each diver must conduct a functional check of their diving equipment in the presence of the dive buddy or tender. They must ensure the equipment is functioning properly and suitable for the type of diving operation being conducted.
- Each diver must have the capability of achieving and maintaining positive buoyancy at the surface.
- Environmental conditions at the site will be evaluated prior to entering the water.

2.25 Pre-dive Briefings

Before conducting any diving operations under the auspices of the South Carolina Aquarium, the dive team members must be briefed on:

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

2.30 Diving Procedures

2.31 Solo Diving Prohibition

All diving under the auspices of The South Carolina Aquarium must be planned and executed in such a manner as to ensure proper manning requirements and constant effective communication based on the job task and dive environment.

Diving should be planned around the competency of the least experienced person. If loss of effective communication occurs within a team, all persons in that team must surface and re-establish contact.

Normal diving procedure in the GOT permits at least two divers on SCUBA to work together (one Safety diver and one or more Working diver(s)) in conjunction with a Standby diver and a DPIC.

A standby diver must be available topside at the dive location while divers are in the water for all operation in the Great Ocean Tank. The Standby Diver must be trained and willing to respond in an emergency.

An in-water Safety diver is required for all normal commercial dive operations in the Great Ocean Tank.

Under special considerations and approval from DPIC, a SCUBA diver on full face mask communications can be line tended by a qualified tender and have a standby diver on ready.

Open water diving requires a buddy system for divers on SCUBA for all dives. A Standby diver will be available at the dive site.

2.32 Decompression Management

- On any given dive, both divers in the buddy pair must follow the most conservative dive profile
- A mandatory safety stop must be made at 15 feet for 3 minutes before exiting the water during open water diving and dives in the Great Ocean Tank.

2.33 Termination of the Dive

- 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.
- It is the responsibility of the diver to terminate the dive that he/she considers unsafe, without fear of reprisal, in a way that does not compromise the safety of another diver already in the water.

2.34 Emergency Deviation from Standards

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

2.40 Post-Dive Procedures

2.41 Post-Dive Safety Check

After the completion of a dive, each diver must report any physical problems, symptoms of decompression sickness, or equipment malfunctions to the DPIC, DSO, and/or DCB. .

2.50 Emergency Procedures

Diving must not be conducted unless procedures have been established for emergency evacuation of the diver(s) to a hyperbaric chamber or appropriate medical facility, and these procedures have been approved by The South Carolina Aquarium Diving Control Board. (Appendix 8)

2.51 Open Water Diving Emergency Procedures

These procedures should be followed in the event of an accident (unless otherwise specified):

On a boat:

- Administer proper First Aid, including oxygen, CPR, and AED
- Notify the nearest Coast Guard Base—VHF Radio Ch. 16; coordinate emergency response and transportation procedures with them.
- Record dive profile, personal information and accident/symptom descriptions for emergency personnel. (Appendix 9)
- Notify the Divers Alert Network (DAN) at (919) 684-9111.
- Notify the DSO

On land, off property:

- Administer proper First Aid, including oxygen, CPR, and AED
- Notify the Emergency Medical System (EMS) - Telephone # 911.
- Advise the EMS of your situation and location; coordinate emergency response and transportation procedures with them.

- Record dive profile, personal information and accident/symptom descriptions for emergency personnel. (Appendix 9)
- Notify the Divers Alert Network (DAN) at (919) 684-9111.
- Notify the DSO

2.52 Exhibit Diving Emergency Procedures:

Administer proper First Aid, including oxygen, CPR, and AED.

Call the South Carolina Aquarium Security on channel 1 or at (843) 579-8507.

DO NOT CALL 911—Security will coordinate the response with in-house personnel, the EMS and contact the DSO.

Describe your location, emergency situation and any specifics needed to help with the response.

Exhibit Diver Evacuation Procedures

The objective of these procedures is to preserve life, prevent further injury or worsening of a condition, and promote recovery.

Great Ocean Tank: Activate alarm system. Stabilize victim at surface. Extract diver with Stokes Basket. Check for pulse and breathing. Administer CPR, AED, Emergency Oxygen and First Aid if required.

Carolina Seas: Activate alarm system. Stabilize victim at surface. Extract diver with cinch collar. Check for pulse and breathing. Administer CPR, AED, Emergency Oxygen and First Aid if required.

Small Exhibits or Backup tanks: Notify Security at once via phone or radio. Stabilize victim at surface. Extract diver with spine board. Check for pulse and breathing. Administer CPR, AED, Emergency Oxygen and First Aid if required.

First Aid Supplies

- There is a Backboard, DAN Oxygen Kit (O2), AED, First Aid Kit, Ring Buoy, Stokes Basket and a 15' Rescue Hook located at the entrance to the Great Ocean Tank.
- Backboard and Cinch Collar located at Carolina Seas.
- Backboard available at all other exhibits.
- There is an Emergency Oxygen/AED/and First Aid Kit attached to the surface supply cart.
- There is an Automated External Defibrillator (AED) located on each floor of the aquarium.
- A First Aid Kit, Emergency Oxygen Unit, and AED will be available at all open water dive sites.

First Aid Procedures

The following information outlines the first aid procedures for diving-related injuries. Professional medical treatment procedures will not be discussed; only immediate and temporary aid is described.

First Aid Priorities - Primary Assessment

In the event of an accident or sudden illness, it is necessary to act quickly; but it is equally important to know *what to do and what the correct priority for action is.* For example, both a superficial cut and respiratory failure require immediate action. However, should both problems occur simultaneously, first aid priorities (in addition to common sense) dictate that response to the respiratory failure should occur before attending to the superficial cut. Diving related causes of respiratory failure include obstructed airway, near drowning, cardiac failure (most common in diving emergencies), head injuries, adverse (allergic) reaction to marine-life wounds (poison), or decompression illness (DCI).

A *Primary Assessment* is to be done in the position in which the victim is found except when the victim must be removed from a life-threatening situation. Examples, surfacing an unconscious, non-breathing diver. Listed in correct order are the steps included in a primary assessment:

1) AROUSAL/CHECK FOR CONSCIOUSNESS
2) CHECK FOR PULSE
3) ESTABLISH AN AIRWAY
4) CHECK FOR BREATHING
5) CHECK FOR BLEEDING
6) SHOCK MANAGEMENT

Unconscious Diver

In the event that a diver is found unconscious in the Great Ocean Tank or other exhibits, the following steps should be taken:

1) Activate alarm system Security will notify 911 and the DSO
2) Get diver to platform
3) Remove gear from diver (*Do not disassemble the patient's gear*)
4) Get diver on Stokes basket, cinch collar, or spine board depending on exhibit
5) Remove patient from water
6) Make a Primary Assessment
7) Start **CPR** at once if needed
8) Ready the AED
9) Provide Oxygen First Aid

Evacuating Diver

In the event of a diving related emergency, the diver will need to be transported. DO NOT ATTEMPT TO TRANSPORT DIVER VIA THE FREIGHT ELEVATOR. Notify security of your location, stabilize the patient there and wait for EMS to respond. Wait with stabilized patient at the original location until the arrival of EMS, at which time EMS will transport patient down the elevator. Once Security has activated EMS (**9-1-1**), they will dispatch an individual to position the Freight Elevator.

Basic Life Support

A primary assessment of a patient may indicate the need for ***B**asic **L**ife **S**upport*.
BLS includes those emergency lifesaving procedures designed to treat failure of the respiratory or cardiovascular system. Diving-related causes of respiratory failure include obstructed airway, near drowning, cardiac failure, head injury, and severe reaction to marine-life wounds or poisoning.
When a patient does not respond to being aroused during a primary assessment, place him in a horizontal position, face up, and on a firm surface. Quickly loosen the wet suit or remove restrictive equipment.

When an individual is in a life-threatening position, the following steps should be taken:

1) Activate diver alarm.
2) Security will notify DSO and husbandry staff.
3) Begin **CPR** if needed. Once CPR is started, continue until spontaneous breathing and heartbeat occur or until patient is turned over to another equally trained person.
4) Ready AED as soon as possible
5) Provide 100% emergency oxygen

6) Once EMS has arrived at The South Carolina Aquarium they will be escorted by security to location of the patient.
7) Patient will be turned over to EMS, and SCA personnel will assist EMS with evacuating patient.

2.60 Flying After Diving Or Ascending to Altitude (over 1000 feet)

- Following a Single No-Decompression Dive: Divers should have a minimum preflight surface interval of 12 hours.
- Following Multiple Dives per Day or Multiple Days of Diving: Divers should have a minimum preflight surface interval of 18 hours.
- Following Dives Requiring Decompression Stops: Divers should have a minimum preflight surface interval of 24 hours.
- Before ascending to Altitude above (1000 feet) by Land Transport: Divers should follow the appropriate guideline for preflight surface intervals unless the decompression procedure used has accounted for the increase in elevation.

2.70 Recordkeeping and Requirements
2.71 Personal Diving Log

Each diver must log every dive made under the auspices of The South Carolina Aquarium's program. All divers will record their daily dives in the written dive log kept by the DSO. All divers will also record their dives on the computerized individual dive log at https://adpa.org/aquaguard/index.html . All logs will be accessible by the DSO at any time. The dive log must be in a format specified by the organization and/or must include the following:

- Name of diver and buddy
- Date and location
- Diving modes used
- General nature of diving activity
- Approximate surface and water conditions (open water)
- Maximum depth, bottom and surface-interval times
- Diving tables or computers used
- Detailed report of any near or actual incidents

2.72 Required Incident Reporting

All diving incidents requiring recompression treatment, or resulting in moderate or serious injury, or death must be reported to the South Carolina Aquarium's DCB and AAUS in a timely manner. The South Carolina Aquarium must record and report occupational injuries and illnesses in accordance with requirements of the appropriate Labor Code section. The South Carolina Aquarium must 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.

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

The acting DPIC must complete the Incident Report Form (Appendix9).
Written descriptive report to include:

- Name, address, phone numbers of the principal parties involved.
- Summary of experience of divers involved.
- Location, description of dive sites and description of conditions that led up to incident.
- Description of symptoms, including depth and time of onset.
- Description and results of treatment.
- Disposition of case.
- Recommendations to avoid repetition of incident.

In addition to requirements specific to the South Carolina Aquarium, all diving incidents will be reported to the AAUS. This report must first be reviewed and released by the South Carolina Aquarium's DCB and at a minimum contain:

- Complete AAUS Incident Report.
- Summary of experience of divers involved.
- 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.

SECTION 3.00 DIVING EQUIPMENT

3.10 General Policy

All equipment must meet standards as determined by the DSO and the DCB. 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

The South Carolina Aquarium DCB must establish the minimum equipment configuration for all dives.

3.21 Regulators

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

Inspection and testing:

- SCUBA regulators must be inspected and tested prior to first use and every six months thereafter.
- Be serviced annually or more frequently in accordance with the manufacturer's recommendations.
- Standard open circuit (OC) regulator configuration is:
  - A first stage
  - Primary 2nd stage
  - Back up 2nd stage
  - Submersible Pressure Gauge (SPG)
  - Inflator hose for a Buoyancy Compensator Device
- Reserve Air Systems will have a first stage, second stage, and a pressure gauge.
- Regulators must be able to deliver the proper pressure and flow to the diver.
- Regulators must be fitted with a dust cap.

3.22 Breathing Full Face Masks and Helmets

- A Full Face Mask may be used in place of the primary 2nd stage according to manufacturer's recommendations

Breathing masks and helmets must:

- Contain a first stage, second stage, LPI hose, and HP pressure gauge when used for SCUBA.
- Be serviced annually in accordance with the manufacturer's recommendations.
- Have a visual and performance test including a check of the intermediate and inhalation break pressures every six months.
- Have a non-return valve at the attachment point between helmet or mask hose, which must close readily and positively.
- Have an exhaust valve.
- Have a minimum ventilation rate capable of maintaining the diver at the depth to which he/she is diving.

3.23 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 every 5 years in accordance with DOT/CGA standards.
- SCUBA cylinders must have an internal inspection at intervals not to exceed twelve months.
- SCUBA cylinder valves must be functionally tested at intervals not to exceed twelve months.

3.24 Diver's Dress

Diver's dress must be suitable for the job intended, considering such factors as thermal conditions, and may include the following:

- Full wetsuit or drysuits
- Neoprene booties
- Gloves
- Hood

Divers must keep them clean, disinfected, and presentable.

3.25 Harnesses

Harnesses must:

- Be made of material of suitable strength to lift the diver and their equipment from the water
- Have a mechanical quick release between the harness and the umbilical during commercial operations
- Be constructed and fitted to prevent an unconscious diver from slipping free of the harness, or from a strain being placed on the full facemask or regulator
- Must be capable of a quick release of the weight system
- Be designed to prevent restriction of the diver's breathing when their full weight is supported by the harness
- A positive buckling device when used for surface-supplied diving

3.26 Weight Belts

Weight belts must:

- Be of sufficient weight to maintain the diver at the working depth or at neutral buoyancy
- Not be used as an attachment point for the diving umbilical during surface-supplied dive operations
- Be capable of quick release
- Be attached to the diver in a manner to avoid accidental disengagement
- BCD's with integrated weight systems may be used

3.27 Diver-Carried Reserve Breathing Supply

Reserve breathing supply must:

- Have a cylinder meeting Section 3.23
- Have a regulator on the cylinder capable of delivering the proper pressure and flow to the diver

- Have a means of attachment which prevents accidental detachment
- Be of sufficient capacity to permit return of the diver to the surface at a travel rate of
- 30 ft. (10m) per minute.

**NOTE FROM FED OSHA 29 CFR 1910.424(c)(4)(5): A Spare Air® bottle, or equivalent device, that is attached positively to the diver by a suitable line (so that the bottle is not lost if dropped) is sufficient as an independent reserve cylinder, provided that it meets the emergency air volume requirements for the dive profile. Spare Air® is the trade name for a small, high-pressure air bottle with an attached breathing regulator that is designed for use as an emergency-air source.*

3.28 Hoses

General

Flexible hoses used with diving systems or equipment must:

- Have a minimum burst pressure equal to four (4) times the Maximum Allowable Working Pressure (M.A.W.P.)
- Have a M.A.W.P. and flow rating not less than the system in which it is installed or used and be suitable for the service intended
- Have connectors with pressure capability equal to or greater than the hose on which they are installed, made of corrosion-resistant materials, and be resistant to accidental disengagement from either the hose or mating connector
- Be kink resistant or arranged to prevent kinking
- Be subjected to annual visual examination and pressure test to 1.5 times the working pressure
- Have their open ends taped, capped or plugged when not in use

Breathing Gas Hoses

Breathing gas hose assemblies must:

- Be made of corrosion-resistant materials including cadmium or zinc plated material
- Be suitable for breathing gas service
- Have a maximum allowable working pressure equal to or greater than maximum depth of dive relative to supply source plus 150 PSI
- Be of suitable design to prevent collapse when used for operation with higher external pressure than internal pressure
- Be resistant to accidental disengagement from either the hose or the mating connector

3.29 Umbilicals

South Carolina Aquarium dive umbilicals used for commercial operations must:

- Be subjected to a planned annual maintenance program
- Consist of a breathing hose, communications cable, and strength member rating
- Have strength members made of material unaffected by immersion in water for extended periods
- Be marked in 10-ft increments to 100 feet beginning at the diver and then 50-ft increments thereafter.

3.30 Flotation Devices

- Each diver must have the capability of achieving and maintaining positive buoyancy.
- Personal flotation systems, buoyancy compensators, 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 twelve months.
- For all open water dives, or exhibit dives with SCUBA gear, each diver must wear equipment that has been approved by the DCB
    - Drysuits are not to be used without a separate buoyancy control device (BCD).
    - BCDs are not required by divers diving in the exhibits while on surface supplied diving mode.
    - BCDs must be capable of providing the diver with positive floatation at the surface.
    - Wetsuits, drysuits and BCDs are not acceptable substitutes for the Coast Guard approved personal floatation devices required for the operator and all passengers on boats.

3.31 Timing Devices, Depth and Pressure Gauges

- Both members of the diving pair must have an underwater timing device, an approved depth indicator, and a submersible pressure gauge for open water 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.
- Gauges must be inspected and tested before first use and every twelve months thereafter.
- Submersible pressure gauges must be tested against a master gauge at intervals not to exceed six months.
- Each depth gauge must be tested or calibrated every six months and when there is reasonable cause to believe a discrepancy exists

3.32 Determination of Decompression Status: Dive Tables, Dive Computers

A set of diving tables, approved by the Diving Control Board, must be available at the dive location. These tables must be as conservative as the United States Navy Diving Tables, and the SCA divers will not exceed the No Decompression Limits (NDLs) or Maximum Dive Times (MDTs).

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

See Section 3.46 for recommendations on dive computers.

3.33 Dive Tables

No Decompression Table

The US Navy Diving No-Decompression Table 9-7 gives the maximum time that can be spent at a given depth without the need for decompression stops during the subsequent ascent to the surface.

At depths of 20 FSW and shallower, there is no limit on the amount of time that can be spent at depth. Deeper than 20 FSW, the time that can be spent is limited.

The No-Decompression Table also provides the repetitive group designators for dives that fall within the no-decompression limits. Even though no decompression stops are required during ascent, the diver still surfaces with some residual nitrogen in their tissues. This residual nitrogen needs to be accounted for if a repetitive dive is planned.

Table 9-7 No-Decompression Limits and Repetitive Group Designators for No-Decompression Dives

depth (fsw)	No-Stop Time Limit	Repetitive Group Designation (RGD)															
		A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	Z
10	Unlimited	57	101	158	245	426	*										
15	Unlimited	36	60	88	121	163	217	297	449	*							
20	Unlimited	26	43	61	82	106	133	165	205	256	330	461	*				
25	595	20	33	47	62	78	97	117	140	166	198	236	285	354	469	595	
30	371	17	27	38	50	62	76	91	107	125	145	167	193	223	260	307	371
35	232	14	23	32	42	52	63	74	87	100	115	131	148	168	190	215	232
40	163	12	20	27	36	44	53	63	73	84	95	108	121	135	151	163	
45	125	11	17	24	31	39	46	55	63	72	82	92	102	114	125		
50	92	9	15	21	28	34	41	48	56	63	71	80	89	92			
55	74	8	14	19	25	31	37	43	50	56	63	71	74				
60	60	7	12	17	22	28	33	39	45	51	57	60					
70	48	6	10	14	19	23	28	32	37	42	47	48					
80	39	5	9	12	16	20	24	28	32	36	39						
90	30	4	7	11	14	17	21	24	28	30							
100	25	4	6	9	12	15	18	21	25								
110	20	3	6	8	11	14	16	19	20								
120	15	3	5	7	10	12	15										
130	10	2	4	6	9	10											
140	10	2	4	6	8	10											
150	5	2	3	5													

*Highest repetitive group that can be achieved at this depth regardless of bottom time

Figure 9-7 U.S. Navy Diving Manual – Volume 2 Revision 6 pg. 9-62

3.34 Auxiliary Equipment

Hand held 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

3.41 First aid supplies.

First aid kit, emergency oxygen, and AED must be available at all dive exhibits and when offshore.

3.42 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.

3.43 Compressor Systems – South Carolina Aquarium 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.
- Must meet required service and record keeping in Section 3.52.

3.44 SCUBA Cylinder Fill Station

All divers are required to be trained and certified in accordance to Professional SCUBA Inspectors (PSI) Cylinder Hazmat Fill Station Compliance guidelines. Cylinders must be filled at the SCUBA fill station blast chamber in the dive hallway or compressor room and done in accordance with the posted Fill Station Operator Checklist. Only cylinders owned and maintained by SCA must be filled by the SCA compressor unless the DSO specifically authorizes otherwise. The Dive Office will be responsible for the training and evaluating of divers in the proper use of the fill stations.

3.45 Oxygen Systems

- Equipment used with oxygen or mixtures containing over forty percent (40%) by volume oxygen must be designed and maintained for oxygen service.
- Components exposed to oxygen or mixtures containing over forty percent (40%) by volume oxygen must be cleaned of flammable materials before being placed into service.
- Oxygen systems over 125 psig must have slow-opening shut-off valves.

3.46 Dive Computers

Only those models of dive computers specifically approved by the Dive Safety Officer (DSO) may be used.

Any diver desiring the approval to use a dive computer as a means of determining decompression status must apply to the DSO.

Dive computer training will include:

- Personal instruction and diver access to all literature supplied by the computer manufacturer, including display interpretation, proper operation and basic maintenance.

- A written examination covering basic decompression theory, specifics on the computer to be used, computer diving safety and The South Carolina Aquarium guidelines for computer diving.
- Each diver relying on a dive computer must have his own unit.
- On any given dive, both divers in the buddy pair must follow the more conservative computer.
- If the dive computer fails or gives erroneous readings at any time during the dive, the dive must be terminated and appropriate surfacing procedures should be initiated immediately. The computer should be returned to the manufacturer and should not be used again until it has been repaired.

  NOTE: *Subsequent dives can be made only if the dive profile from previous diving falls within the limits of the US Navy dive tables or more conservative dive planning table.*

Always begin using a dive computer without pressure exposure during the preceding 24 hours when using a computer which is not designed for multi-day use. Diving with a computer while the diver is retaining excess nitrogen, which is not factored into the computer, will lead to misleading and dangerous readings from the computer.

Once the dive computer is in use, it must not be switched off until it indicates complete off gassing has occurred.

When using a dive computer, non-emergency ascents are to be at the rate specified for the make and model of dive computer being used. If the diver exceeds the ascent rate requirement of the computer, the diver's nitrogen situation will be beyond the monitoring capability of the computer and all diving should be terminated for at least 18 hours.

Ascent rates must not exceed 30 ft/min. in the last 60 fsw.

Whenever practical, divers using a dive computer should make a safety stop between 15 and 25 feet for 3-5 minutes, especially for dives below 60 fsw.

Decompression diving is not allowed under the auspices of The South Carolina Aquarium diving program. Dive computers must not be used to facilitate this type of diving.

Ascending profiles should always be used on a deep, multi-level dive.

Repetitive dives should be planned with the deepest dive first and subsequent dives shallower than the one preceding.

Divers should avoid pushing bottom times to the computer's limits. These limits are model limits, they do not allow for environmental conditions or personal limitations (i.e.: strenuous work, diver's age, previous injury, history of DCS etc.). A safety factor should be also added to minimum surface intervals between dives.

All dives using a computer for determining time and depth factors should be backed up with an additional depth gauge and timing device in the event of computer malfunction.

Due to the additional bottom time allowed by the use of a dive computer, divers are more likely to encounter hypothermia and out of air situations. Special consideration of these possibilities should be observed while diving with a computer.

Repetitive diving should be limited to Recreational Dive Planner (RDP) limits.

3.47 Diver Recall Devices

- An underwater speaker is mounted beside the Great Ocean Tank to use in emergency audible/verbal recall to the surface.
- A metal wrench and submersed metal ladder must be available at the entrance to the Great Ocean Tank for auxiliary audible diver recall to the surface.
- A dive light must be available at the entrance to the Great Ocean Tank for auxiliary visual diver recall to the surface.

3.50 Equipment Maintenance

3.51 Recordkeeping

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, and the name of the person performing the work for the following equipment:

- Regulators
- Gauges (SPG, Depth Gauges, Timers, and Dive Computers)
- SCUBA cylinders
- Cylinder valves
- Diving helmets
- Submersible breathing full face masks
- Compressors, air filtration systems, gas control panels, and storage banks
- Analytical instruments
- Buoyancy control devices
- Dry suits
- Surface supplied equipment
- Rebreather systems
- Additional equipment categories as determined by the DCB

3.52 Compressor Operation and Air Test Records

Gas analyses and air tests must be performed on each organizational member-controlled breathing air compressor at regular intervals of no more than 100 hours of operation or three months, whichever occurs first. The results of these tests must be entered in a formal log and be maintained.

A log must be maintained showing operation, repair, overhaul, filter maintenance, and temperature adjustment for each compressor. Responsibility for compressor maintenance and air quality testing falls with the Dive Safety Officer or a qualified designee.

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).

Component	CGA Grade E Maximum	Oxygen Compatible Air Maximum
Oxygen %	20 - 22%/v	20 - 22%/v
Carbon Dioxide	1000 PPM/v	1000 PPM/v
Carbon Monoxide	10 PPM/v	2 PPM/v
Total Hydrocarbons as Methane	25 PPM/v	25 PPM/v
Water Vapor	67 PPM	67 PPM
Dew Point	-50 F	-50 F
Condensed Hydrocarbons	5 mg/m^3	0.1 mg/m^3
Particles	NA	0.1 mg/m^3
Objectionable Odors	None	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 the OM, every effort should be made to verify breathing gas meets the requirements of this standard. If CGA Grade E gas is not verifiable, the DCB must develop a protocol to mitigate risk to the diver.

SECTION 4.00 SCIENTIFIC DIVER CERTIFICATION AND AUTHORIZATIONS

This section describes the training and performance standards for AAUS Scientific Divers and represent the minimum required level of knowledge and skills presented in a generalized format. Individual diving programs are encouraged to expand upon and augment these requirements, develop or utilize appropriate educational materials, and optimize instructional programs to suit and reflect their specific needs.

4.10 Prerequisites

Administrative

The candidate must complete all administrative and legal documentation required by the South Carolina Aquarium.

Entry Level Diver Certification

The candidate must, at minimum, show documented proof of Diver Certification or equivalent from an internationally recognized training agency. OMs who wish to train and certify entry level divers may do so under the standards of the most current version of the RSTC/WRSTC and/or ISO entry-level diver standards. Entry level diver training is a prerequisite to scientific diver training and therefore no part of entry level training may be counted in any way toward scientific diver training.

1 "Minimum Course Content for Open Water Diver Certification"- World Recreational Scuba Training Council (WRSTC), 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 for Standardization (ISO) - www.iso.org.

Medical Examination

The candidate must be medically qualified for diving as described in Section 5.0 and Appendices 1-4 of this Manual. AAUS medical standards 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.

- Swim underwater for a distance of 25 yards (23 meters) without surfacing.
- Swim 400 yards (366 meters) in less than 12 minutes.
- Tread water for 10 minutes, or 2 minutes without the use of hands.
- Transport a passive person of equal size a distance of 25 yards (23 meters) in the water.

4.20 Training

The candidate 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 must include principles and activities appropriate to the intended area of scientific study. Formats for meeting the 100 hour training requirement include South Carolina Aquarium developed formalized training course, or a combination of formalized and on the job training.

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

Any candidate who does not convince the DCB, through the DSO, that they possess the necessary judgment, under diving conditions, for the safety of the diver and his/her buddy, may be denied South Carolina Aquarium scientific diving privileges.

Theoretical Training / Knowledge Development	
Required Topics:	**Suggested Topics:**
Diving Emergency Care Training • Cardiopulmonary Resuscitation (CPR) • AED • Standard or Basic First Aid • Recognition of DCS and AGE • Accident Management • Field Neurological Exam • Oxygen Administration	Specific Dive Modes (methods of gas delivery) • Open Circuit • Hookah • Surface Supplied diving • Rebreathers (closed and/or semi-closed)
Dive Rescue • To include procedures relevant to OM specific protocols. (See water skills below)	Specialized Breathing Gas • Nitrox • Mixed Gas
Scientific Method	Small Boat Operation
Data Gathering Techniques (Only items specific to area of study required) • Transects and Quadrats • Mapping • Coring • Photography • Tagging • Collecting • Animal Handling • Archaeology • Common Biota • Organism Identification • Behavior • Ecology • Site Selection, Location, and Re-location • Specialized Data Gathering Equipment	Specialized Environments and Conditions • Blue Water Diving • Altitude • Ice and Polar Diving (Cold Water Diving) • Zero Visibility Diving • Polluted Water Diving • Saturation Diving • Decompression Diving • Overhead Environments • Aquarium Diving • Night Diving • Kelp Diving • Strong Current Diving • Potential Entanglement/Entrapment • Live boating

<table>
<tr><th>Required Topics:</th><th>Suggested Topics:</th></tr>
<tr><td>Navigation</td><td rowspan="2">HazMat Training
• Chemical Hygiene, Laboratory Safety (Use of Chemicals)</td></tr>
<tr><td>HazMat Training
• HP Cylinders</td></tr>
<tr><td>Decompression Management Tools
• Dive Tables
• Dive Computers
• PC Based Software</td><td rowspan="3">Specialized Diving Equipment
• Full face mask
• Dry Suit
• Communications
• Dive Propulsion Vehicle (DPV)
• SMBs/Lift Bags
• Line Reels</td></tr>
<tr><td>AAUS Scientific Diving Regulations and History
• Scientific Dive Planning
• Coordination with other Agencies
• Appropriate Governmental Regulations</td></tr>
<tr><td>Hazards of breath-hold diving and ascents</td></tr>
<tr><td>Dive Physics (Beyond entry level scuba)</td><td rowspan="4">Other Topics and Techniques as Determined by the DCB</td></tr>
<tr><td>Dive Physiology (Beyond entry level scuba)</td></tr>
<tr><td>Dive Environments</td></tr>
<tr><td>Decompression Theory and its Application</td></tr>
</table>

Practical Training / Skill Development	
Confined Water	At the completion of training, the trainee must satisfy the DSO or DCB-approved designee of their ability to perform the following, as a minimum, in a pool or in sheltered water: • Enter water fully equipped for diving • Clear fully flooded face mask • Demonstrate air sharing and ascent using an alternate air source, as both donor and recipient, with and without a face mask • Demonstrate buddy breathing as both donor and recipient, with and without a face mask • Demonstrate understanding of underwater signs and signals • Demonstrate ability to remove and replace equipment while submerged • Demonstrate acceptable watermanship skills for anticipated scientific diving conditions
Open Water Skills	The trainee must satisfy the DSO, or DCB-approved designee, of their ability to perform at least the following in open water: • Surface dive to a depth of 10 feet (3 meters) without scuba* • Enter and exit water while wearing scuba gear* ^^ • Kick on the surface 400 yards (366 meters) while wearing scuba gear, but not breathing from the scuba unit* • Demonstrate proficiency in air sharing ascent as both donor and receiver* • Demonstrate the ability to maneuver efficiently in the environment, at and below the surface* ^^ • Complete a simulated emergency swimming ascent* • Demonstrate clearing of mask and regulator while submerged* • Underwater communications^^ • Demonstrate ability to achieve and maintain neutral buoyancy while

	submerged* • Demonstrate techniques of self-rescue and buddy rescue* • Navigate underwater ^ • Plan and execute a dive^ • Demonstrate judgment adequate for safe scientific diving* ^^
	Rescue Skills: • Rescue from depth and transport 25 yards (23 meters), as a diver, a passive simulated victim of an accident: surface diver, establish buoyancy, stabilize victim • Demonstrate simulated in-water mouth-to-mouth resuscitation • Removal of victim from water to shore or boat • Stressed and panicked diver scenarios • Recommendations For Rescue Of A Submerged Unresponsive Compressed-Gas Diver – Appendix 9
	Successfully complete a minimum of one checkout dive and at least eleven additional open water dives in a variety of dive sites, for a cumulative surface to surface time of 6 hours. Dives following the checkout dive(s) may be supervised by an active Scientific Diver holding the necessary depth authorization experienced in the type of diving planned, and with the knowledge and permission of the DSO
	The eleven dives (minimum) following the initial checkout dive may be conducted over a variety of depth ranges as specified by the South Carolina Aquarium DCB. Depth progression must proceed shallower to deeper after acceptable skills and judgement have been demonstrated, and are not to exceed 100 feet (30 m) during the initial 12 dive cycle
	* Checkout dive element ^^ Evaluated on all dives ^ Evaluated at some point during the training cycle

Examinations	
Equipment	The trainee will be subject to examination/review of: • Personal diving equipment • Task specific equipment • Function and manipulation of decompression computer to be employed by the diver (if applicable)
Written Exams	The trainee must pass a written examination reviewed and approved by the OM DCB that demonstrates knowledge of at least the following: • Function, care, use, and maintenance of diving equipment • Advanced physics and physiology of diving • Diving regulations • Applicable diving environments • Emergency procedures for South Carolina Aquarium -specific dive mode(s) and environments, including buoyant ascent and ascent by air sharing • Currently accepted decompression theory and procedures • Proper use of dive tables • Hazards of breath-hold diving and ascents • Planning and supervision of diving operations • Navigation

	• Diving hazards & mitigations • Cause, symptoms, treatment, and prevention of the following: near drowning, air embolism, hypercapnia, squeezes, oxygen toxicity, nitrogen narcosis, exhaustion and panic, respiratory fatigue, motion sickness, decompression sickness, hypothermia, and hypoxia/anoxia • Applicable theoretical training and knowledge development from the Required and Suggested Topics (above)

4.30 Diver Certification and Authorizations
Only a person diving under the auspices of the South Carolina Aquarium that subscribes to the practices of the AAUS is eligible for a scientific diver certification.

Diver-In-Training (DIT) Authorization
This is an authorization to dive, usable only while it is current and for the purpose intended. This authorization signifies that a diver has completed and been certified as at least an entry level diver through an internationally recognized certifying agency and has the knowledge skills and experience necessary to commence and continue training as a scientific diver under supervision, as approved by the DCB. DIT status must only be used when the diver is on his/her way to becoming certified as a scientific diver. While it is recommended for DIT's 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
Signifies a diver has completed all requirements in Section 4.20 and is certified by the SCA to engage in scientific diving without supervision, as approved by the DCB through the DSO. Submission of documents and participation in aptitude examinations does not automatically result in certification. To be certified, the applicant must demonstrate to the DCB, through the DSO, that s/he is sufficiently skilled and proficient, and possess the necessary judgement for their safety and/or that of the dive team. Scientific Diver Certification is only active when required authorizations are in place and current.

Scientific Aquarium Diver Certification
Scientific Aquarium Diver 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 as 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 DCB.

Temporary Diver Authorization
Only a diver not under the auspices of an AAUS OM may be granted a Temporary Diver Authorization. The individual in question must demonstrate proficiency in diving and can contribute measurably to a planned dive. A Temporary Diver Authorization constitutes a waiver of selected requirements of Section 4.0 and is valid only for a limited time, as approved by the DCB. A Temporary Diver Authorization must be restricted to the planned diving operation and must comply with all other policies, regulations, and standards of this Manual, including medical requirements. This authorization is not to be utilized as a repeated mechanism to circumvent existing standards set forth in this Manual.

4.40 Depth Authorizations

Depth Ratings 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 diver may be authorized to the next depth level after successfully completing the requirements for that level. A diver may exceed his/her depth authorization when accompanied and supervised by a dive buddy holding a depth authorization greater or equal to the intended depth. Dives must be planned and executed with the permission of the DCB or designee.

In the event a diver within the South Carolina Aquarium does not hold an authorization at the desired next level, the DCB 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 DCB may devise a reasonable accommodation. However, the total number of dives to obtain a given depth authorization must follow the cumulative number of dives listed below.

a) Authorization to 30 Foot Depth - Initial science diver depth authorization, approved upon the successful completion of training listed in Section 4.0. 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 and logging 12 supervised dives to depths between 31 and 60 feet under supervision of a diver authorized by the DCB, 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 and logging 6 supervised dives to depths between 61 and 100 feet under supervision of a dive buddy authorized by the DCB. The diver must also demonstrate proficiency in the use of the appropriate decompression profiling method. 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 and logging 6 supervised dives to depths between 100 and 130 feet under supervision of a dive buddy authorized by the DCB. The diver must also demonstrate proficiency in the use of the appropriate decompression profiling method. Cumulative minimum supervised dives: 36.
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 and logging 6 supervised dives to depths between 130 and 150 feet under supervision of a dive buddy authorized by the DCB. The diver must also demonstrate knowledge of the special problems of deep diving and of special safety requirements. 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 and logging 6 dives to depths between 150 and 190 feet under supervision of a dive buddy authorized by the DCB. The diver must also demonstrate knowledge of the special problems of deep diving and of special safety requirements. Cumulative minimum supervised dives: 48.

   Diving on air is not permitted beyond a depth of 190 feet. Dives beyond 190 feet require the use of mixed gas.

g) Authorization to 250 Foot Depth - A diver holding a 190-foot authorization may be authorized to a depth of 250 feet after successfully completing and logging 6 supervised dives to depths between 190 and 250 feet under supervision of a dive buddy authorized by the DCB. 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 300 feet after successfully completing and logging 6 supervised dives to depths between 200 and 250 feet under supervision of dive buddy authorized by the DCB. The diver must also demonstrate knowledge of the special problems of deep diving and of special safety requirements.

i) Authorizations deeper than 300 Feet – Depth authorizations deeper than 300 feet progress in 50-foot depth/6 dive increments. A diver holding a 300 foot, or deeper authorization may be authorized to the next depth authorization increment after successfully completing and logging 6 supervised dives under supervision of dive buddy authorized by the DCB. 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 scientific diver must log a minimum of 12 scientific, scientific training, or proficiency dives. At least one dive must be logged near the maximum depth, as defined by the DCB, of the diver's authorization during each 6-month period. Divers authorized to 150 feet or deeper may satisfy these requirements with dives to 130 feet or deeper. Failure to meet these requirements will result in revocation or restriction of authorization by the DSO under procedures established by the DCB.

Requalification of Authorization

Once the initial requirements of Section 4.0 are met, divers whose depth authorization has lapsed due to lack of activity may be requalified by procedures adopted by the DCB.

Medical Examination

All 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 Candidates From Diving (Appendix 2) must receive clearance to return to diving from a physician before resuming diving activities. This 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 Authorization

An individual's scientific diver certification can be restricted or revoked for cause by the DCB. Authorizations associated with an individual's scientific diver certification may be restricted or suspended for cause by the DSO. Restrictions or suspensions issued by the DSO may be rescinded by the DSO; these issues will be reported to and reviewed by the DCB, and the outcomes or actions resulting from this review will be documented in the diver's South Carolina Aquarium record. Violations of regulations set forth in this Manual or other governmental subdivisions not in conflict with this Manual, or demonstration of poor judgement, may be considered cause. The DCB or designee 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 to the DCB for reconsideration. Following revocation, the diver may be reauthorized after complying with conditions the DCB may impose. All such written statements and requests, as identified in this section, are formal documents, and therefore part of the diver's file.

SECTION 5.00 MEDICAL STANDARDS

5.10 Medical Requirements

General

- All medical evaluations required by this *Manual* 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.
- 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 2)
- The South Carolina Aquarium must verify that divers have been declared by the examining medical authority to be fit to engage in diving activities.

5.20 Frequency of Medical Evaluations

Medical evaluation must be completed:		
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 (Appendix 2), 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

The South Carolina Aquarium must provide a copy of the medical evaluation requirements of this *Manual* to the examining physician. (Appendices 2, 3, and 4)

5.40 Content of Medical Evaluations

Medical examinations conducted initially and at the intervals specified in Section 5.20 must consist of the following:

1. Diving physical examination (Appendix 3). Modifications or omissions of required tests are not permitted
2. Applicant agreement for release of medical information to the Diving Safety Officer and the DCB (Appendix 3)
3. Medical history (Appendix 4).

5.50 Physician's Written Report

- A Medical Evaluation of Fitness For Scuba Diving Report (or South Carolina Aquarium equivalent) signed by the examining physician stating the individual's fitness to dive, including

any recommended restrictions or limitations will be submitted to the South Carolina Aquarium for the diver's record after the examination is completed.

- The Medical Evaluation of Fitness For Scuba Diving Report will be reviewed by the DCB or designee and the diver's record and authorizations will be updated accordingly.
- A copy of any physician's written reports will be made available to the individual.
- It is the diver's responsibility to provide to the South Carolina Aquarium a written statement from the examining medical authority listing any restrictions, limitations, or clearances to dive resulting from medical examinations obtained by the individual outside of their normal diving medical examination cycle. These statements will be reviewed by the DCB or designee and the diver's record and authorizations will be updated accordingly.

Volume 2

Sections 6.00 through 14.00
Required Only When Conducting Described Diving Activities
And
Organizational Member Specific Sections

SECTION 6.00 NITROX DIVING

This section describes the requirements for authorization and use of nitrox for Scientific Diving.

6.10 Requirements for Nitrox Authorization

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

6.11 Prerequisites

Only a certified Scientific Diver or DIT diving under the auspices of the South Carolina Aquarium is eligible for authorization to use nitrox.

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 DCB through the DSO that they are sufficiently knowledgeable, skilled and proficient in the theory and use of nitrox for diving.

6.12 Training

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

a) Under the auspices and standards of an internationally recognized diver training agency.

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

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

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

6.13 Practical Evaluation

- Oxygen analysis of nitrox mixtures.
- Determination of MOD, oxygen partial pressure exposure, and oxygen toxicity time limits, for various nitrox mixtures at various depths.
- Determination of nitrogen-based dive limits status by EAD method using air dive tables, and/or using nitrox dive tables, as approved by the DCB.
- Nitrox dive computer use may be included, as approved by the DCB.
- A minimum of two supervised open water dives using nitrox is required for authorization.

Written Evaluation

- Function, care, use, and maintenance of equipment cleaned for nitrox use.
- Physical and physiological considerations of nitrox diving (eg.: O_2 and CO_2 toxicity).
- Diving regulations, procedures/operations, and dive planning as related to nitrox diving.
- Equipment marking and maintenance requirements.
- Dive table and/or dive computer usage.
- Calculation of: MOD, pO_2, and other aspects of Nitrox diving as required by the DCB.

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

6.31 Oxygen Exposure Limits

- The inspired oxygen partial pressure experienced at depth should not exceed 1.6 ATA.
- The maximum allowable exposure limit should be reduced in cases where cold or strenuous dive conditions, or extended exposure times are expected.

6.32 Calculation of Decompression Status

- A set of DCB approved nitrox dive tables 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_2 limit and fO_2 adjustment should be checked by the diver prior to the start each dive to ensure conformity with the mix being used.

6.33 Gas Mixture Requirements

- Only nitrox mixtures and mixing methods approved by the DCB may be used.
- South Carolina Aquarium personnel mixing nitrox must be qualified and approved by the DCB for the method(s) used.
- 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 outlined 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^3.
    - For remote site operations using compressors not controlled by the South Carolina Aquarium where this is not verifiable, the DCB must develop a protocol to mitigate risk to the diver.

6.34 Analysis Verification by User

- Prior to the dive, it is the responsibility of each diver to analyze the oxygen content of his/her scuba cylinder and acknowledge in writing the following information for each cylinder: fO_2, MOD, cylinder pressure, date of analysis, and user's name.
- Individual dive log reporting forms should report fO_2 of nitrox used, if different than 21%.

6.40 Nitrox Diving Equipment

6.41 Required Equipment

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

- Labeled SCUBA Cylinders in Accordance with Industry Standards
- Oxygen Analyzers
- Oxygen compatible equipment as applicable

6.42 Requirement for Oxygen Service

- All equipment, which during the dive or cylinder filling process is exposed to concentrations greater than 40% oxygen, should be cleaned and maintained for oxygen service.
- Any equipment used with oxygen or mixtures 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.

6.43 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

Surface supplied diving technologies include any diving mode in which a diver at depth is supplied with breathing gas from the surface.

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 South Carolina Aquarium.

7.20 Surface Supplied Diving

Surface Supply 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, with voice communications.

Procedures

- Each diver must be continuously tended while in the water.
- A diver must be stationed at the underwater point of entry when diving is conducted in enclosed or physically confined spaces.
- Each diving operation must have a primary breathing gas supply sufficient to support divers for the duration of the planned dive including decompression.
- For dives deeper than 100fsw (30 m) or outside the no-decompression limits:
    - A separate dive team member must tend each diver in the water;
    - A standby diver must be available while a diver is in the water;
- A diver using Surface Supply may rely on surface personnel to keep the diver's depth, time and diving profile.
- Surface supplied air diving must not be conducted at depths deeper than 190 fsw (57.9 m).
- The South Carolina Aquarium DCB is responsible for developing additional operational protocols.

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. It is the South Carolina Aquarium DCB's responsibility to define when the surface supplied dive team must be expanded beyond the minimum manning 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 as defined by the South Carolina Aquarium DCB.
- The South Carolina Aquarium's DCB is responsible for developing additional operational protocols for surface supplied diving specific to the aquarium environment.

7.30 Hookah

Hookah Definition

Hookah is an open circuit diving mode comprised of a remote gas supply, a long hose, and a standard scuba second stage or full face mask. Hookah is generally used in shallow water (30 fsw or less), though the configuration has been used to supply breathing gas from a diving bell, habitat, or submersible/submarine.

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 outlined in Section 3.60
- Hookah supply systems must be capable of supplying all divers breathing from the system with 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 independent reserve breathing gas supplied will be carried by each hookah diver:
  - When the diver does not have direct access to the surface or
  - At depths or distance from alternate breathing gas source determined by the DCB.

Operational Requirements

- Hookah diving must not be conducted beyond depths or distance from alternate breathing gas source as determined by the DCB.
- 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.
- The South Carolina Aquarium DCB is responsible for developing additional operational protocols.

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 South Carolina Aquarium DCB.
- The South Carolina Aquarium DCB is responsible for developing additional operational protocols for hookah diving specific to the aquarium environment.
- *** Hookah dive mode, when no voice communication is included, would not be compliant in commercial operations with the exception of California OSHA guidelines**

SECTION 8.00 Specialized Diving Environments

Certain types of diving, some of which are listed below, require equipment or procedures that require training. The South Carolina Aquarium members using these must have guidelines established by their Diving Control Board. Divers must comply with all SCUBA diving procedures in this manual unless specified.

8.10 Blue Water Diving

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

Divers participating in SCA-sanctioned open water diving, are not authorized for blue water diving unless the buddy team is trained, has the need, been approved by the DSO, and is equipped and certified to do so.

8.20 Overhead Environments

Where an enclosed or confined space is not large enough for two divers, a diver must be stationed at the underwater point of entry and an orientation line must be used. Divers participating in SCA-sanctioned open water diving, are not authorized to enter overhead environments unless the buddy team is trained, has the need, been approved by the DSO, and is equipped and certified to do so.

Overhead environments in the Great Ocean Tank are large enough for two divers. A buddy system of one diver in the cave and the safety diver stationed at an entry point is required, but line tether is not needed as the diver is visible.

8.30 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 South Carolina Aquarium's DCB to establish the requirements and protocol under which diving will be safely conducted.

8.40 Snorkel, Freedive, Breathhold Diving

These terms can be used interchangeably to describe a diving mode in which the diver uses no self-contained or surface-supplied air or oxygen supply. A breathing device like a snorkel may or may not be used. During this dive mode the diver can/does hold their breath while going underwater.

Because of the risk of hypocapnia, reduced carbon dioxide in the blood, the natural breathing reflex may be altered and shallow water blackout may occur. Divers need to follow a buddy system with only one diver underwater at a time. Anyone engaging in this dive mode must be fully qualified as a diver at SCA.

Section 9 Guest Immersion Divers

Guest Immersion divers are classified as any non-SCA volunteer or staff diver(s) who dive under the auspices of the South Carolina Aquarium. Examples of Guest Immersion Diver would include Donors, VIP, Media, and Pay-to-Dive. Guest divers must be at a minimum certified open water divers by an internationally-recognized SCUBA certifying agency. An age requirement may be initiated at the Diving Control Board's discretion.

Guest dive programs will follow World Recreational SCUBA Training Council guidelines.

Guest divers must:

- Provide proof of open water certification or higher when applicable
- Sign Liability and Risk Acknowledgment waiver
- Provide a signed medical clearance

Guest immersion programs require in-water guides to be certified and active as recreational Divemasters or higher.

The South Carolina Aquarium requires

- 1:1 supervision ratio.
- A Standby Diver will be topside during in-water activities.
- A DPIC will also be onsite during in-water activities.

APPENDICES

Appendix 1 through 14

Appendix 1 OSHA Guidelines for Scientific Diving

Based on the OSHA directive CPL 02-00-151 effective June 13, 2011
Subject - 29 CFR Part 1910, Subpart T – Commercial Diving Operations
APPENDIX C: Exclusions and Exemptions from OSHA's Commercial Diving Standard

https://www.osha.gov/OshDoc/Directive_pdf/CPL_02-00-151.pdf

1. "The Diving Control (safety) Board consists of a majority of active scientific divers and has autonomous and absolute authority over the scientific diving program's operations."

   The first guideline concerns organizational structure. OSHA concluded that the organizational structure of the scientific diving community's consensual standard program is not only vital to the integrity of scientific diving programs, but effectively serves to segregate scientific diving from commercial diving. The Diving Control Board required for scientific diving programs must contain several elements that distinguish the exempt scientific diving programs from commercial diving. These distinctive elements include absolute authority over diving operations, the autonomy inherent in the Diving Control Board's decision making powers and responsibilities, and peer review. OSHA's intent was for the Diving Control Board, primarily consisting of the divers themselves, to regulate the diving activities in a manner consistent with that described by the scientific diving community during the rulemaking process. Therefore, OSHA requires that Diving Control Boards have this autonomous and absolute authority over scientific diving operations. OSHA also concluded that the peer review system has successfully regulated scientific diving programs and, therefore, OSHA mandated that the majority of members of the Diving Control Board be active divers. OSHA's intent with respect to this "peer review" was that the active divers required to make up the Diving Control Board would be scientists who actively dive, since at issue was the control of a scientific program. Thus, OSHA will interpret the membership requirement as it was intended in the final rule. The "majority of active divers" on the Diving Control Board also must be scientists.

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."

   The second guideline concerns the restricted purpose of the project. In part, the definition of scientific diving is "diving performed solely as a necessary part of a scientific, research, or educational activity" (see Federal Register notice 47 FR 53365 and 29 CFR 1910.402). The National Oceanic and Atmospheric Administration (NOAA) Diving Manual notes that "marine research using diving as a tool has been important in understanding the ocean, its organisms, and its dynamic processes." Such diving includes the study of fish behavior, ecological surveys and benthic surveys (the aggregate of organisms living on or at the bottom of a body of water). Scientific diving is an adjunct used in the advancement of underwater science. For example, representatives from the scientific diving community noted during public hearings and in written comments "Our objective is to promote the advancement of science and the use of underwater methods," that "Research and the furtherance of scientific knowledge are their (the divers) primary goals," results are "shared worldwide," and further that coverage of the scientific diving community by 29 CFR Part 1910, Subpart T - Commercial Diving Operations, may cause "irreparable damage to the underwater scientific effort of the United States." Because the exemplary safety record,

which led OSHA to promulgate the scientific exemption to 29 CFR Part 1910, Subpart T, was created by diving with the restricted purpose of advancing science, OSHA limited the scope of the exemption to diving intended to advance science. OSHA recognizes that the advancement of science cannot occur unless such studies are made available to contribute to and enhance scientific knowledge. Therefore, OSHA's intent was to restrict the exemption to scientific research dives that result in non-proprietary information, data, knowledge, or other work product. The requirement that information be non-proprietary applies to scientific, research, and educational activities engaged in by scientific divers. Material available to the public for review is non-proprietary, whether or not it is published; material not available for review is 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."

   The third guideline concerns the tasks performed. The scientific diving definition in the standard states that such diving must be done by employees whose sole purpose for diving is to perform scientific research tasks. Also contained in the definition is a list of those tasks that are traditionally considered commercial, with emphasis on construction and the use of construction tools (such as heavy equipment, power tools, explosives, welding equipment, burning equipment). As OSHA discussed in the final rule (see Federal Register notice 47 FR53357), a commercial diver is typically an underwater construction worker, builder, and troubleshooter; a scientific diver is an observer of natural phenomena or responses of natural systems, and a gatherer of data for scientific analysis. The tasks performed by the scientific diver usually are light and short in duration; if any hand tools are used, they are simple ones (such as a small hammer, collecting jars, special hand-held measuring devices, plastic core tubes, hand net, suction fish collector, camera, or slate pencil). As was indicated in a Federal Register notice (49FR29105), an example of task distinction might involve a scientific study of kelp. The construction of the kelp bed used in the project is not scientific diving since construction activities are commercial diving tasks; however, the consequent studies made of the kelp would be scientific diving tasks. Another example of task distinction was provided in the discussion of the final guidelines (see Federal Register notice 50FR1046). Lowering a large object into the water (such as the Project Aquarius habitat), even though a part of a scientific project, is not scientific diving. The special skills of an underwater scientist, including observation and data-collection skills, do not contribute to the placement of a large object underwater. OSHA avoided the possibility of the exemption applying to scientific divers who undertake such tasks while participating in a scientific research project by focusing the definition on the sole purpose of the dive (scientific research tasks), eliminating dives with mixed purposes, and further indicating typical examples of what OSHA considers to be commercial tasks. It is noted that the scientific diving community supported this limited definition (see the amicus brief in United Brotherhood of Carpenters and Joiners v. Department of Labor, No. 82-2509 (D.C. Cir. 1982)).

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."

   The fourth guideline concerns special qualifications. As was previously noted, a scientific diver is an observer and data gatherer involved in studying the underwater environment, its organisms and its dynamic processes, in order to promote underwater science. OSHA concluded, based on the nature of these activities, that these divers must be able to use scientific expertise in studying and analyzing the underwater environment. Consequently, OSHA requires these divers to be scientists or scientists in training. For example, a project to map segments of the ocean floor might hire

commercial divers to undertake certain mapping tasks. These commercial divers are neither scientists nor scientists in training as prescribed by this guideline and, therefore, would not be eligible for the exemption. If, however, scientific expertise was needed to effectively accomplish tasks associated with the mapping (such as specialized geological knowledge), and a geologist trained as a diver performed the special geological tasks associated with the mapping, then such diving tasks would meet this particular criterion. As stated previously, however, all program criteria and guidelines must be met in order for this diving scenario to qualify for the exemption. In promulgating the exemption, OSHA rejected using credentials to determine who is a scientist. However, the Agency accepted the limitation that divers covered by the exemption had to be scientists because this limitation reflects the scientific diving community's underwater activities, and it prevents obvious commercial diving from being construed as scientific diving

APPENDIX 2
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 South Carolina Aquarium. 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 South Carolina Aquarium standards. Thank you for your assistance.

_____ _____

Diving Safety Officer Date

_____ _____

Printed Name Phone Number

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

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

CONDITIONS WHICH MAY DISQUALIFY CANDIDATES FROM DIVING

1. Abnormalities of the tympanic membrane, such as perforation, presence of a monomeric membrane, or inability to autoinflate the middle ears. [5 ,7, 8, 9]
2. Vertigo, including Meniere's Disease. [13]
3. Stapedectomy or middle ear reconstructive surgery. [11]
4. Recent ocular surgery. [15, 18, 19]
5. Psychiatric disorders including claustrophobia, suicidal ideation, psychosis, anxiety states, untreated depression. [20 - 23]
6. Substance abuse, including alcohol. [24 - 25]
7. Episodic loss of consciousness. [1, 26, 27]
8. History of seizure. [27, 28]
9. History of stroke or a fixed neurological deficit. [29, 30]
10. Recurring neurologic disorders, including transient ischemic attacks. [29, 30]

11. History of intracranial aneurysm, other vascular malformation or intracranial hemorrhage. [31]
12. History of neurological decompression illness with residual deficit. [29, 30]
13. Head injury with sequelae. [26, 27]
14. Hematologic disorders including coagulopathies. [41, 42]
15. Evidence of coronary artery disease or high risk for coronary artery disease. [33 - 35]
16. Atrial septal defects. [39]
17. Significant valvular heart disease - isolated mitral valve prolapse is not disqualifying. [38]
18. Significant cardiac rhythm or conduction abnormalities. [36 - 37]
19. Implanted cardiac pacemakers and cardiac defibrillators (ICD). [39, 40]
20. Inadequate exercise tolerance. [34]
21. Severe hypertension. [35]
22. History of spontaneous or traumatic pneumothorax. [45]
23. Asthma. [42 - 44]
24. Chronic pulmonary disease, including radiographic evidence of pulmonary blebs, bullae, or cysts. [45,46]
25. Diabetes mellitus. [46 - 47]
26. Pregnancy. [56]

SELECTED REFERENCES IN DIVING MEDICINE

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

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

APPENDIX 3
AAUS MEDICAL EVALUATION OF FITNESS FOR SCUBA DIVING REPORT

_____ _____ _____

Name of Applicant (Print or Type) Date (Mo/Day/Year) Date of Birth (Mo/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 (Section 6.00). If you have questions about diving medicine, please consult with the Undersea Hyperbaric Medical Society or Divers Alert Network.

TESTS: THE FOLLOWING TESTS ARE <u>REQUIRED</u>:

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[1]
  (age, lipid profile, blood pressure, diabetic screening, smoking)
  Note: Exercise stress testing may be indicated based on Multiple-Risk-Factor Assessment[2]

PHYSICIAN'S STATEMENT:

_____ 01 Diver **<u>IS</u>** medically qualified to dive for: _____2 years (over age 60)
_____3 years (age 40-59)
_____5 years (under age 40)

_____ 02 Diver **<u>IS NOT</u>** medically qualified to dive:_____Permanently_____Temporarily.

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

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

Name of Applicant _____ Date_____

R**EMARKS:**

_____
_____
_____
_____
_____

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

_____ _____
Date Signature of Medical Doctor

_____
Name (Print or Type)

_____
Address

_____ _____
Telephone Number Email

My familiarity with applicant is:
O With this exam only
O Regular Physician for _____ years
O Other (describe)_____
_____

My familiarity with diving medicine is: **Circle all that apply**:

1) US Navy Dive Doctor (DMO)
2) NOAA Qualified Dive Doctor
3) Board Certified in Hyperbaric and Undersea Medicine
4) Qualified Staff member of a Hospital based Hyperbaric Medicine Facility
5) UHMS approved certification in Diving and Hyperbaric Medicine (DAN)
6) None

_____

APPLICANT'S RELEASE OF MEDICAL INFORMATION FORM

I authorize the release of this information and all medical information subsequently acquired in association with my diving to the South Carolina Aquarium Diving Safety Officer and Diving Control Board or their designee at 100 Aquarium Wharf, Charleston, SC on (date)_____.

Signature of Applicant _____

*** The Aquarium does not discriminate in employment opportunities or practices on the basis of race, color, religion, gender, sexual orientation, national origin, age, genetic information, disability, veteran status or any other characteristic protected by law. Due to variations in the recurrence of required dive physicals and the differences in the required testing, this information is required.**

APPENDIX 4
DIVING MEDICAL HISTORY FORM

(To Be Completed By Applicant-Diver)

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

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

TO THE APPLICANT:

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

This form 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	

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

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

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

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

_____
_____
_____
_____
_____
_____

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

Signature Date

APPENDIX 5

RECOMMENDED PHYSICIANS WITH EXPERTISE IN DIVING MEDICINE

List of local medical doctors that have training and expertise in diving or undersea medicine:

Roper Hospital Hyperbaric Chamber
316 Calhoun Street
Charleston, SC
843 724-2014

Divers Alert Network
6 West Colony Place
Durham, NC 27705
919 684-9111

APPENDIX 6

DEFINITION OF TERMS

AAUS - The American Academy of Underwater Sciences. The Academy is a non-profit organization comprised of individuals and organizations that are interested in and/or use diving as a research tool. The principal aims of the Academy are to establish and maintain scientific diving standards, to promote diving safety, and to exchange information on scientific diving methods and techniques.
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.
Bottom Time - The total elapsed time measured in minutes from the time when the diver leaves the surface in descent to the time that the diver begins a direct ascent to the surface.
Breath-hold Diving - A diving mode in which the diver uses no self-contained or surface-supplied air or oxygen supply.
Buddy Breathing - The sharing of a single air source between divers.
Buddy Diver - Second member of the dive team.
Buoyant Ascent - An ascent made using some form of positive buoyancy.
Burst Pressure - The pressure at which a pressure containment device would fail structurally.
Certified Diver - A diver who holds a recognized valid certificate from a member organization or recognized certifying agency.
Controlled Ascent - Any one of several kinds of ascents including normal, swimming, and buddy breathing 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 that may result from gas and bubbles in the tissues of divers after pressure reduction.
Decompression Table - A profile or set of profiles of depth-time relationships for ascent rates and breathing mixtures to be followed after a specific depth-time exposure or exposures. (Also called dive tables.)
Dive - A descent into the water, an underwater diving activity utilizing compressed gas, an ascent, and return to the surface.
Dive Location - A surface or vessel from which a diving operation is conducted.
Dive Location Reserve Breathing Air - A supply system of air at the dive location, which is independent of the primary supply system and sufficient to support divers during any planned decompression dive.
Dive Person in Charge - The qualified paid staff diver with experience and training to conduct and supervise the diving operation.
Dive Site - The physical location of a diver during a dive.
Dive Table - A profile or set of profiles of depth-time relationships for ascent rates and breathing mixtures to be followed after a specific depth-time exposure or exposures.
Dive Team - Divers and support individuals who are exposed to or control the exposure of others to hyperbaric conditions.
Diver - An individual in the water who uses apparatus, including snorkels, which supplies breathing gas at ambient pressure.

Diver-In-Training - An individual gaining experience and training in additional diving activities under the supervision of a dive team member experienced in those activities.
Diver-carried Reserve Breathing Air - A diver-carried independent supply of air or sufficient under standard operating conditions to allow the diver to reach the surface, or another source of breathing gas, or to be reached by another diver.
Diving Mode - A type of diving requiring specific equipment, procedures, and techniques, for example, snorkel, SCUBA or surface-supplied air).
Diving Control Board or DCB. - The group of individuals who sit in council with autonomous and absolute authority for the South Carolina Aquarium in matters concerning the scientific diving program.
Diving Safety Officer or DSO - The official representative for the DCB that is responsible for the safe conduct of overall diving procedures and the operation of the dive program of The South Carolina Aquarium (see Section 1.23).
EAD - Equivalent Air Depth (see below).
Emergency Ascent - An ascent made under emergency conditions where the diver exceeds the normal ascent rate.
Enriched Air (EANx) - A name for a breathing mixture of air and oxygen when the percentage of oxygen exceeds 21%. This term is considered synonymous with the term "nitrox" (Section 7.00)
Equivalent Air Depth (EAD) - Depth at which air will have the same nitrogen partial pressure as the nitrox mixture being used. This number expressed in units of feet seawater or saltwater, will always be less than the actual depth for any enriched air mixture.
Entry-level - Refers to the initial training received by new divers for recreational, sport, or underwater sightseeing purposes only while using SCUBA. An active instructor with a nationally recognized diver training organization awards certification. It certifies the individual for open water diving in daylight hours to a depth of 60 fsw or 61 ffw.
fN_2 - Fraction of nitrogen in a gas mixture, expressed as either a decimal or percentage by volume.
fO_2 - Fraction of oxygen in a gas mixture, expressed as either a decimal or percentage by volume.
FFW - Feet of freshwater, or equivalent static head.
FSW - Feet of seawater, or equivalent static head.
Hookah Diving - A type of shallow water surface-supplied diving where there is no voice communication with the surface.
Hyperbaric Chamber - See Recompression chamber.
Hyperbaric Conditions - Pressure conditions in excess of normal atmospheric pressure at the dive location.
Lead Diver - The most experienced scientific diver during open water activities. Responsible for the dive log and all diving operations, subject to the discretion of the "chief scientist" or a boat captain. Ensures that all equipment is in good working order. Reports to the DSO how SDTs performed during open water diving. Is responsible for advising the "chief scientist" on the diving to be conducted
Maximum Working Pressure - The maximum pressure to which a pressure vessel may be exposed under standard operating conditions.
Mixed Gas - MG
Mixed-gas diving - A diving mode in which the diver is supplied in the water with a breathing gas other than air.
MOD - Maximum Operating Depth, usually determined as the depth at which the pO2 for a given gas mixture reaches a predetermined maximum.
MSW - Meters of seawater or equivalent static head.
Nitrox - Any gas mixture comprised predominately of Nitrogen and Oxygen, most frequently containing between 21% and 40% oxygen. Also referred to as Enriched Air Nitrox, abbreviated EAN.

NOAA Diving Manual - Refers to the *NOAA Diving Manual, Diving for Science and Technology*, 2001 edition. National Oceanic and Atmospheric Administration, Office of Undersea Research, US Department of Commerce.
No-Decompression Limits - The depth-time limits of the "no-decompression limits and repetitive dive group designations table for no-decompression air dives" of the U.S. Navy Diving Manual or equivalent limits.
Normal Ascent - An ascent made with an adequate air supply at a rate of 60 feet per minute or less.
Organization Member - An organization which is a current member of the AAUS, and which has a program that adheres to the standards of the AAUS as set forth in the AAUS Standards for Scientific Diving Certification and Operation of Scientific Diving Programs.
Oxygen Clean - All combustible contaminants have been removed.
Oxygen Compatible - A gas delivery system that has components (o-rings, valve seats, diaphragms, etc.) that are compatible with oxygen at a stated pressure and temperature.
Oxygen Service - A gas delivery system that is both oxygen clean and oxygen compatible.
Oxygen Toxicity Unit - OTU
Oxygen Toxicity - Any adverse reaction of the central nervous system ("acute" or "CNS" oxygen toxicity) or lungs ("chronic", "whole body", or "pulmonary" oxygen toxicity) brought on by exposure to an increased (above atmospheric levels) partial pressure of oxygen.
Pressure-related Injury - Any injury resulting from pressure disequilibria within the body as the result of hyperbaric exposure. Examples include decompression sickness, pneumothorax, mediastinal emphysema, air embolism, subcutaneous emphysema, or ruptured eardrum.
Pressure Vessel - See cylinder.
pN_2 - Inspired partial pressure of nitrogen, usually expressed in units of atmospheric absolute.
pO_2 - Inspired partial pressure of oxygen, usually expressed in units of atmospheric absolute.
Psi - Units of pressure, "pounds per square inch".
Psig - Units of pressure, "pounds per square inch gauge".
Recompression Chamber - A pressure vessel for human occupancy. Also called a hyperbaric chamber or decompression chamber.
Reserve Air Supply System - See Diver Carried Reserve Breathing Air
Safety Diver - A diver responsible for in-water supervision and monitoring of the working divers
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.
Standby Diver - A diver at the dive location capable of rendering assistance to a diver in the water.
Surface Supplied Diving - A diving mode in which the diver in the water is supplied from the dive location with compressed gas for breathing and voice communication with the surface.
Swimming Ascent - An ascent that can be done under normal or emergency conditions accomplished by simply swimming to the surface.
Tender - Topside active diver that monitors, air and communications during a Surface Supply Dive
Umbilical - The composite hose bundle between a dive location and a diver or bell, or between a diver and a bell, which supplies the 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.
Volume Tank - A pressure vessel connected to the outlet of a compressor and used as an air reservoir.
Working Pressure - The normal pressure at which the system is designed to operate.

South Carolina Aquarium

APPENDIX 7
AAUS REQUEST FOR DIVING RECIPROCITY FORM
VERIFICATION OF DIVER TRAINING AND EXPERIENCE

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

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

Name of diver:

(Date)

_____Written diving examination
_____Last diving medical examination
_____Most recent checkout dive
_____Regulator Service Date (Serial Number) _____
_____AGA Service Date (Serial Number) _____
_____BCD Service Date (Serial Number) _____
_____Cylinder Inspection Date (Serial Number) _____
_____CPR training (Agency) _____
_____Oxygen administration (Agency) _____
_____First aid for diving (Agency) _____
_____Date of last dive
_____Number of dives completed within previous 12 months?
_____Depth certification
_____Any restrictions? (Y/N)
_____if yes, explain:

Please check any pertinent specialty certifications:

_____Dry suit	_____Rescue	_____Blue water
_____Dive Computer	_____Divemaster	_____Altitude
_____Nitrox	_____Instructor	_____Ice/Polar
_____Mixed gas	_____EMT	_____Cave
_____Closed circuit	_____Full Face Mask	_____Dive Accident Management
_____Night	_____Saturation	_____Chamber operator
_____Decompression	_____Lifesaving	

OTHER_____

Emergency Information: (To notify in an emergency)

Name: _____ Relationship: _____

Telephone: (work) _____ (home) _____

Address: _____

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

Diving Safety Officer: _____
(Signature) (Date)

_____ _____
(Print) (Telephone, FAX, e-mail)

_____
(Institution)

APPENDIX 8

DIVING EMERGENCY MANAGEMENT PROCEDURES

Introduction

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

General Procedures

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

Make contact with victim and/or rescue as required. Activate dive alarm and/or call Security (depending on location).

Establish, (C)irculation (A)irway, and (B)reathing as required.

Administer 100% oxygen, if appropriate (in cases of decompression illness, or near drowning).

Call Security for response to all emergencies. Do not dial 911 unless security cannot be reached.

Call DAN for contact with dive physician and recompression chamber @ Roper Hospital.

Notify DSO or designee according to Section 2.50 of the Diving Safety Manual.

Complete and submit Incident Report Form (Appendix 9) to the DCB of the organization and the AAUS (As required in Section 2.72)

Emergency Contact numbers for dive emergencies: SCA SECURITY- 579-8507or Radio Channel 1

Security will notify the following husbandry staff:

Curator
Dive Officer
Director/ Husbandry
Executive Director

DAN- DIVER ALERT NETWORK- Duke University, Durham, North Carolina- 919-684-9111
ROPER HOSPITAL HYPERBARIC CHAMBER- 316 Calhoun Street, Charleston, S.C. 724-2014
EMERGENCY MEDICAL SERVICES- 911
OFFSHORE DIVING- COAST GUARD- VHF CHANNEL 16 MOBILE- 911

APPENDIX 9 Staff/ Volunteer Accident/Injury/Incident Report

MIR # _____

SS#: ___ - ___ - ___ SEX: M / F

Name (Last, First, M.I.) _____

Street Address _____

City _____ State _____ Zip _____

Home Phone: (___) ___ - ____ Work Phone: (___) ___ - ____ Cellular: (___) ___ - ____

Job Title: _____ Normal Working Hours: ____ to ____

Division: _____ Supervisor: _____

Department: _____

Type of Accident / Injury or Incident: _____

_____

_____

_____

_____

Date and Time of Accident / Incident: _____ (am / pm)

Location of Accident / Incident: (Be as specific as possible – in route to work / at work / work related business) _____

_____

_____

Date and Time of Accident / Injury or Incident Reported: _____ (am / pm)

To who was the Incident Reported: _____

Describe the nature of the accident / Injury: _____

(Staff / Volunteer Accident / Injury or Incident Report Continued) MIR #

Print Names of any witnesses and their Telephone numbers:	( ) -
	( ) -
	( ) -
	( ) -

FIRST RESPONDER INFORMATION

Name of 1st Responder: _____

Medical Information:

Time:	B/P: /	Pulse:	RESP:
Time:	B/P: /	Pulse:	RESP:
Time:	B/P: /	Pulse:	RESP:

Treatment Given: _____

DISPOSITION

No First Aid required, Returned to work ☐

Provided First Aid, Returned to work ☐

Sent for Medical Evaluation / Treatment ☐

Emergency Transport to Medical Facility ☐

_____ EMS Activated (Unit #: _____)

_____ Transported by Aquarium Vehicle

_____ Transported by Personal Vehicle

_____ Photographs taken (QTY: _____)

Safety Manager Notified: Yes or No Date: _____ Time: _____ am / pm

APPENDIX 10 ASSUMPTION OF RISK AND LIABILITY RELEASE AGREEMENT

I _____, acknowledge that I have voluntarily applied to participate in skin and/or SCUBA diving under the auspices of The South Carolina Aquarium dive program located in the City of Charleston, County of Charleston, and State of South Carolina.

I AM AWARE THAT SCUBA AND/OR SKIN DIVING IS A HAZARDOUS ACTIVITY AND INVOLVES RISKS THAT MAY LEAD TO SERIOUS INJURY OR DEATH. I AM VOLUNTARILY PARTICIPATING IN THESE ACTIVITIES WITH KNOWLEDGE OF THE DANGER INVOLVED, HEREBY AGREE TO ACCEPT ANY AND ALL RISKS OF INJURY OR DEATH, AND VERIFY THIS STATEMENT BY PLACING MY INITIALS HERE: _____.

As consideration for being permitted to enroll and participate in skin and/or SCUBA diving within the auspices of The South Carolina Aquarium dive program, I hereby voluntarily release, discharge, waive and relinquish any and all actions or causes of action for personal injury, property damage or wrongful death occurring to me arising as a result of engaging or receiving instructions in skin and/or SCUBA diving activities, or any activities incidental thereto, wherever or however the same may occur and for whatever period the activities or instructions may continue, and I do for myself, my heirs, executors, administrators and assigns hereby voluntarily release, waive, discharge and relinquish any action or causes of action which may hereafter arise for me and for my estate, and agree that under no circumstances will I or my heirs, executors, administrators and assigns prosecute, present any claim for personal injury, property damage or wrongful death against The South Carolina Aquarium or any of its officers, agents, servants or employees for any of said causes of action, whether the same shall arise by negligence or otherwise.

IT IS MY INTENTION, BY THIS INSTRUMENT, TO EXEMPT AND RELIEVE THE SOUTH CAROLINA AQUARIUM FROM LIABILITY FOR PERSONAL INJURY, PROPERTY DAMAGE OR WRONGFUL DEATH CAUSED BY NEGLIGENCE.

The Undersigned, for him/herself, his/her heirs, executors, administrators or assigns agrees that in the event any claim for personal injury, property damage or wrongful death shall be prosecuted against The South Carolina Aquarium he/she shall indemnify and save harmless the same The South Carolina Aquarium from any and all claims or causes of action by whomever or wherever made or presented for personal injuries, property damage or wrongful death.

I have carefully read this agreement, am fully and completely aware of the potential dangers incidental to engaging in the activity of skin and/or SCUBA diving, and am fully aware of the legal consequences of signing this agreement. I am aware that this is a release from liability and sign it of my own free will.

_____ _____

Witness Signature of Volunteer/Guest Date

APPENDIX 11 APPLICATION FOR THE SOUTH CAROLINA AQUARIUM DIVE CERTIFICATION

Name _____Date .....
Address .....
Home phone _____Work phone .....
Emergency Contact: _____ Phone .....
SCUBA Certification:
Agency _____ Date _____ Level _____
Total dives logged _____Date of last dive _____

SOUTH CAROLINA AQUARIUM CERTIFICATION REQUESTED:

❑ STAFF DIVER ❑ VOLUNTEER DIVER

❑ OPEN WATER DIVER ❑ EXHIBIT DIVER

(CHECK ALL THAT APPLY)

❑ RECIPROCITY CERTIFICATION If RECIPROCITY is being requested:

Name of home organization:.....

Dive Officer: _____ Telephone: .....

Applicant: Do not write below this line

THE SOUTH CAROLINA AQUARIUM CERTIFICATION REQUIREMENT CHECK LIST

Checkout Dive
Physical examination
SCUBA certification card
Written examination
CPR Certification
O2 Certification

TYPE OF CERTIFICATION/ DEPTH

Diver in Training
Aquarium Diver
Open Water Diver
Temporary Diver Permit

OPEN WATER DIVER CERTIFICATION DEPTH

30 foot 60 foot 100 foot 130 foot

Certification is not valid until all requirements are met and the South Carolina Aquarium Diving Safety Officer approves this application.

_____ _____

Signature, the South Carolina Aquarium Diving Safety Officer Date

APPENDIX 12

Accident Medical Coverage Acknowledgment Form

It is the intention of the South Carolina Aquarium to clearly explain the extent of accident medical coverage provided by the South Carolina Aquarium for its volunteer divers.

The maximum coverage for any medical expense resulting from an accident while diving as a volunteer at the South Carolina Aquarium is $50,000 per covered accident. Any amount of medical expenses over $50,000 will be the sole responsibility of the individual volunteer diver.

Divers Alert Network (DAN) supplemental dive insurance does not cover divers during aquarium dives.

As a volunteer diver, I acknowledge the accident medical coverage provided through the South Carolina Aquarium and understand that the medical expenses over $50,000 associated with injuries resulting from dive accidents is the sole responsibility of each individual volunteer diver in the case of a covered accident while diving in exhibits at the South Carolina Aquarium.

_____ _____

Signature Date

_____

Print Name

APPENDIX 13
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: 0-30, 31-60, 61-100, 101-130, 131-150, 151-190, 191-250, 251-300, and 301->. Depths are in feet seawater (when measured in meters: 0-10, >10-30, >30-40, >40-45, >45-58, >58-76, >76-92, and >92->). A dive is logged to the maximum depth reached during the dive. Note: Only "The Number of Dives Logged" and "The Number of Divers Logging Dives" will be collected for this category.

Specialized Environments:

- Required Decompression: Any dive where the diver exceeds the no-decompression limit of the decompression planning method being employed.
- Overhead Environments: Any dive where the diver does not have direct access to the surface due to a physical obstruction.
- Blue Water Diving: Openwater diving where the bottom is generally greater than 200 feet deep and 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

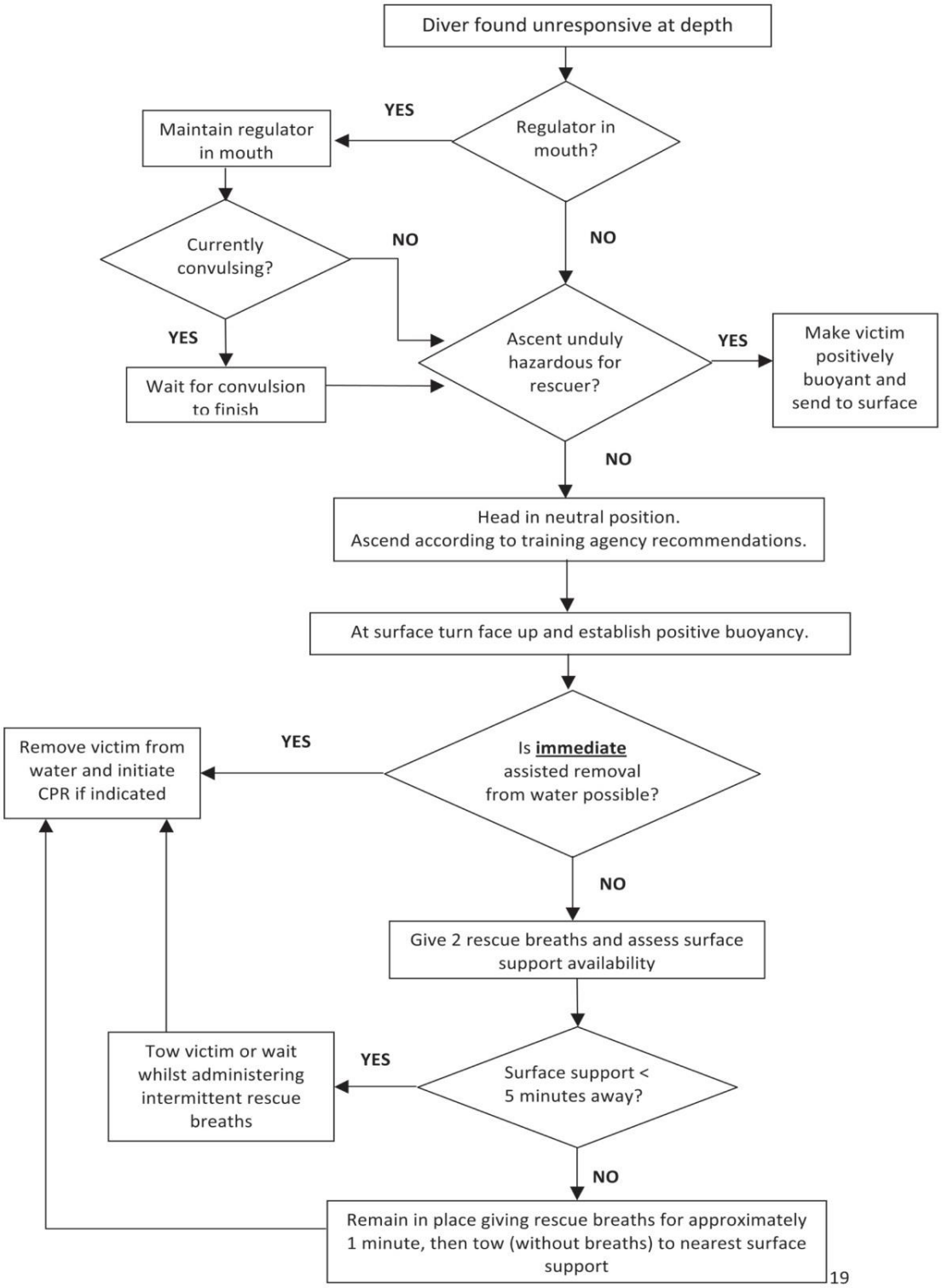
Incident Classification Rating Scale:

- Minor: Injuries that the South Carolina Aquarium 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 South Carolina Aquarium 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 South Carolina Aquarium 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 14

Recommendations For 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



19