



**STANDARDS FOR SCIENTIFIC DIVING CERTIFICATION
&
OPERATION OF SCIENTIFIC DIVING PROGRAMS**

**University of California, Santa Cruz
Institute of Marine Sciences**

The American Academy of Underwater Sciences
2020 Revision

(Updated to AAUS 2019 standards by UCSC DCB 1/2019)

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FOREWORD

A researcher's presence in the environment has proven to be an improved method of collecting data. Specifically the effectiveness of the underwater scientist lies in having the trained mind and eye at sites of primary interest. The superior observational capabilities of the human eye in depth perception and color sensitivity, the use in diving of the sense of touch and the special ability of the human mind to integrate the field observation and to provide rapid feedback, are of prime importance in such areas as spatial distribution, population dynamics, behavior and dynamic geological processes (Jim Stewart, 1988).

In short, diving, when conducted in a manner, which will maximize protection of the scientific diver while allowing efficiency of observation, is a tool of great potential value, a means of collecting data, which in many cases is available through no other means.

This document is drawn from the American Academy of Underwater Sciences (AAUS) *Standards for Scientific Diving Certification and Operations of Scientific Diving Programs*, of 2019. 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 manual, derived from the AAUS document, represents the minimum safety standards for scientific diving at the present day. It will be continuously reviewed by the University of California at Santa Cruz's Diving Control Board and Diving Safety Officer to see that it always reflects state of the art, safe diving practices.

VOLUME I

SECTION 1.00 GENERAL POLICY

1.10 THE SCIENTIFIC DIVING STANDARDS

Purpose

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

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

Historical Perspective

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

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

The University of California, Santa Cruz (UCSC) has adopted additional standards, which extend this document, according to local procedure.

Scientific Diving Definition

Scientific diving is defined (29 CFR 1910.402) as:

“Diving performed solely as a necessary part of a scientific, research, or educational activity by employees whose sole purpose for diving is to perform scientific research tasks. Scientific diving does not include performing any tasks usually associated with commercial diving such as: Placing or removing heavy objects underwater; inspection of pipelines and similar objects; construction; demolition; cutting or welding; or the use of explosives.”

Scientific Diving Exemption

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

- a) Diving safety manual which includes at a minimum: Procedures covering all diving operations specific to the program; procedures for emergency care, including recompression and evacuation; and criteria for diver training and certification.
- b) Diving control (safety) board, with the majority of its members being active science divers, which shall at a minimum have the authority to: Approve and monitor diving projects; review and revise the diving safety manual; assure compliance with the manual; certify the depths to which a diver has been trained; take disciplinary action for unsafe practices; and, assure adherence to the buddy system (a diver is accompanied by and is in continuous contact with another diver in the water) for SCUBA diving. OSHA has granted an exemption of scientific diving from commercial diving regulations under the following guidelines (Appendix B to 29 CFR 1910 Subpart T):

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

Recommendations for Changes to Manual

As part of each OMs annual report, recommendations for modifications of this Manual shall be submitted to AAUS for consideration.

1.20 OPERATIONAL CONTROL

UCSC Auspices and Responsibilities

UCSC auspices include any scientific diving operation in which UCSC is connected because of ownership of life support equipment used, locations selected, or relationship with the associated individual(s). This includes all cases involving the operations of authorized individuals of UCSC or auxiliary organizations, where such individuals are acting within the scope of their authorization.

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

UCSC Diving Safety Manual

UCSC shall develop and maintain a Diving Safety Manual (DSM), which provides for the development and implementation of policies and procedures that will enable UCSC to meet requirements of local environments and conditions as well as to comply with the AAUS minimum standards.

Diving Control Board

- A. The DCB shall consist of a majority of active scientific divers. Voting members must include the Diving Safety Officer (DSO), the responsible administrative officer, or designee, and should include other representatives of the diving program such as qualified divers and members selected by procedures established by the UCSC Chancellor through the Dean of Physical and Biological Sciences. A chairperson and a secretary may be chosen from the membership of the board according to DCB procedure. The DCB may delegate operational oversight for portions of the program to the DSO; however, the DCB may not abdicate responsibility of the safe conduct of the diving program.
- B. Establish additional standards, protocols and operational procedures beyond the AAUS minimums to address specific local needs and concerns.
- C. Has autonomous authority over the scientific diving program's operation.
- D. Shall act as a board of appeal to consider diver-related problems.
- E. Shall periodically review the Diving Safety Officer's performance and program.
- F. Shall investigate diving incidents within UCSC's diving program or violations of UCSC's DSM.
- G. Acting through the DSO, the DCB shall oversee the following:
 1. Approve and monitor diving projects.
 2. Review and revise the diving safety manual.
 3. Ensure compliance with the manual.

4. Approve the depth to which a diver has been authorized to dive.
5. Take disciplinary action for unsafe practices.
6. Ensure adherence to the buddy system for scientific diving.
7. Act as the official representative of UCSC in matters concerning the scientific diving program.
8. Recommend the issue, reissue, or the revocation of diving authorizations.
9. Recommend changes in policy and amendments to the UCSC and the AAUS diving manuals as the need arises.
10. Establish and/or approve training protocols or standards through which the applicants for authorization can satisfy the requirements of the UCSC diving safety manual.
11. Suspend diving projects considered to be unsafe or unwise.
12. Establish criteria for equipment selection and use.
13. Recommend new equipment or techniques.
14. Establish and/or approve facilities for the inspection and maintenance of diving and associated equipment.
15. Shall ensure that UCSC air station(s) meet air quality standards as described in Section 3.60 of this manual.
16. Shall establish University regulations that meet or exceed current National Association of Underwater Instructors (NAUI) standards, as interpreted by the DCB, for all UCSC OPERS, recreational, scientific, extension, and other diving activities.
17. Shall ensure that all UCSC OPERS, recreational, scientific, extension, and other diving activities meet all relevant community, University, state, and federal diving safety regulations and to make recommendations to the Director of the Institute of Marine Sciences (IMS) and Office of Physical Education, Recreation and Sports (OPERS) concerning the management and safe operation of diving programs.

Diving Safety Officer

The DSO serves as a member of the DCB and should be designated one of the OM Representatives to AAUS. This person should have broad technical and scientific expertise in research related diving.

A. Qualifications

1. Shall be an active SCUBA instructor from an internationally recognized certifying agency.
2. Shall be appointed by the responsible administrative officer or designee, with the advice and counsel of the DCB.
3. Shall qualify as a Full Voting Member of AAUS as defined by AAUS Bylaws:
 - “(a) Holds a diving certification from a recognized national certifying agency or equivalent, and
 - (b) Has engaged in sustained or successive scientific diving activities during the past two years, or
 - (c) Has completed a course in scientific diving that meets the requirements as specified by the most current edition of the AAUS Standards for Scientific Diving.”
4. Shall attend an AAUS DSO Orientation within one year of accepting a position at UCSC, unless he/she has served as a DSO for another current AAUS OM within the last year.

B. Duties and Responsibilities

1. Answers, through the DCB, to the responsible administrative officer or designee, for the conduct of the UCSC scientific diving program. The routine operational authority for this program, including the conduct of training and authorization, approval of dive plans, maintenance of diving records, and ensuring compliance with this manual and all relevant regulations of UCSC, rests with the Diving Safety Officer.
2. May permit some duties and responsibilities to be carried out by a qualified delegate, with approval of the DCB. However, the Diving Safety Officer may not delegate responsibility for the safe conduct of the local diving program.
3. Shall be guided in the performance of the required duties by the advice of the DCB, but operational responsibility for the conduct of the local diving program will be retained by the Diving Safety Officer.
4. Shall suspend diving operations considered unsafe or unwise.

Dive Instruction/Supervision Personnel

A. Qualifications

All personnel involved in diving instruction or diving supervision under the auspices of UCSC shall be qualified for the type of instruction being given and supervision being done.

B. Definitions

Instruction: The teaching and evaluation of specific skill sets. This must be done on a one-to-one basis with the instructor present for all aspects of the instruction and evaluation. The instruction/evaluation must be documented either in Webdiver or in the diver's file and with a certification card if applicable.

Supervision: The overseeing of dive operations typically within a teaching context. The specific responsibilities of dive supervisors would mirror those of a Lead Diver. These supervisors would report directly to the course instructors. If any dive procedures are deemed unsafe or there are any violations of safe diving protocols all diving operations must stop until the DSO is consulted.

C. Selection

Instructional and Supervising personnel will be selected by the DSO, or designee, who may solicit the advice of the DCB in conducting preliminary screening of applicants for instructional or supervisory positions.

D. Field Class Diving Supervision

Field classes involving diving shall have at least one designated dive supervisor on site during diving operations. This dive supervisor will have helped teach at least one Scientific Diving class (Bioe75) and have logged at least 50 scientific dives, with demonstrated proficiency in a diving environment similar to the course. The ultimate responsibility for proper class dive supervision lies with the course instructor.

Lead Diver

For each dive, one individual shall be designated as the Lead Diver who shall be at the dive location during the diving operation. The Lead Diver is generally not the Principal Investigator (PI) for a research project, but has an essential role in making sure that the project is planned properly and conducted safely. This should be the diver with the most experience under the given circumstances. The Lead Diver shall be responsible for:

- A. Coordination with other known activities in the vicinity, which are likely to interfere with diving operations.
- B. Ensuring all dive team members possess current authorization and are qualified for the type of diving operation.
- C. Ensuring dives are conducted in accordance with Section 2.0.
- D. Ensuring safety and emergency equipment is in working order and at the dive site.
- E. Verifying that all divers log their dives accurately and in a timely manner.
- F. May prohibit any dive team member from diving who, in their opinion, exhibits behavior that may compromise the safety of a diver or dive team.

G. Reporting to the DCB through the DSO any physical problems or adverse physiological effects including symptoms of pressure-related injuries.

H. Briefing the dive team members on:

1. Dive objectives.
2. Unusual hazards or environmental conditions likely to affect the safety of the diving operation.
3. Modifications to diving or emergency procedures necessitated by the specific diving operation.
4. Suspending diving operations if in their opinion conditions are not safe.

5. Review the buddy system plan.

Remote Operations

A Remote Operation is defined as any diving operation that involves four or more divers and/or is conducted at a location with constrained access to emergency services (e.g. 911), including prolonged EMS response times.

For each remote dive operation, a Lead Diver and a Lead Scientist shall be designated – these cannot be the same person unless pre-approved by the DSO and PI. As these designations imply, the Lead Diver will supervise the diving operations and the Lead Scientist will oversee the science being done. These two will collaborate on performing the needed science using the safest diving protocols. If there is any deviation from the submitted dive plan, change in gear configurations or change in equipment used to perform the science, the diving operations must stop until the changes have been approved by the UCSC DSO.

Reciprocity and Visiting Scientific Diver

- A. Two or more AAUS organizational members engaged jointly in diving activities, or engaged jointly in the use of diving resources, shall designate one of the participating Diving Control Boards to govern the joint dive project. However, responsibility for individual divers ultimately resides with the home institution.
- B. A Scientific Diver from one OM shall apply for permission to dive under the auspices of another OM by submitting to the DSO of the host OM a document containing all the information listed in Appendix 2 (letter of reciprocity), signed by the DSO or designee of the home DCB chairman.
- C. A visiting Scientific Diver may be asked to demonstrate their knowledge and skills for the planned dive.
- D. If a host OM denies a visiting Scientific Diver permission to dive, the host DCB shall notify the visiting Scientific Diver and their DCB with an explanation of all reasons for the denial.

UCSC Dive Team Composition

Each UCSC diver should be paired with another active AAUS diver verified by an institutional Letter of Reciprocity (LOR). If the non-UCSC diver cannot secure a LOR, approval to dive with a UCSC diver must be obtained from the UCSC Diving Control Board or their designee. The primary concern of the Dive Safety Program is that all dive buddies have appropriate training and experience, medical and physical fitness to dive and recent diving activity in similar environments. The following steps outline how approval can be obtained when a LOR cannot be presented.

Definitions

Staff Diver: paid/non-paid or volunteer UCSC staff that will be a participant on a dive team. This person can be a faculty, postdoc, staff, graduate or undergraduate student. This person will be covered under UCSC's Workers Compensation program and will be incorporated into UCSC's diver database (Webdiver). These divers have access to all appropriate UCSC resources needed for their field work.

Collaborator: non-paid, non-volunteer, non-UCSC diver that may be a participant on a dive team. This person will be diving under their home academic institution auspices and will not be covered under UCSC's Workers Compensation program. They will not be incorporated into Webdiver. These divers do not have access to UCSC resources unless approved by a UCSC faculty or staff member for specific resources for specific uses.

Unaffiliated Dive Buddy: due to research constraints, the UCSC diver needs to dive with the most qualified diver available in the area of operation. This person is not affiliated with an academic institution but shall have his/her own liability insurance and medical coverage. These divers do not have access to UCSC resources.

REQUIREMENTS FOR ABOVE DIVERS

UCSC Staff Divers:

- 1) If they have active scientific diver status with an AAUS institution, a Letter of Reciprocity is required. A checkout dive may also be required.
- 2) If they were trained as a scientific diver at an AAUS institution but are currently unaffiliated with an AAUS institution, a Verification of Training is required. All documentation required to be a current UCSC scientific diver must be presented prior to a checkout dive with the UCSC DSO or his/her designee.
- 3) If they have scientific diving experience but no documented training the diver will need to go through a five-day challenge course at UCSC to document swimming and scuba skills, knowledge of diving related topics and an open water checkout that includes a complete unconscious diver rescue.
- 4) If any aspect of section "3" cannot be met, the Diving Control Board will need to review and approve the diver for the intended project.

Collaborators:

- 1) If they have active scientific diver status with an AAUS institution a Letter of Reciprocity is required.
- 2) If they were trained as a scientific diver at an AAUS institution but are currently unaffiliated with an AAUS institution, a Verification of Training is required. All documentation equivalent to being a current UCSC scientific diver will be required.
- 3) If they have scientific diving experience but no documented AAUS training, the diver will need to provide the following documentation: Authorization from their home institution to do scientific diving on the project; coverage for diving medical emergencies (DAN insurance); medical approval to be diving (letter from a physician); copies of dive certification cards; documentation of diving first aid training (First Aid/CPR/O2); proof of regulator/gauge/BCD inspection/service within the last year and their last 12 dive logs.
- 4) If any aspect of section "3" cannot be met, the Diving Control Board will need to review and approve the diver for the intended project.

Unaffiliated Dive Buddy:

- The UCSC diver shall conduct dives through an established diving operation that is recognized by an international training agency or institution, and has a website and email connectivity.
- The unaffiliated dive buddy shall be a Divemaster (DM) or Dive Instructor affiliated with the diving operation or an independent and locally active DM or Instructor. The dive buddy must provide documentation of currency as a DM or Instructor by emailing a copy of their current card and dive log for last six months to the UCSC DSO or designee.
- Lacking a locally active DM or Instructor the potential dive buddy shall be reviewed on a case by case basis and approved by the Diving Control Board for the intended project.
- Unaffiliated dive buddies must show self-insurance in regards to medical and liability coverage before diving operations are approved.

Waiver of Requirements

The DCB may grant a waiver for specific requirements of training, examinations, depth authorizations, and minimum activity to maintain authorizations. AAUS medical standards may not be waived.

Verification of Training (VOT)

Any diver entering UCSC's dive program with a VOT will need to have:

- Documentation for any specialized training linked to national standards (e.g. Drysuit, EAN)
- Documentation of depth authorizations greater than 60FSW as outlined in AAUS standards:

"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."

1.30 Consequence of Violation of Regulations by Scientific Divers

Failure to comply with the regulations of the UCSC diving manual may be cause for the restriction or revocation of the diver's scientific diving authorization by action of the UCSC DCB.

1.40 Consequences of Violation of Regulations by UCSC

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

1.50 RECORD MAINTENANCE

UCSC shall maintain consistent records for its diving program and for each participant. These records include but are not limited to: DSM; equipment inspection, testing and maintenance records; dive plans; records of dives; medical approval to dive; diver training records; diving authorization(s); individual dive log; dive incident reports; reports of disciplinary actions by the DCB; and other pertinent information deemed necessary by UCSC.

Availability of Records:

- A. Medical records shall be made available to the attending physician of a diver or former diver when released in writing by the diver.
- B. Records and documents required by this standard shall be retained by UCSC for the following period:
 1. 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
 2. Diving Safety Manual - Current document only.
 3. Diver Training Records - 10 years.
 4. Diving Logs - 30 years after termination of employment.
 5. Incident Reports - Permanently.
 6. Equipment inspection and testing records - 10 years.
 7. Diver authorization(s) – Minimum of 1 year beyond the life of the diver's program participation.
 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 scientific diving operations under the auspices of UCSC scientific diving program unless they are authorized pursuant to the provisions of this manual.

2.20 PRE-DIVE PROCEDURES

Dive Plans

Dives should be planned around the competency of the least experienced diver. Before conducting any diving operations under the auspices of UCSC, the lead diver for a proposed operation must formulate and submit a dive proposal to the DSO at least one month prior to the project start. The proposal form is available on a diver's Webdiver portal. The proposal 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
- Emergency Action Plan (Appendix 5)
- In water details of the dive plan should include:
 - o Dive buddy assignments and tasks
 - o Goals and objectives
 - o Maximum depth(s) and bottom time(s)
 - o Gas management plan
 - o Entry, exit, descent and ascent procedures
 - o Perceived environmental and operational hazards and mitigations
 - o Emergency and diver recall procedures

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 their judgment, conditions are unsafe or unfavorable, or if they would be violating the precepts of their training or the regulations in this manual.

No dive team member shall be required to be exposed to hyperbaric conditions against their will.

No dive team member shall be permitted to dive for the duration of any known condition that is likely to adversely affect the safety and health of the diver or other dive members.

It is the responsibility of each buddy team member to inform the Lead Diver if they feel any aspect of the dive operation is unsafe. Operations may not continue until the safety issue has been corrected to the satisfaction of the buddy team and Lead Diver. The team is encouraged to contact the Diving Safety Program for assistance in making decisions about team safety.

Pre-dive Safety Checks

- Prior to commencing the dive, the team must assure that every team member is healthy, fit, trained and authorized for the type of dive that is being attempted.
- Scientific divers shall 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. Gas mix settings on dive computers must be verified.
- If any piece of gear shows potential failure, the diver whose gear has a potential failure must terminate diving until the failure point has been corrected, or item replaced, to the satisfaction of the buddy team and Lead Diver. Gear that fails in the field cannot continue to be used until inspected by a certified technician, as required. Consultation with the Diving Safety Program is encouraged to assure the buddy team that the correct action has been taken.
- Each diver shall 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.

Pre-Dive Briefings

Before conducting any diving operations under the auspices of UCSC, the dive team members shall be briefed on:

- Dive buddy assignments and tasks
- Dive objectives
- Maximum depth(s) and bottom time(s)
- Turn 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

Buddy Diving Requirements and Solo Diving Prohibition

All diving activities shall assure adherence to the buddy system (two or three suitably equipped divers that shall be in effective communication throughout the dive). This buddy system is based upon mutual assistance, especially in the case of an emergency. Exceptions to this policy may be made by the DSO, particularly in the case of surface supported diving, diving in holding tanks and diving in overhead environments.

Decompression Management

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

A safety stop (3-5 minutes @ 15') performed during the ascent phase of the dive should be conducted on any dive that exceeds 30fsw. A deep stop (1 minute @ ½ the maximum depth) should be incorporated into the ascent phase of any dive that exceeds 60fsw.

Termination of the Dive

The dive shall be terminated while there is still sufficient cylinder pressure to permit the diver to safely reach the surface, including a safety stop (or decompression stop) or to safely reach an additional air source at the decompression station. It is recommended that cylinder pressure should not fall below 500psi before reaching the surface. It is the responsibility of the diver to terminate any dive that they consider unsafe, without fear of reprisal, in a way that does not compromise the safety of another diver already in the water.

Emergencies and Deviations from Regulations

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

2.40 POST-DIVE PROCEDURES

Post-Dive Safety Checks

After the completion of a dive, each diver shall report any physical problems, symptoms of decompression sickness, or equipment malfunctions to the Lead Diver, DSO and Supervisor.

When diving outside the no-decompression limits, the divers should remain awake for at least one hour after diving, and in the company of a dive team member who is prepared to transport them and seek emergency medical attention if necessary.

2.50 EMERGENCY PROCEDURES

Each dive project leader will develop emergency procedures, which follow the standards of care of the community and must include procedures and implementation criteria for emergency care, recompression, evacuation and incident reporting for each dive location.

2.60 FLYING AFTER DIVING

Following a Single No-Decompression Dive: Divers should have a minimum preflight surface interval of 12 hours and be cleared by their diver computer to fly.

Following Multiple Dives per Day or Multiple Days of Diving: Divers should have a minimum preflight surface interval of 18 hours and be cleared by their diver computer to fly.

Following Dives Requiring Decompression Stops: Divers should have a minimum preflight surface interval of 24 hours and be cleared by their diver computer to fly.

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

Personal Dive Log

Each authorized scientific diver shall log every dive made under the auspices of the UCSC program, and is encouraged to log all other dives. Dives should be logged into Webdiver at the earliest reasonable opportunity but no later than 1 month following the dive. The dive log shall include at least the following:

- Name of diver and buddy.
- Date, time, and location.
- Diving modes used.
- Appropriate dive group / activities.
- Maximum depth and bottom time.
- Diving tables or computers used.
- Detailed report of any near or actual incidents. An incident is defined as, “An occurrence that interrupts normal procedure or brings about a crisis.”

Required Incident Reporting

A reportable incident is defined as: 1) any deviation from the intended dive plan (eg diver separation, out of air) 2) any injury that requires more than just field first aid.

All diving incidents shall be reported to the UCSC DSO in a timely manner. All occupational injuries and illnesses should follow established UCSC procedures for incident reporting, including those required by the AAUS and the appropriate Labor Code section. The report will specify the circumstances of the incident and the extent of any injuries or illnesses. The DCB shall investigate and document any incident of pressure related injury and prepare a report that is to be forwarded to AAUS during the annual reporting cycle. UCSC Diving Safety Program’s (DSP) incident form can be found at <http://www2.ucsc.edu/sci-diving> under the diving forms tab in the left menu bar.

- If pressure-related injuries are suspected, or if symptoms are evident, the following additional information shall be recorded and permanently retained by UCSC, with the record of the dive:
- Complete UCSC Incident Report Form available from the DSP website
- Written descriptive report to include:
 - Name, address, and 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.
 - The circumstances of the incident the extent of any injuries or illnesses.
 - Description of symptoms, including depth and time of onset.
 - Description and results of treatment.
 - Disposition (i.e. outcome) of case.
 - Recommendations to avoid repetition of incident.

SECTION 3.00 DIVING EQUIPMENT

3.10 GENERAL POLICY

All equipment shall meet standards as determined by the DSO and the DCB. All Equipment shall be regularly examined by the person using it and serviced according to the manufacturer recommendations. The annual DSP inspection does not take the place of the manufacturer's recommended servicing interval.

3.20 EQUIPMENT

The UCSC DCB shall establish the minimum equipment configuration for all dives.

Any gear configuration changes in the field need to be reviewed with the Diving Safety Program or appointed designee prior to implementing the change. If a gear configuration change is approved, the diver must be inspected by their buddy both above the water and in the water to check for any gear conflicts before conducting any diving.

Only regulators, gauges, buoyancy compensators and drysuits that have been inspected or approved by the Diving Safety Program may be used for UCSC dive training, academic courses or science diving.

Regulators and Gauges

- SCUBA regulators and gauges shall be inspected and tested prior to each use by the diver and serviced, at a minimum, according to manufacturer's recommendations.
- Dive computers shall be inspected and tested by the DSP before the first use and every twelve months thereafter.
- SCUBA regulators and submersible pressure gauges need to be inspected by the DSP prior to first use, after any servicing and every twelve months thereafter.
- Standard open circuit (OC) regulator configuration is:
 - A first stage
 - Primary second stage
 - Back up second stage
 - Submersible pressure gauge (SPG)
 - Inflator hose for a Buoyancy Compensator Device and Drysuit (if one is being used)

A Full Face Mask may be used in place of the primary second stage according to manufacturer's recommendations.

Equipment for Determination of Decompression Status

- All UCSC divers must use a dive-logger during any UCSC training or science dive. The logger must be set at a sampling rate no greater than 10 seconds.
- Each member of the buddy team must have an underwater timing device and depth indicator, or dive computer.
- A set of diving tables, approved by the DCB, must be available at the dive location.
- If a dive computer is used, the diver shall use the same computer used on repetitive dives. Before using a dive computer, UCSC Scientific Divers must have a UCSC Dive Computer waiver on file. At no time should the remaining dive time displayed at depth be less than 10 minutes.
- All dive computers and dive loggers must be set to local time prior to commencing any dive.
- In a holding tank or other manmade structure of a known maximum obtainable depth:
 - A depth indicator is not required.
 - All dives are considered to be the at the maximum obtainable depth.
 - Only one buddy must be equipped with a timing device.
 - Decompression status will be calculated using an appropriate dive table including any repetitive dives.

Scuba Cylinders

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

- Scuba cylinders must be hydrostatically tested in accordance with DOT standards.
- Scuba cylinders must have an internal and external inspection at intervals not to exceed twelve months.
- Scuba cylinder valves shall be functionally tested at intervals not to exceed twelve months.

Buoyancy Compensation Devices (BCD)

- Each diver shall have the capability of achieving and maintaining neutral buoyancy underwater and positive buoyancy at the surface, independent of the exposure suit.
- Buoyancy compensators, dry suits, or other variable volume buoyancy compensation devices shall be equipped with an exhaust valve.
- These devices shall be functionally inspected by the diver prior to each use and tested by the DSP at intervals not to exceed twelve months.
- BCDs, drysuits or other variable volume buoyancy compensation devices shall not be used as a lifting device in lieu of lift bags.

Drysuits

- All drysuits need annual in-person integrity tests which will functionally check inflation and deflation valves, operation of zippers, clips and straps, condition of all seals, document areas of wear and test for the ability of the suit to hold air for at least five minutes.
- Any suit that fails this annual test will need to be sent to Diving Unlimited Inc. for their 20 point inspection service.
- Tracking of this annual inspection will be separate from the regular gear inspection so that wet diving may continue if the drysuit inspection has expired.

3.30 AUXILIARY EQUIPMENT

Hand-held or diver-operated sampling equipment

All sampling gear, including dive slates, shall be reviewed by the dive team for potential entanglement and/or gear conflicts prior to use. Modifications to existing sampling gear shall be reviewed by the Diving Safety Program or appointed designee prior to implementing the change.

Hand-held underwater power tools

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

3.40 SUPPORT EQUIPMENT

First aid supplies.

A First aid kit, trauma kit, emergency oxygen appropriate for the diving being conducted and a communication device shall be available at each dive site. AEDs, if available, are also recommended at the dive site.

Diver's Flag

A diver's flag shall be displayed prominently whenever diving is conducted under circumstances where it is required or where vessel traffic may occur.

Compressor Systems - UCSC 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, shall have a check valve on the inlet side, a relief valve, and a drain valve.
- Compressed air systems over 500 psig shall have slow-opening shut-off valves.
- All air compressor intakes shall be located away from areas containing exhaust or other contaminants.

3.50 EQUIPMENT MAINTENANCE

Recordkeeping

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

- Regulators
- Gauges (SPG, Depth, Timers and Dive Computers)
- Buoyancy control devices
- Dry suits
- Scuba cylinders and valves
- Full Face Masks
- Compressors, air filtration systems, gas control panels and storage banks
- Surface supplied equipment
- Rebreather systems

Compressor Operation and Air Test Records

Gas analyses and air tests shall be performed on each UCSC controlled breathing air compressor at regular intervals of no more than 100 hours of operation or six months, whichever occurs first. A copy of the results of these tests shall be posted at each compressor and these tests shall be entered in a formal log.

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

3.60 AIR QUALITY STANDARDS

Breathing Gas

Breathing gas shall meet the following specifications as set forth by the Compressed Gas Association (CGA Pamphlet G-7.1; see table below) and referenced in OSHA 29 CFR 1910.134.

CGA Grade E Standards

Component	Maximum
Oxygen	20-22%/v
Carbon Monoxide	10 PPM/v
Carbon Dioxide	1000 PPM/v
Condensed Hydrocarbons	5 mg/m ³
Total Hydrocarbons as Methane	25 PPM/v
Water Vapor	2 PPM/v
Objectionable Odors	None

Remote Operations

For remote site operations using gas sources not controlled by UCSC, every effort should be made to verify breathing gas meets the requirements of this standard. If CGA Grade E gas is not verifiable, sensory evaluation of the breathing gas must be made by each diver prior to diving as well as analyzation of the gas with Oxygen and Carbon Monoxide analyzers.

SECTION 4.00 SCIENTIFIC DIVER CERTIFICATION AND AUTHORIZATIONS

This section describes the training and performance standards for AAUS Scientific Divers and represents 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 UCSC.

Entry Level Diver Scientific Diver Candidate

The candidate must show documented proof of Basic, Advanced and Rescue Diver Certifications, or equivalent, from an internationally recognized training agency. They must also be current in adult first aid, adult CPR/AED and oxygen administration certifications.

Medical Examination

The candidate must be medically qualified for diving as described in Section 5.0. Appropriate dive medical forms can be found at <http://www2.ucsc.edu/sci-diving> under the diving forms link in the left menu bar. AAUS medical standards may not be waived.

Swimming/Watermanship Evaluation

The candidate must demonstrate the following in the presence of the DSO or designee. Items a-d are to be performed without swim aids; items e-j are to be performed with mask, snorkel and fins (skin gear). However, where exposure protection is needed, the candidate must be appropriately weighted to provide for neutral buoyancy.

- a) Swim (without swim aids) underwater for a distance of 25 yards (23 meters) without surfacing.
- b) Swim (without swim aids) 400 yards (366 meters) in less than 12 minutes.
- c) Tread water (without swim aids) for 10 minutes, or 2 minutes without the use of hands.
- d) Transport a passive person (without swim aids) of equal size a distance of 25 yards (23 meters) in the water.
- e) Swim with skin gear 900 yards (823 meters) in less than 20 minutes.
- f) Swim with skin gear 50 yards (46 meters) underwater on three breaths.
- g) With skin gear recover a 10# weight from 10 feet of water.
- h) With skin gear perform a weight belt ditch and recovery in 10 feet of water.
- i) Perform a skin gear ditch/recovery in 10 feet of water, with only 5 recovery breaths between the ditch and recovery.

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 shall include principles and activities appropriate to the intended area of scientific study. Formats for meeting the 100-hour training requirement include a 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, UCSC 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 UCSC scientific diving privileges.

Theoretical Training / Knowledge Development	
Required Topics:	Suggested Topics:

<p>Diving Emergency Care Training</p> <ul style="list-style-type: none"> • Cardiopulmonary Resuscitation (CPR) • AED • Standard or Basic First Aid • Recognition of DCS and AGE • Accident Management • Field Neurological Exam • Oxygen Administration 	<p>Specific Dive Modes (methods of gas delivery)</p> <ul style="list-style-type: none"> • Open Circuit • Hookah • Surface Supplied diving • Rebreathers (closed and/or semi-closed)
<p>Dive Rescue</p> <ul style="list-style-type: none"> • To include procedures relevant to OM specific protocols. (See water skills below) 	<p>Specialized Breathing Gas</p> <ul style="list-style-type: none"> • Nitrox • Mixed Gas
<p>Scientific Method</p>	<p>Small Boat Operation</p>
<p>Data Gathering Techniques (Only Items specific to area of study required)</p> <ul style="list-style-type: none"> • Transects and Quadrats • Mapping • Coring • Photography • Tagging • Collecting • Animal Handling • Archaeology • Common Biota • Organism Identification • Behavior • Ecology • Site Selection, Location, and Re-location 	<p>Specialized Environments and Conditions</p> <ul style="list-style-type: none"> • Blue Water Diving • Altitude • Ice and Polar Diving (Cold Water Diving) • Zero Visibility Diving • Polluted Water Diving • Saturation Diving • Decompression Diving • Overhead Environments • Aquarium Diving • Night Diving • Kelp Diving • Strong Current Diving • Potential Entanglement/Entrapment • Liveboating

<ul style="list-style-type: none"> Specialized Data Gathering Equipment 	
Required Topics:	Suggested Topics:
Navigation	HazMat Training <ul style="list-style-type: none"> Chemical Hygiene, Laboratory Safety (Use of Chemicals)
HazMat Training <ul style="list-style-type: none"> HP Cylinders 	
Decompression Management Tools <ul style="list-style-type: none"> Dive Tables Dive Computers PC Based Software 	Specialized Diving Equipment <ul style="list-style-type: none"> Full face mask Dry Suit Communications Dive Propulsion Vehicle (DPV) SMBs/Lift Bags Line Reels
AAUS Scientific Diving Regulations and History <ul style="list-style-type: none"> Scientific Dive Planning Coordination with other Agencies Appropriate Governmental Regulations 	
Hazards of breath-hold diving and ascents	
Dive Physics (Beyond entry level scuba)	
Dive Physiology (Beyond entry level scuba)	Other Topics and Techniques as Determined by the DCB
Dive Environments	
Decompression Theory and its Application	

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: <ul style="list-style-type: none"> Enter water fully equipped for diving Clear fully flooded face mask Demonstrate air sharing and ascent using an alternate air source, as both donor and recipient, with and without a face mask Demonstrate buddy breathing as both donor and recipient, with and without a face mask Demonstrate understanding of underwater signs and signals Demonstrate ability to remove and replace equipment while submerged Demonstrate acceptable watermanship skills for anticipated scientific diving conditions
Open Water Skills	The trainee must satisfy the DSO, or DCB-approved designee, of their ability to perform at least the following in open water: <ul style="list-style-type: none"> Surface dive to a depth of 10 feet (3 meters) without scuba* Enter and exit water while wearing scuba gear* ^^ Kick on the surface 400 yards (366 meters) while wearing scuba gear, but not breathing from the scuba unit* Demonstrate proficiency in air sharing ascent as both donor and receiver* Demonstrate the ability to maneuver efficiently in the environment, at and below the surface* ^^ Complete a simulated emergency swimming ascent* Demonstrate clearing of mask and regulator while submerged*

	<ul style="list-style-type: none"> • 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* ^^
	<p>Rescue Skills:</p> <ul style="list-style-type: none"> • Rescue from depth and transport 25 yards (23 meters), as a diver, a passive simulated victim of an accident: surface diver, establish buoyancy, stabilize victim • Demonstrate simulated in-water mouth-to-mouth resuscitation • Removal of victim from water to shore or boat • Stressed and panicked diver scenarios • Recommendations For Rescue Of A Submerged Unresponsive Compressed- Gas Diver – Appendix 9
	<p>Successfully complete a minimum of one checkout dive and at least eleven additional open water dives in a variety of dive sites, for a cumulative surface to surface time of 6 hours. Dives following the checkout dive(s) may be supervised by an active Scientific Diver holding the necessary depth authorization experienced in the type of diving planned, and with the knowledge and permission of the DSO</p>
	<p>The eleven dives (minimum) following the initial checkout dive may be conducted over a variety of depth ranges as specified by the DCB. Depth progression must proceed shallower to deeper after acceptable skills and judgement have been demonstrated, and are not to exceed 100 feet during the initial 12 dive cycle</p>
	<p>* Checkout dive element ^^ Evaluated on all dives ^ Evaluated at some point during the training cycle</p>

Examinations	
Equipment	<p>The trainee will be subject to examination/review of:</p> <ul style="list-style-type: none"> • Personal diving equipment • Task specific equipment • Function and manipulation of decompression computer to be employed by the diver (if applicable)
Written Exams	<p>The trainee must pass a written examination reviewed and approved by the DCB that demonstrates knowledge of at least the following:</p> <ul style="list-style-type: none"> • Function, care, use, and maintenance of diving equipment • Advanced Physics and physiology of diving • Diving regulations • Applicable diving environments • Emergency procedures for UCSC-specific dive mode(s) and environments, including buoyant ascent and ascent by air sharing • Currently accepted decompression theory and procedures • Proper use of dive tables • Hazards of breath-hold diving and ascents • Planning and supervision of diving operations

	<ul style="list-style-type: none"> • Navigation • Diving hazards & mitigations • Cause, symptoms, treatment, and prevention of the following: near drowning, air embolism, hypercapnia, squeezes, oxygen toxicity, nitrogen narcosis, exhaustion and panic, respiratory fatigue, motion sickness, decompression sickness, hypothermia, and hypoxia/anoxia • Applicable theoretical training and knowledge development from the Required and Suggested Topics (above)
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4.30 Diver Certification and Authorizations

Only a person diving under the auspices of UCSC that subscribes and adheres to the AAUS standards and diving operations 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 UCSC 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 possesses 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 shall apply, except follows:

- Practical training shall 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.

Scientific Skin Diver Certification

A scientific skin diver is a diver who has at least met the guidelines outlined in Appendix 3 and has had specific skin diving orientation and who is diving solely as a skin diver.

Temporary Diver Authorization (TDA)

Only a diver not under the auspices of an AAUS OM may be granted a TDA. The individual in question must demonstrate proficiency in diving and can contribute measurably to a planned dive. A TDA constitutes a waiver of selected requirements of Section 4 and is valid only for a limited time, as approved by the DCB. A TDA shall be restricted to the planned diving operation and shall 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 shall be planned and executed with the permission of the DCB or designee.

In the event an active UCSC scientific diver does not hold an authorization at the desired depth authorization, the DCB may grant 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 - DIT depth authorization, indicating the diver needs more supervised dive experience beyond the successful completion of training listed in Section 4.20. Cumulative minimum supervised dives: 12 from the initial training plus *at least* 6 more supervised dives and clearance from DSO.
- b) Authorization to 45 Foot Depth - Initial science diver depth authorization, approved upon the successful completion of training listed in Section 4.20. Cumulative minimum supervised dives: 12.
- c) Authorization to 70 Foot Depth - A diver holding a 45 foot authorization may be authorized to a depth of 70 feet after successfully completing and logging 12 supervised science dives to depths between 46 and 70 feet, for a minimum total time of 4 hours. Cumulative minimum supervised dives: 24.
- d) Authorization to 100 Foot Depth - A diver holding a 70 foot authorization may be authorized to a depth of 100 feet after successfully completing 2 supervised science dives between 71' and 100' and the completion of a 100' authorization course. Cumulative minimum supervised dives: 30.
- e) 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 shall also demonstrate proficiency in the use of the appropriate decompression profiling method. Cumulative minimum supervised dives: 36.
- f) 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.

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

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 (can be recreational). 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 4.00 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 shall pass a medical examination at the intervals specified in Section 5.00. This medical examination requirement cannot be waived for any diver. A medically cleared diver experiencing any Conditions Which May Disqualify Candidates from Diving (see current on-line medical forms) or following any

major injury or illness, or any condition requiring chronic medication, shall receive clearance to return to diving from a physician and the UCSC health center before resuming diving activities. If the condition is pressure related, the clearance to return to diving must come from a physician trained in diving medicine.

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 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 shall inform the diver in writing of the reason(s) for revocation. The diver will be given the opportunity to present their case in writing 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* shall be performed by, or under the direction of, a licensed physician of the applicant-diver’s choice, preferably one trained in diving/undersea medicine.
- 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 (see current on-line medical forms).
- Any exams not done through the UCSC health center need to be reviewed by health center staff prior to approval for diving.
- The DSO shall 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

<i>Medical evaluation shall be completed:</i>		
Before Age 40	After age 40 Before Age 60	After Age 60
Before a diver may begin diving, unless an equivalent initial medical evaluation has been given within the preceding 5 years	Before a diver may begin diving, unless an equivalent initial medical evaluation has been given within the preceding 3 years	Before a diver may begin diving, unless an equivalent initial medical evaluation has been given within the preceding 2 years
At 5 year intervals	At 3 year intervals	At 2 year intervals
Clearance to return to diving must be obtained from a healthcare provider following a medically cleared diver experiencing any Conditions Which May Disqualify Candidates From Diving (see current on-line medical forms), 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 to Examining Physician

The diver shall provide a copy of the medical evaluation requirements of this *Manual* to the examining physician. (see current on-line medical forms).

5.40 Content of Medical Evaluations

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

1. Diving physical examination (see current on-line medical forms). 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 (see current on-line medical forms)
3. Medical history (see current on-line medical forms)

5.50 Physician's Written Report

- A Medical Evaluation of Fitness For Scuba Diving Report signed by the examining physician (and UCSC medical staff if not examining physician) stating the individual's fitness to dive, including any recommended restrictions or limitations will be submitted to the DSO 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 DSO 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 UCSC Medical Director or designee and the diver's record and authorizations will be updated accordingly.

VOLUME II

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 shall be met:

Prerequisites

Only a certified Scientific Diver or DIT diving under UCSC auspices is eligible for authorization to use nitrox. Application for authorization to use nitrox shall 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.

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 enriched air nitrox (EAN) diving". ISO 11107:2009 - International Organization for Standardization (ISO),

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 openwater 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 (ex.: O₂ and CO₂ 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, pO₂, 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

Oxygen Exposure Limits

- The inspired oxygen partial pressure experienced at depth should not exceed 1.4 ATA.
- The maximum allowable exposure limit should be reduced in cases where cold or strenuous dive conditions, or extended exposure times are expected

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 pO₂ limit and fO₂ adjustment should be checked by the diver prior to the start each dive to ensure conformity with the mix being used.

Gas Mixture Requirements

- Only nitrox mixtures and mixing methods approved by the DCB may be used
- UCSC 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/m³
 - o For remote site operations using compressors not controlled by the OM where this is not verifiable, the DCB shall develop a protocol to mitigate risk to the diver

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: fO₂, MOD, cylinder pressure, date of analysis, and user's name.
- Individual dive log reporting forms should report fO₂ of nitrox used, if different than 21%

6. 40 Nitrox Diving Equipment

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

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 shall be designed and maintained for oxygen service. Oxygen systems over 125 psig shall have slow-opening shut-off valves.

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 REBREATHERS

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

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

Application of this standard is in addition to pertinent requirements of all other sections of this *Manual*. For rebreather dives that also involve staged decompression and/or mixed gas diving, all requirements for each of the relevant diving modes shall be met. The DCB reserves the authority to review each application of all specialized diving modes, and include any further requirements deemed necessary beyond those listed here on a case-by-case basis. No diver shall conduct planned operations using rebreathers without prior review and approval of the DCB. In all cases, trainers shall be qualified for the type of instruction to be provided. Training shall be conducted by agencies or instructors approved by DSO and DCB.

7.10 Definition

- A. Rebreathers are defined as any device that recycles some or all of the exhaled gas in the breathing loop and returns it to the diver. Rebreathers maintain levels of oxygen and carbon dioxide that support life by metered injection of oxygen and chemical removal of carbon dioxide. These characteristics fundamentally distinguish rebreathers from open-circuit life support systems, in that the breathing gas composition is dynamic rather than fixed
- B. There are three classes of rebreathers:
 1. Oxygen Rebreathers: Oxygen rebreathers recycle breathing gas, consisting of pure oxygen, replenishing the oxygen metabolized by the diver. Oxygen rebreathers are generally the least complicated design but are limited in depth of use due to the physiological limits associated with oxygen toxicity
 2. Semi-Closed Circuit Rebreathers: Semi-closed circuit rebreathers (SCR) recycle the majority of exhaled breathing gas, venting a portion into the water and replenishing it with a constant or variable amount of a single oxygen-enriched gas mixture. Gas addition and venting is balanced against diver metabolism to maintain safe oxygen levels
 3. Closed-Circuit Rebreathers: Closed-circuit mixed gas rebreathers (CCR) recycle all of the exhaled gas. Electronically controlled CCRs (eCCR) replace metabolized oxygen via an electronically controlled valve, governed by oxygen sensors. Manually controlled CCR (mCCR) rely on mechanical oxygen addition and diver monitoring to control oxygen partial pressure (ppO₂). Depending on the design, manual oxygen addition may be available on eCCR units as a diver override, in case of electronic system failure. Systems are equipped with two cylinders; one with oxygen, the other with a diluent gas source used to make up gas volume with depth increase and to dilute oxygen levels. CCR systems operate to maintain a constant ppO₂ during the dive, regardless of depth

7.20 Prerequisites for use of any rebreather

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

7.30 Training

- A. Specific training requirements for use of each rebreather model shall be defined by DCB on a case-by-case basis. Training shall include factory-recommended requirements, but may exceed this to prepare for the type of mission intended (e.g., staged decompression or heliox/trimix CCR diving). (See training section for details.)
- B. Successful completion of training does not in itself authorize the diver to use rebreathers. The diver must demonstrate to the DCB or its designee that the diver possesses the proper attitude, judgment, and discipline to safely conduct rebreather diving in the context of planned operations.
- C. Post training supervised dives are required before the Scientific rebreather diver is authorized to use rebreather for research dives. (See training section for details).

Individual Equipment Requirements

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

7.40 Equipment Requirements

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

7.50 Operational Requirements

- A. Dive Plan
 - In addition to standard dive plan components, at a minimum all dive plans that include the use of rebreathers must include:
 - a) Information about the specific rebreather model(s) to be used
 - b) Type of CO₂ absorbent material
 - c) Composition and volume(s) of supply gasses
 - d) Bailout procedures
 - e) Other specific details as required by the DCB
- B. Particular attention should be paid to using rebreathers under conditions where vibration or pulsating water movement could affect electronics or control switches and systems
- C. Particular attention should be paid to using rebreathers under conditions where heavy physical exertion is anticipated
- D. Respirated gas densities should be less than 5 g·L⁻¹, and should not exceed 6 g·L⁻¹ under normal circumstances.
- E. User replaceable consumable rebreather components should be replaced per manufacture recommendations or as defined by the DCB
- F. If performed, periodic field validation of oxygen cells should be conducted per DCB designated procedure
- G. Diver carried off-board bailout is not required under conditions where the onboard reserves are adequate to return the diver to the surface while meeting proper ascent rate and stop requirements, and the system is configured to allow access to onboard gas. These calculations must take into consideration mixed mode operations where an open circuit diver could require assistance in an out of gas situation
- H. Use and reuse of CO₂ scrubber media should be per manufacture recommendations or as defined by the DCB
- I. Planned oxygen partial pressure in the breathing gas shall not exceed 1.4 atmospheres at depths greater than 30 feet, or 1.6 at depths less than 30feet
- J. Both CNS and Oxygen Tolerance Units (OTUs) should be tracked for each diver. Exposure limits should be established by the DCB
- K. The DCB or their designee will:
 - 1. Establish policies for the use of checklists related to rebreather operations
 - 2. Establish policies for pre and post dive equipment checks to be conducted by their divers
 - 3. Establish policies for disinfection of rebreathers to be used by their divers
 - 4. Establish policies for pre-breathing of rebreathers used by their divers
 - 5. Establish policies for the use of mixed mode and mixed rebreather platform dive teams under their auspices.
 - a) Mixed mode and/or mixed platform dive teams are permitted.
 - b) At minimum, divers must be cross briefed on basic system operations for establishing positive buoyancy, closing a rebreather diver's breathing loop, and procedures for gas sharing
 - 6. Establish policies for the maximum depth of dives conducted using a particular class of rebreather within the auspices of their diving operations
 - 7. Establish policies for depth authorization and maintenance for divers using rebreathers
 - 8. Establish policies for implementing workup dives within program
 - a) Pre-operation workup dives, including review and practice of emergency recognition and response skills, and management of task loading are required for operations defined by the DCB as beyond the scope of normal operating conditions.

9. Establish policies for the minimum use of rebreathers to maintain proficiency.
 - a) The minimum Annual rebreather diving activity should be 12 rebreather dives, with a minimum of 12 h underwater time.
 - b) To count, dives should be no less than 30 min in duration. A required element of maintaining proficiency is the periodic performance and reevaluation of skills related to in-water problem recognition and emergency procedures.
- L. Establish policies for reauthorization for the use of rebreathers if minimum proficiency requirements are not met
 1. Reestablishment of authorization to use rebreathers must require more than just performing a dive on a particular make or model of rebreather
 2. At minimum demonstrated skills included in the required training elements for the level of rebreather operation must be performed and reevaluated.

7.60 REBREATHING TRAINING SECTION

A. Entry Level Training

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

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

Hygienic concerns	X	X	X
Nitrogen absorption & decompression		X	X
CO2 retention	X	X	X
Hyperoxia-induced	X	X	X
System design, assembly, and operation, including:			
Layout and design	X	X	X
Oxygen control systems	X	X	X
Diluent control systems		ISE	ISE
Complete assembly and disassembly of the	X	X	X
Canister design & proper packing and handling of chemical	X	X	X
Decompression management and applicable tracking		ISE	X
Oxygen and high pressure gas handling and	X	X	X
Fire triangle	X	X	X
Filling of cylinders	X	X	X
Pre-dive testing & trouble	X	X	X
Post-dive break-down and	X	X	X
Trouble shooting and manufacturer authorized field	X	X	X
Required maintenance and	X	X	X
Manufacturer supported additional items	ISE	ISE	ISE
Dive planning:			
Operational planning	X	X	X
Gas requirements	X	X	X
Oxygen exposure and	X	X	X
Gas density calculations		X	X
Oxygen metabolizing	X	X	X
Scrubber limitations	X	X	X
Mixed mode diving (buddies using different dive modes)	X	X	X
Mixed platform diving (buddies using different rebreather	X	X	X
Problem Recognition & Emergency Procedures:			
Applicable open circuit emergency procedures for common gear	X	X	X
Loss of electronics	ISE	ISE	X
Partially flooded loop	X	X	X
Fully flooded loop	X	X	X
Cell warnings		ISE	X
Battery warnings	ISE	ISE	X
High O2 warning	ISE	ISE	X
Low O2 warning	ISE	ISE	X
High CO2 warning	ISE	ISE	ISE
Recognizing issues as indicated by onboard scrubber	ISE	ISE	ISE
Recognizing hypercapnia signs and symptoms in self or	X	X	X
Excluded O2 cell(s)	ISE	ISE	ISE
Loss of Heads Up Display	ISE	ISE	ISE
Loss of buoyancy	X	X	X
Diluent manual add button not		ISE	ISE
O2 manual add button not	ISE	ISE	ISE
Exhausted oxygen supply	X	X	X
Exhausted diluent supply		ISE	ISE
Lost or exhausted bailout	ISE	ISE	ISE

Handset not functioning	ISE	ISE	ISE
Solenoid stuck open	ISE	ISE	ISE
Solenoid stuck closed	ISE	ISE	ISE
ADV stuck open	ISE	ISE	ISE
ADV stuck closed	ISE	ISE	ISE
Isolator valve(s) not	ISE	ISE	ISE
Oxygen sensor validation	ISE	ISE	X
Gas sharing	X	X	X
Diver assist and diver rescue	X	X	X
Other problem recognition and emergency procedures specific to the rebreather unit	X	X	X
Practical Training and Evaluations			
Demonstrated skills shall include, at a minimum:			
Use of checklists	X	X	X
Carbon dioxide absorbent canister	X	X	X
Supply gas cylinder analysis and pressure	X	X	X
Test of one-way valves	X	X	X
System assembly and breathing loop leak	X	X	X
Oxygen control system	ISE	ISE	X
Proper pre-breathe procedure	X	X	X
In-water bubble check	X	X	X
Proper buoyancy control during descent, dive operations, and	X	X	X
System monitoring & control during descent, dive operations, and	X	X	X
Proper interpretation and operation of system	X	X	X
Proper buddy contact and	X	X	X
Use of a line reel or spool to deploy an SMB from planned	X	X	X
Proper management of line reel or spool, and SMB	X	X	X
Unit removal and replacement on the	X	X	X
Bailout and emergency procedures for self and buddy, including:			
System malfunction recognition and	X	X	X
Manual system control	ISE	ISE	ISE
Flooded breathing loop	IA	IA	IA
Absorbent canister failure	X	X	X
Alternate bailout options	X	X	X
Manipulation of onboard and off board cylinder	X	X	X
Manipulation of bailout cylinders (removal, replacement,	ISE	ISE	ISE
Manipulation of quick disconnects, isolator valves, and	ISE	ISE	ISE
Proper system maintenance, including:			
Breathing loop disassembly and	X	X	X
Oxygen sensor	ISE	ISE	ISE
Battery removal and replacement or	ISE	ISE	ISE
Other tasks as required by specific rebreather	X	X	X
Written Evaluation	X	X	X
Supervised Rebreather Dives	X	X	X
Entry Level Training – Minimum Underwater Requirements			

	Pool/Confined Water	Openwater	Supervised Dives
O2	1 Dive, 90 – 120 minutes	4 dives, 120 minute	2 Dives, 120 minute
SCR	1 Dive, 90 – 120 minutes	4 dives, 120 minute	4 dives, 120 minute

B. Required Decompression, Normoxic, and Hypoxic Mix Training

1. Required Decompression and Normoxic Training may be taught separately or combined.
2. Prerequisites:
 - a) Required Decompression 25 rebreather dives for a minimum cumulative dive time of 25 hours
 - b) Mixed Gas:
 - (1) Normoxic Mixes – 25 rebreather dives for a minimum cumulative dive time of 25 hours
 - (2) Hypoxic Mixes – Rebreather Required Decompression Certification and Normoxic Certification and 25 decompression rebreather dives for a minimum cumulative dive time of 40 hours on dives requiring decompression
3. Who may teach: Individuals authorized as a CCR/SRC required decompression and/or Normoxic and/or Hypoxic Mix instructor by the DCB or their designee (this is in addition to the original authorization from Section A#5).
4. Maximum Student/Instructor Ratio: 2 to 1. This ratio is to be reduced as required by environmental conditions or operational constraints
5. Upon completion of practical training, the diver must demonstrate proficiency in pre-dive, dive, and post-dive operational procedures for the particular model of rebreather to be used
6. Supervised dives target activities associated with the planned science diving application. Supervisor for these dives is the DSO or designee, experienced with the make/model rebreather being used

Rebreather Required Decompression, Normoxic & Hypoxic Mix Training Requirements			
Key: X = include, IA = If Applicable, ISE = If So Equipped			
	Deco	Normoxic	Hypoxic Mixes
Required Training Topic			
Academic			
Review of applicable subject matter from	X	X	X
Medical & physiological aspects of:			
Hypercapnia, hypoxia,	X	X	X
Oxygen limitations	X	X	X
Nitrogen limitations	X	X	X
Helium absorption and		X	X
High Pressure Nervous			X
System design, assembly, and operation, including:			
Gear considerations	X	X	X
Gas switching	X	X	X
Dive planning:			
Decompression	X	X	X
Gradient Factors	X	X	X
Scrubber duration and the effects of depth on scrubber	X	X	X

Gas requirements including bailout	X	X	X
Bailout gas management – individual vs	X	X	X
Gas density calculations	X	X	X
Operational Planning	X	X	X
Equivalent narcosis		X	X
Gas selection, gas mixing and gas		X	X
Problem Recognition & Emergency Procedures:			
Applicable open circuit emergency procedures for common	X	X	X
Flooded loop	X	X	X
Cell warnings	X	X	X
Battery warnings	X	X	X
Hypercapnia, hypoxia,	X	X	X
Practical Training and Evaluations			
Demonstrated skills shall include, at a minimum:			
Proper demonstration of applicable skills from previous training	X	X	X
Proper manipulation of DSV	X	X	X
Proper descent and bubble check	X	X	X
Proper monitoring of setpoint switching and pO2 levels	X	X	X
Proper interpretation and operation of system instrumentation	X	X	X
System monitoring & control during descent, dive operations, and ascent	X	X	X
Demonstrate the ability to manually change setpoint and electronics settings during the dive	ISE	ISE	ISE
Demonstrate buoyancy control; ability to hover at fixed position in water column without moving hands or feet	X	X	X
Onboard and off board valve manipulation for proper use, and reduction of gas loss	X	X	X
Diagnosis of and proper reactions for a flooded absorbent canister	X	X	X
Diagnosis of and proper reactions for CO2 breakthrough	X	X	X
Diagnosis of and proper response to Cell Errors	X	X	X
Diagnosis of and proper reactions for Low oxygen drills	X	X	X
Diagnosis of and proper reactions for Flooded Loop	X	X	X
Diagnosis of and proper reactions for High Oxygen Drills	X	X	X
Diagnosis of and proper reactions for electronics and battery failure	X	X	X
Operation in semi-closed mode	X	X	X
Properly execute the ascent procedures for an incapacitated dive buddy	X	X	X
Demonstrate controlled ascent with an incapacitated diver including surface tow at least 30 meters / 100 feet with equipment removal on surface, in water too deep to stand	X	X	X
Proper buddy contact and communication	X	X	X
Use of a line reel or spool to deploy an SMB from planned dive depth and while controlling buoyancy in the water column	X	X	X
Proper management of line reel or spool, and SMB during ascents and safety or required stops	X	X	X

Demonstrate the ability to maintain minimum loop volume	X	X	X
Demonstrate comfort swimming on surface and at depth carrying a single bailout/decompression cylinder/bailout rebreather	X		
Demonstrate ability to pass and retrieve a single bailout/decompression cylinder or bailout rebreather while maintaining position in the water column	X		
Demonstrate ability to pass and receive multiple bailout/decompression cylinders or bailout rebreather while maintaining position in the water column	IA	X	X
Demonstration of the ability to perform simulated decompression stops	X	X	X
Demonstration of the ability to perform decompression stops	X	X	X
Demonstrate competence managing multiple bailout cylinders, including drop and recovery while maintaining position in the water column	IA	X	X
Demonstrate appropriate reaction to simulated free-flowing deco regulator	X	X	X
Gas share of deco gas for at least 1 minute	X	X	X
Demonstrate oxygen rebreather mode at appropriate stop depth		X	X
Complete bailout scenarios from depth to include decompression obligation on open circuit	X	X	X
Written Evaluation	X	X	X
Supervised Rebreather Dives	X	X	X
Minimum Underwater Requirements			
	Pool/Confined	Openwater	Supervised Dives**
Deco	1 Dive / 60 min	7 Dives / 420 min	4 Dives / 240 min.
Normoxic	1 Dive / 60 min	7 Dives / 420 min	4 Dives / 240 min.
Deco/Normoxic Combined	1 Dive / 60 min	7 Dives / 420 min 3 Normoxic Dives / 180 min	4 Dives / 240 min.
Hypoxic Mixes		7 Dives / 420 min	4 Dives / 240 min.
**A minimum of three supervised dives should comply with authorization parameters			

B. Rebreather Crossover Training

1. Crossover training to a new rebreather platform requires a minimum of 4 training dives for a minimum cumulative dive time of 240 min.

Advanced level certification on a new rebreather platform may be awarded upon successful demonstration of required

SECTION 8.00 SPECIALIZED DIVING ENVIRONMENTS

Certain types of diving, some of which are listed below, utilize equipment or procedures that require specialized training. Supplementary guidelines for these technologies are in development by the AAUS. The DCB defines these activities and references the following publications and recommendations as operational policy for these diving modes and environments. Divers shall 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 greater than 200 feet deep. It requires special training and the use of multiple-tethered diving techniques. Specific guidelines that should be followed are outlined in "Blue Water Diving Guidelines" (California Sea Grant Publ. No. T-CSGCP-014).

8.20 Ice and Polar Diving

Divers planning to dive under ice or in polar conditions should use the following: "PESH-POL_2000.08 Standards for the Conduct of Scientific Diving", National Science Foundation, Division of Polar Programs, 2015.

8.30 Overhead Environments

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

For the purposes of this *Manual*, Ice diving is a specialized overhead environment addressed in Section 8.20 and supplemented by requirements and protocols established by the UCSC's DCB.

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

8.40 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 DCB to establish the requirements and protocol under which diving will be safely conducted.

8.50 Drysuit Diving

All UCSC divers diving with drysuits under the auspices of UCSC must demonstrate proficiency to the DSO or designee before diving with a drysuit without supervision.

8.60 Dive Computers

All UCSC divers using dive computers while diving under the auspices of UCSC shall have a signed dive computer waiver on file. Remaining no-decompression limit allowed at depth as displayed by the computer shall not be less than 10 minutes.

8.70 Altitude Diving

Divers planning to dive at sites with elevations greater than 1000 feet must have specialized training (see NOAA Dive Manual, Chapter 10 - manual available in DSP office) and prior approval of the DCB.

8.80 Scientific Skin Diving

Divers planning to use Skin Diving as their mode of data collection must have prior approval of the DSO or designee and must follow the guidelines in Appendix 3.

8.90 Individual Accommodation

Divers that may need accommodation to perform scientific diving need approval by the DCB prior to commencing scientific diving under the auspices of UCSC.

- The DCB shall review each individual accommodation that might be needed to perform scientific diving (SKIN or SCUBA) under the auspices of UCSC.
- The DCB will review the diver's training, practical experience and incident history. The DCB will consult with UCSC's Medical Director for any accommodations related to health issues. This information would then be reviewed as it relates to dive team safety and national and community standards.
- If an accommodation is granted the DSO will develop a specific protocol. The protocol will then be reviewed by the DCB (and Medical Director if needed) before being approved by the DCB.

APPENDIX 1

DEFINITION OF TERMS

Air sharing - Sharing of an air supply between divers.

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

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

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

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

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

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

Buddy System -Two or three **suitably** equipped scuba divers that shall be in effective communication throughout the dive.

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

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

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

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

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

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

Cylinder - A pressure vessel for the storage of gases.

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

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

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

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

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

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

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

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

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

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

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

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

DPIC – See Designated Person-In-Charge.

EAD - Equivalent Air Depth (see below).

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

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

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

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

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

FSW - Feet of seawater.

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

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

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

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

Hyperbaric Chamber – See decompression chamber.

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

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

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

Life Support Equipment – Underwater equipment necessary to sustain life.

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

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

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

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

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

MOD – Maximum Operating Depth, usually determined as the depth at which the pO₂ for a given gas mixture reaches a predetermined maximum.

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

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

OUT – Oxygen Toxicity Unit

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

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

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

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

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

Pressure Vessel – See cylinder.

pO₂ – Inspired partial pressure of oxygen, usually expressed in units of atmospheres absolute.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

APPENDIX 2

Letter of Reciprocity/Verification of Training

BERKELEY · DAVIS · IRVINE · LOS ANGELES · RIVERSIDE · SAN DIEGO · SAN FRANCISCO
SANTA BARBARA · SANTA CRUZ

UNIVERSITY OF CALIFORNIA, SANTA CRUZ
 DIVING & BOATING SAFETY PROGRAM
 831-206-3332 voice
 http://www2.ucsc.edu/sci-diving
 srclabue@ucsc.edu

100 Shaffer Road
 SANTA CRUZ, CA 95060

UCSC/AAUS REQUEST FOR DIVING RECIPROCITY 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 (2001 edition). The visiting diver will comply with the diving regulations of the host organization's Diving Safety Manual unless previously arranged by both organizations DCBs.

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 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: _____

Email: _____

Dive Dates: _____

	Completed	Renewal																				
Last diving medical examination	██████████	██████████																				
Scuba regulator/equipment service/inspected	██████████	██████████																				
CPR training		██████████																				
Oxygen administration		██████████																				
First aid for diving		██████████																				
Depth certification																						
Date Assigned Current Certification Depth	██████████																					
Date of last dive	██████████																					
Number of dives completed within previous 12 months?	██████████																					
Maximum dive depth within previous 12 months?	██████████																					
Total number of dives logged:		Dive Log History:																				
UCSC Scientific:	██████████	<table style="font-size: x-small; border-collapse: collapse;"> <tr> <td style="border-right: 1px solid black; padding: 2px;">Depth Range</td> <td style="padding: 2px;">Dives</td> <td style="border-right: 1px solid black; padding: 2px;">Depth Range</td> <td style="padding: 2px;">Dives</td> </tr> <tr> <td style="border-right: 1px solid black; padding: 2px;">0-40 ft.:</td> <td style="padding: 2px;">██████████</td> <td style="border-right: 1px solid black; padding: 2px;">130-150 ft.:</td> <td style="padding: 2px;">██████████</td> </tr> <tr> <td style="border-right: 1px solid black; padding: 2px;">40-60 ft.:</td> <td style="padding: 2px;">██████████</td> <td style="border-right: 1px solid black; padding: 2px;">150-190 ft.:</td> <td style="padding: 2px;">██████████</td> </tr> <tr> <td style="border-right: 1px solid black; padding: 2px;">60-100 ft.:</td> <td style="padding: 2px;">██████████</td> <td style="border-right: 1px solid black; padding: 2px;">190+ ft.:</td> <td style="padding: 2px;">██████████</td> </tr> <tr> <td style="border-right: 1px solid black; padding: 2px;">100-130 ft.:</td> <td style="padding: 2px;">██████████</td> <td></td> <td></td> </tr> </table>	Depth Range	Dives	Depth Range	Dives	0-40 ft.:	██████████	130-150 ft.:	██████████	40-60 ft.:	██████████	150-190 ft.:	██████████	60-100 ft.:	██████████	190+ ft.:	██████████	100-130 ft.:	██████████		
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60-100 ft.:	██████████	190+ ft.:	██████████																			
100-130 ft.:	██████████																					
UCSC Training:	██████████																					
Non-UCSC :	██████████																					

Additional specialty training/certifications:

Comments/Restriction:

Person to Notify in an Emergency: _____ Relationship: _____

Contact Number: Home: _____

This is to verify that the above individual is currently a certified scientific diver at UNIVERSITY OF CALIFORNIA, SANTA CRUZ and that UNIVERSITY OF CALIFORNIA, SANTA CRUZ is an organizational member of AAUS. This document does not verify employment status with, or insurability of the divers activity by UCSC. If you have questions about this diver other information provided, please contact the UCSC's Diving & Boating Safety Program.

Diving Safety Officer: _____ **Date:** _____

APPENDIX 3

GUIDELINES FOR SCIENTIFIC SKIN DIVERS

1. Must be current in CPR and First Aid.
2. Must have a current AAUS Dive physical.
3. If not certified as a SCUBA diver, individual must attain a Skin Diving certification from a nationally recognized certifying organization.
4. There are three levels of Skin Diving authorization:
 - A) 20' Skin Diver – this diver passed all the confined water 20' Skin Diver skill tests listed below. This diver cannot exceed a depth of twenty feet on any dive, their buddy must also be a 20' Skin Diver if diving below the water surface and they must be equipped with a Bluebuddy on all dives.
 - B) 5' Skin Diver – this diver did not pass the confined water Scientific Skin Diver skill tests listed below but did pass the modified NAUI Skin Diving confined water skill tests listed below. This diver cannot exceed a depth of five feet on any dive, their buddy must be either another 5' Skin Diver or a 20' Skin Diver, they cannot wear a weight belt and they must be equipped with a Bluebuddy on all dives.
 - C) Supervised Skin Diver – this diver has passed at least the modified NAUI Skin Diving water skills tests. This diver requires constant supervision by course instructional staff as determined by DSO, their buddy can be a 5' Skin Diver or a 20' Skin Diver, they cannot exceed a depth of five feet on any dive, they cannot wear a weight belt, they may be required to wear an inflatable personal floatation device (PFD) and they must be equipped with a Bluebuddy on all dives.
5. All 20' Skin Diver candidates must pass a confined water swimming and snorkeling evaluation consisting of:

Swim underwater without swim aids for a distance of 25 yards without surfacing.

Swim 450 yards in less than 12 minutes without swim aids.

Tread water for 10 minutes without swim aids.

Without the use of swim aids, transport another person of equal size a distance of 25 yards in the water.

Swim 900 yards in less than 20 minutes in full skin diving gear using only fin kicks.

Swim 50 yards underwater in full skin diving gear, surfacing only twice for breaths.

Perform a surface rescue on an unconscious skin diver, which includes transporting while performing rescue breathing.

Recover a 10 lb weight from the bottom in at least ten feet of water.

Perform a weight belt ditch and recovery in at least 8 feet of water.

Perform a skin ditch and recovery in at least 8 feet of water.

6. All 5' Skin Diver candidates must pass a confined water swimming and snorkeling evaluation consisting of:

Swim underwater without swim aids for a distance of 25 yards taking no more than three breaths.

Swim for 12 minutes without swim aids.

Tread water for 10 minutes without swim aids.

GUIDELINES FOR SCIENTIFIC SKIN DIVERS cont.

Without swim aids, transport another person of equal size a distance of 25 yards in the water.

Swim 450 yards in full skin diving gear using only fin kicks, no time limit.

Swim 50 yards underwater in full skin diving gear, taking no more than three breaths.

Perform a surface rescue on an unconscious skin diver, which includes transporting while performing rescue breathing.

Recover a 10 lb weight from the bottom in at least ten feet of water.

Perform a weight belt ditch and recovery in at least 8 feet of water.

7. All Dive candidates must perform each of the below skills in confined water:

Enter and exit water with full equipment both from a simulated shore and vessel.

Clear facemask and snorkel.

Demonstrate understanding of hand signals.

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

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

Demonstrate self-rescue and buddy assist techniques.

Perform at least 3 different surface dives.

Demonstrate waterman ship ability, which is acceptable to the instructor.

8. All Dive candidates must pass a written examination covering the below topics:

Function, care, use, and maintenance of diving equipment.

Physics and physiology involved in Free Diving.

Planning and supervision of diving operations.

Diving regulations and precautions.

Near-shore currents and waves.

Dangerous marine animals.

Emergency procedures.

Skin Diving hazards.

Hand signals.

Cause, symptoms, treatment, and prevention of the following: near drowning, carbon dioxide excess, squeezes, exhaustion and panic, respiratory fatigue, motion sickness, hypothermia, hyperthermia and hypoxia/anoxia.

GUIDELINES FOR SCIENTIFIC SKIN DIVERS cont.

9. All Divers must perform the below listed skills in open water:

Surface dive to a depth of at least 10 feet in open water.

Enter and leave open water fully suited from the shore and a vessel.

Kick on the surface 650 yards while fully suited as a skin diver using only fin kicks.

Demonstrate judgment adequate for safe diving including safely planning and executing a dive.

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

Demonstrate clearing of mask and snorkel.

Demonstrate ability to perform 3 different surface dives.

Demonstrate techniques of self-rescue and buddy rescue, performing a complete rescue of an unconscious diver.

Swim underwater at least 25 yards on one breath.

Demonstrate the ability to remove and replace all skin diving gear on the surface.

Dive to a depth of at least 10 feet three times to retrieve an object from the bottom.

APPENDIX 4

UCSC DIVING PROGRAM EMERGENCY TELEPHONE NUMBERS

IN ANY LIFE THREATENING EMERGENCY, THE CORRECT PROCEDURE IS TO CALL 911. FOR A NON-LIFE THREATENING DIVING EMERGENCY CALL DAN AS SOON AS IS PRACTICAL. THE FOLLOWING IS SUPPLEMENTARY INFORMATION ONLY. IT IS SUBJECT TO CHANGE SO PLEASE CHECK EACH INSTITUTION'S WEBSITE PRIOR TO FILLING OUT YOUR PROJECT PROPOSAL.

Emergency Personnel University of California Santa Cruz

Diving Safety Officer	DSP Office Cell	(831) 459-4286 (831) 206-3332
Recreational Diving Program	OPERS Office	(831) 459-4518
Elizabeth Miller MD, UCSC Medical Director	Business	(831) 459-1740 Mon-Fri, 8a-5p
UCSC Health Center		(831) 459-2780

Other References

<u>Divers Alert Network (DAN)</u>	Emergency Nonemergency	(919) 684-9111 (800) 446-2671
<u>Community Hospital of the Monterey Peninsula (CHOMP)</u> 23625 WR Holman Highway, Monterey	Emergency	(831) 625-4900
<u>Dominican Hospital</u> 1555 Soquel Dr., Santa Cruz	Emergency	(831) 462-7700
<u>Catalina Hyperbaric Chamber</u>	Emergency Business	(310) 510-1053 (310) 510-4020
<u>LA CO/USC Med. Alert Center</u>	Emergency	(866) 940-4401

APPENDIX 5

DIVING EMERGENCY MANAGEMENT PROCEDURES

Introduction

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

General Procedures

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

1. Make appropriate contact with victim or rescue as required.
2. Establish (A)irway (B)reathing (C)irculation or (C)irculation (A)irway (B)reathing as appropriate
3. Stabilize the victim
3. Administer 100% oxygen, if appropriate (in cases of Decompression Illness, or Near Drowning).
4. Call local Emergency Medical System (EMS) for transport to nearest medical treatment facility.

Explain the circumstances of the dive incident to the evacuation teams, medics and physicians. Do not assume that they understand why 100% oxygen may be required for the diving accident victim or that recompression treatment may be necessary.

5. Call appropriate Diving Accident Coordinator for contact with diving physician and recompression chamber, etc.
6. Notify DSO or designee according to the Emergency Action Plan of the OM.
7. Complete and submit Incident Report Form (www.aaus.org) to the DCB of the organization and the AAUS (Section 2.70 Required Incident Reporting).

List of Emergency Contact Numbers Appropriate For Dive Location

Available Procedures

- Emergency Care
- Recompression
- Evacuation

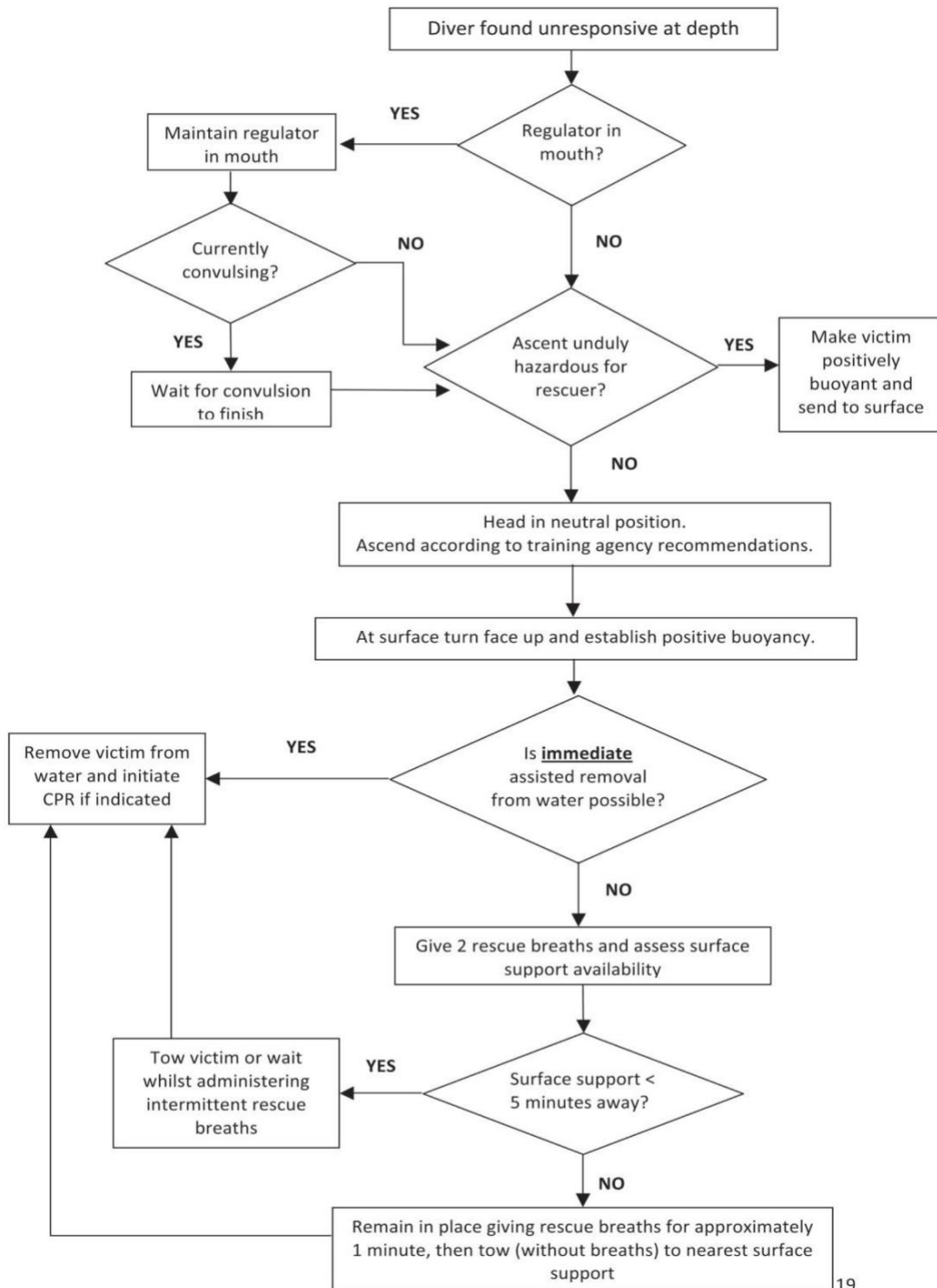
Emergency Plan Content

- Name, telephone number, and relationship of person to be contacted for each diver in the event of an emergency.
- Nearest operational recompression chamber.
- Nearest accessible hospital
- Available means of transport

APPENDIX 6

Recommendations For Rescue Of A Submerged Unresponsive Compressed-Gas Diver

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



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APPENDIX 7

SHARK ACTIVITY RECOMMENDATIONS

Sharks are part of the environment we work in but rarely do we see evidence of their presence. However there may be times when there is evidence of shark activity at a dive site. If large and/or aggressive shark activity is apparent at your dive site, it is recommended that diving operations be cancelled for the day. When subsequent diving at the site and in the areas adjacent to the site is necessary, it is advisable to incorporate as many of the recommendations listed below as are operationally possible.

1. All dive plans should be pre-approved by the DSO prior to departure - this can be done by email or verbally. You will need to provide days and location of operations, members of team, shore contact and planned operations.
2. All divers, boat operators and shore contacts should be made aware of the inherent hazards associated with operations during times of increased shark activity and be especially attentive to surroundings during the operations. Shore contacts should be able to be contacted at anytime during the hours of operations. All vessels need to have at least two means of communicating with the shore contact.
3. All boat operations should have a person on the boat at all times that can render immediate aid (bringing an injured diver into the boat and providing first aid) and should be able to operate all aspects of the vessel. An efficient method of coming aboard the vessel in an emergency should be discussed prior to departure. A first aid and trauma kit should be onboard the vessel. Diver recall strategies also should be discussed. Boats should be anchored well into the kelp bed, avoid anchoring in open water.
4. Surface swimming should be minimized, know compass headings back to the anchor line and as a backup, to shore. If the situation dictates a direct ascent to the surface, do not make a safety stop but do ascend as slow as you can but as fast as you need to with your buddy. Be prepared to enter the vessel as quickly as possible, ditching BC and weight belt if necessary.
5. Buddy teams should stay within touching distance at all times, especially on the surface. This "safety in numbers" statistically proves to be effective when reviewing shark attacks on SCUBA divers. Each dive team should carry a surface float that can be deployed to notify the boat driver of their location.
6. Each diver needs to assess the risks of each dive and make their own decision as to their ability to safely complete the assigned dive. Any diver may refuse to make a dive, even if their decision will lead to the cancellation of the day's activities.