# Humboldt State University

## Diving Safety Manual

**Arcata, California**

**1/29/2013**

## *Acknowledgment*

The Scientific Diving Program at Humboldt State University came into existence solely through the efforts of Dr. John D. De Martini. He singularly developed University programs of underwater research and education. The quality and fervor of his projects and course offerings have generated enthusiasm and professional excellence in our students, staff and faculty. Dr. De Martini's meticulous and animated approach to diving and science exemplifies the optimum combination of diving safety and scientific inquiry.

Above all else, "Dr. D" imbued us with his deep love and appreciation of the natural world, and especially of the underwater realm. We are privileged to have been his students, colleagues and dive partners.

## *Foreword*

The  Humboldt State University Diving Safety Manual has one objective: Diver Safety.

The Manual combines the California State University (CSU), Humboldt State University (HSU), American Academy of Underwater Sciences (AAUS) and Federal Occupational Safety and Health Administration (OSHA) scientific and recreational diving standards. It must be stressed that all applicable standards or regulations in this manual shall be followed for any diving or hyperbaric exposure under the "auspices" of Humboldt State University (Section 1.1.1).  Diving includes, but is not limited to, SCUBA, Surface-Supplied or Free Diving (Appendix 15, page 2) in a pool, confined or open water.

Additional standards and regulations may be established by the Humboldt State University Diving Control Board (DCB).  It is the responsibility of individual divers and persons supervising them to comply with all HSU diving standards.

This Manual provides an administrative framework and the requisite supervision to facilitate safe diving operations, but diver safety ultimately depends on the comprehensive preparation, adequate experience and correct judgment of the individual diver.  Diving is an “at risk” activity that could result in the injury or death of the diver.  Each person diving under the auspices of Humboldt State University must freely decide to participate and accept full responsibility for that decision and their personal safety.

Contact the Diving Safety Officer (DSO) for interpretation of standards, assistance in planning and conducting scientific, leadership or recreational diving programs, for approval of diving conducted under the auspices of HSU, to receive University Diver certification and to request accommodations for persons with disabilities.

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# 1.00 Program Scope and Policy

## 1.1 Program Scope

### 1.11 HSU Auspices Defined

For the purposes of these standards, the auspices of Humboldt State University (HSU or University) includes any operation or activity in which the University is connected because of ownership of any equipment used, locations selected, or relationship with the individual(s) concerned. This includes operations involving employees of HSU or employees of auxiliary organizations, when such employees are acting within the scope of their employment. Students, staff, faculty, members of University recognized organizations and other persons who are engaged in authorized activities of the University are under the auspices of HSU.

Diving under the auspices of HSU includes, but is not limited to, any submersion (this includes in a pool, open or confined water), or hyperbaric exposure while breathing compressed gas or Free Diving (Appendix 15). University diving related activities conducted through the HSU Foundation, Lumberjack Enterprises, University Center, Extended Education, or any University, or University affiliated, unit, club, organization, program or course must be conducted in accordance with these standards and are considered under the auspices of HSU (See Section 9.70 for limited exemption for non-diver training of Free Diving in pool).

During training activities, students and divers are under the auspices of the University, from the beginning of the initial briefing until the end of the final debriefing of the dive day, when they are using University equipment, facilities, or they are in any other way under HSU auspices. The Lead Diver, with approval of the Diving Safety Officer, or the Diving Safety Officer can extend the period when divers under his/her supervision are considered to be under the auspices of the University.

## 1.2 Program Policy and Application

### 1.21 Purpose of Humboldt State University Diving Standards

The purpose of these diving standards is to ensure that all diving under the auspices (Section 1.11) of the Humboldt State University is conducted in a manner that will maximize protection of divers from accidental injury and/or illness, and to set forth standards for training and certification that will allow a working reciprocity between HSU and other organizations. These standards shall apply to scientific, recreational or instructional diving and shall comply with applicable current American Academy of Underwater Sciences (AAUS), California State University (CSU) and National Association of Underwater Instructors (NAUI) diving polices and standards as specified in the current editions of the AAUS Standards for Scientific Diving Certification and Operation of Scientific Diving Programs, the CSU SCUBA Diving Certification and Operation of SCUBA Diving Programs Manual, and the NAUI Standards and Policies Manual.

## 1.22 Application of Diving Standards

All diving, or related activity, under the auspices of HSU must be conducted in accordance with the standards and procedures set forth in the Humboldt State University Diving Safety Manual or other standards prescribed by the Humboldt State University Diving Control Board (DCB).

## 1.23 Deviation from Diving Standards

Any diver may deviate from the requirements of this manual to the extent necessary to prevent or minimize a situation that is likely to cause death, physical harm, or major environmental damage. A diver deviating from the HSU diving standards or procedures shall submit a written report to the Diving Safety Officer within five (5) working days of the event explaining the circumstances and justifications for the deviations.
In addition:

1. The diver(s) deviating from these standards shall immediately notify the Lead Diver or Instructor and the Diving Safety Officer. In no event shall this notification be delayed more than 48 hours.

2. The Lead Diver or Instructor shall submit a written report to the Diving Safety Officer within 72 hours of when they become aware of the standards violation.

3. The Diving Safety Officer shall report violations of standards to the Diving Control Board after receiving the written reports concerning the violations. The Diving Safety Officer's report will include a synopsis of the events, copies of the written reports and recommended action to be taken in response to the violation of standards.

## 1.24 Consequences of Standards Violation

Failure to comply with regulations of this manual may be cause for the revocation or restriction of the diver's HSU diver certification by action of the Diving Control Board. The Diving Control Board shall review each violation of standards and take appropriate action. A diver violating these standards shall have the right to appear before the Diving Control Board and explain the violation or appeal previous actions of the DCB (Section 1.2.5).

## 1.25 Suspension of Diver Certification and Appeal Procedures

The suspension or revocation of diving activities and diver certification shall follow the procedures described in Appendix 9, Procedure for Suspending HSU Diver Certification and Diving Activities and Section 4.6-Revocation of Diver Certification.

The appeal procedure is described in Appendix 10, Review and Appeal of Diver Certification Suspension or Revocation.

## 1.26 Program Standards and Assumption of Liability

In adopting the standards and procedures defined in this manual, HSU assumes no liability not otherwise imposed by law. Outside of those University employees diving in the course of their employment, each diver is assumed under this policy to be voluntarily performing activities for

which they assume all risks, consequences and potential liability. The ultimate responsibility for safety rests with the individual diver. It is the diver's responsibility and duty to refuse to dive if conditions are unsafe or unfavorable, or if they would violate the precepts of their training or regulations in this manual.

All divers must sign the CSU/HSU and NAUI Waiver, Release and Indemnity Agreement, (Appendix 4) and the Statement of Understanding of HSU Diving Standards and Diving Safety Manual (Appendix 5) prior to any in-water diver training or hyperbaric exposure under the auspices of HSU.

## 1.27 Reporting and Investigating Accidents or Injury

Any diver or person having knowledge of a suspected or actual diving related accident or incident of injury shall immediately convey that information to the Lead Diver or Diving Instructor and Diving Safety Officer.

### *Initial Reporting*

All significant accidents or injuries shall be immediately reported verbally to the Lead Diver. If treatment beyond first aid is needed, as defined in CFR 1904.7(b)(5)(ii), notification shall be provided as soon as is feasible, in writing to the Diving Safety Officer by all involved parties and witnesses. In no event shall these notifications be delayed more than 24 hours unless injuries to or the safety of the reporting parties preclude the verbal and written reporting within 24 hours. If the reports are delayed due to injury or issues of safety, they shall be submitted as soon as is practicable.

### *Investigation*

The Diving Safety Officer shall investigate and document any accident or incident of injury related to a diving activity under the auspices of HSU. The Diving Safety Officer's report shall be given to the Diving Control Board for their review and action (Section 8.4).

### *Occupational and Student Accidental Injuries or Illnesses*

The University supervisor or instructor shall record and report occupational and student injuries or illnesses in accordance with requirements of Title 8 of the California Labor Code and University policy. If the victim was a state employee, including volunteer employees, the following reports are required:

1. Standard Form 620, Supervisor's Injury Prevention Report.
2. Ward North America form DWC 1, "Employee's Claim for Workers Compensation Benefits."
3. If the victim was a student, completion of the State of California form STD. 268 Accident Report (Other than Motor Vehicle) and contact with the University office of Contracts, Procurement and Risk Management is required.

# 2.00 Federal Diving Standards

## 2.1 Occupational Safety and Health Administration (OSHA) Diving Standards

The Federal Occupational Safety and Health Administration (OSHA) has established diving and diving related support standards for "all types of work and employment" in the Code of Federal Regulations (29 CFR, Subpart T- 'Commercial Diving Operations', § 1910.401). Exempted from these standards are specified scientific and instructional diving operations. The HSU diving program only conducts scientific and instructional diving operations that are exempted from the OSHA Commercial Diving Operation regulations.

### 2.11 Scientific Diving Definition and OSHA Exemption

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.

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

1. The Diving Control Board consists of a majority of active scientific divers and has autonomous and absolute authority over the scientific diving program's operation.
2. The purpose of the project using scientific diving is the advancement of science; therefore, information and data resulting from the project are non-proprietary.
3. The tasks of a scientific diver are those of an observer and data gatherer. Construction and trouble-shooting tasks traditionally associated with commercial diving are not included within scientific diving.
4. Scientific divers, based on the nature of their activities, must use scientific expertise in studying the underwater environment and therefore, are scientists or scientists- in-training.
5. In addition, the scientific diving program shall contain at least the following elements (29CFR1910.401):

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

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

The Code of Federal Regulations (29 CFR 1910.402) defines Scientific Diving 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.”

## 2.12 OSHA Exemption for Instructional Diving

Diving operations “performed solely for instructional purposes using open-circuit, compressed air SCUBA and conducted within the no-decompression limits are exempted from OSHA diving standards,” (29 CFR §1910.401 (2) (I)). All HSU instructional diving operations qualify for exemption from the OSHA Commercial Diving Operation regulations.

# 3.00 Program Administration

## 3.1 Program Authority and Responsibility

As defined in this manual, the Diving Control Board has final responsibility for, and authority within, the HSU Diving Program. The Diving Control Board is organizationally designated as a subcommittee of the HSU Environmental Health and Safety Committee.

## 3.2 Review of Standards

The Diving Safety Officer shall annually review the University diving standards and procedures. Any recommended standards or procedure modifications shall be given to the DCB for their review and approval. Revisions shall be submitted to the CSU Office of the Chancellor and to the AAUS.

## 3.3 The Diving Safety Officer

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

### 3.31 Qualifications

1. Shall be appointed by the responsible administrative officer (Diving Control Board Chair) or his/her designee, with the advice and recommendation of the Diving Control Board.

2. Shall be trained and certified under the standards of AAUS as a Scientific Diver.

3. Shall be a member of the AAUS and meet their standards as a DSO.

4. Shall be certified as an active SCUBA diving instructor from a nationally recognized certifying agency.

### 3.32 Duties and Responsibilities

1. Shall be responsible through the Diving Control Board, to the responsible administrative officer (Diving Control Board Chair) or his/her designee for, and shall have the authority to conduct the HSU Diving Program. The routine operational authority for this program, including training, certification, approval of dive plans maintenance of diving records and ensuring compliance with this manual and all relevant regulations of the University, rests with the Diving Safety Officer.

2. May permit portions of this program to be carried out by a qualified delegate, although the Diving Safety Officer may not delegate responsibility for the safe conduct of the diving program.

3. Shall be guided in the performance of the required duties by the advice of the Diving Control Board, but operational responsibility and authority for the conduct of the diving program will be retained by the Diving Safety Officer.

4. Shall suspend diving operations which he/she considers to be unsafe or unwise.

## 3.4 The Diving Control Board

### 3.41 Qualifications

When administering the Scientific Diving Program, the voting members of the Diving Control Board (DCB) shall consist of a majority of active Scientific Divers. Voting members shall include the Diving Safety Officer, the responsible administrative officer (Diving Control Board Chair) or his/her designee, and should include other representatives of the Diving Program such as qualified divers and members selected by the DCB.

### 3.42 Duties and Responsibilities

When applicable, the DCB may delegate the authority but not the responsibility to the DSO for the following:

1. Has autonomous and absolute authority over the administration of the Diving Program.
2. Shall approve and monitor diving projects.
3. Shall review and revise the Diving Safety Manual.
4. Shall assure compliance with the Manual.
5. Shall certify the depths to which a diver has been trained.
6. Shall take disciplinary action for unsafe practices or violations of standards.
7. Shall assure adherence to the buddy system for SCUBA Diving.
8. Shall act as the official representative of the campus in matters concerning the diving program.
9. Shall act as a board of appeal to consider diver-related problems.
10. Shall issue, reissue, or revoke HSU diving certifications upon the recommendation of the Diving Safety Officer.
11. Shall recommend changes in policy and amendments to the Office of the Chancellor or AAUS concerning diving standards as the need arises.
12. Shall establish and/or approve training programs through which the applicants for certification can satisfy the training requirements of the HSU Diving Safety Manual.
13. Shall suspend diving activities that it considers to be unsafe or unwise.
14. Shall establish criteria for equipment selection and use.
15. Shall recommend new equipment or techniques.
16. Shall establish and/or approve facilities for the inspection and maintenance of diving and associated equipment.
17. Shall ensure that the University air station(s) meet air quality standards as described in this manual.
18. Shall periodically review the Diving Safety Officer's performance and program.
19. Shall sit as a board of investigation to inquire into the circumstances of diving accidents or violations of the HSU Diving Safety Manual.
20. May delegate additional authority and responsibility to the DSO.

## 3.5 Diving Program Instructional Personnel

All HSU diving instruction or training shall be conducted by persons meeting the standards of this manual (Section 5.8). Diving Assistant Instructors, Divemasters and Instructors are considered Leadership Divers (Appendix 15) and diving program instructional personnel.

### 3.51 Qualifications

All personnel involved in diving instruction under the auspices of the HSU shall be qualified for the type of instruction being given. University Diving Instructors shall be certified active status National Association of Underwater Instructors (NAUI) Open Water Instructors.

### 3.52 Selection

The responsible administrative officer or his/her designee, who will solicit the advice and participation of the Diving Control Board in conducting preliminary screening and selection of applicants for Diving Instructor positions, will select instructional personnel.

## 3.6 Lead Diver

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

1. Submission to and approval of an HSU Dive Plan (Section 7.5 and Appendix 11) by the Diving Safety Officer or his/her designee at least three (3) days before planned dives.
2. Safe coordination with other activities or conditions which are likely to affect diving operations.
3. Ensuring all dive team members possess current HSU diver certification and are qualified for the type of diving operation being conducted.
4. Planning dives in accordance with Section 7.00 and all standards of this manual.
5. Ensuring that adequate safety and emergency equipment is fully functional and readily available at the dive site.
6. Ensuring that all divers have the required diving equipment and that the equipment is fully functional and complies with HSU standards.
7. Briefing the dive team members on:
    a. Dive objectives.
    b. Unusual hazards or environmental conditions likely to affect the safety of the diving operation.
    c. Modifications to diving or emergency procedures necessitated by the specific diving operation.
    d. Suspending diving operations if in the Lead Diver's or Dive Team members' opinions conditions are unsafe.
    e. Reporting to the Lead Diver, DSO and Diving Control Board any violation of HSU standards, accidents or near accidents, physical problems, or adverse physiological effects, including symptoms of pressure-related injuries (Sections 1.23 and 1.27).

# 4.00 HSU Diver Certification

The Diving Control Board reserves the right to restrict or deny any application for diver certification or training if in the judgment of the Diving Control Board it is determined that the applicant's safety or the safety of the Dive Team cannot be protected while diving under the auspices of the University.

## 4.1 Required Diver Certification

No person shall engage in diving operations or diver training under the auspices of HSU unless they hold a current HSU diver certification of correct type for the specific type of diving and they are in compliance with all applicable provisions of this manual (Section 5.0).

## 4.2 Types of HSU Diver Certifications

Humboldt State University has three (3) types of diver certifications: University Diver, Scientific Diver, and Diving Instructor.

### 4.21 HSU University Diver Certification (AAUS Scientific Diver In Training designation)

Includes divers conducting recreational, instructional, or training dives under the auspices of the University. Qualification for this certification is a prerequisite for all diving and certifications under HSU auspices.

### 4.22 HSU Scientific Diver Certification

Is required of all persons engaged in Scientific Diving under the auspices of HSU. This certification requires NAUI Master Diver (or equivalent advanced diver experience) certification, additional specialized training as specified in this manual or by the Diving Safety Officer and approval of the Diving Control Board, upon recommendation of the Diving Safety Officer. In addition, the certification is only valid if the diving activity meets the definition of "Scientific Diving," which is diving performed solely as a necessary part of a scientific, research, or educational activity by employees (or students) whose sole purpose for diving is to perform scientific research tasks (Code of Federal Regulations 29 CFR 1910.402).

### 4.23 HSU Diving Instructor Certification

HSU Diving Instructor certification (Section 3.5) is required of all persons conducting diving instruction under the auspices of HSU. It requires that the instructor meet HSU diving standards and be approved by the Diving Control Board.

## 4.3 Visiting Diver Certification Reciprocity

Divers from other organizations or institutions (Visiting Divers) may apply for permission to dive under the auspices of HSU by submitting to the HSU Diving Safety Officer a document containing all the information described in Appendix 8, AAUS Diving Reciprocity, signed by the Diving Safety Officer or Chairperson of the home Diving Control Board. Certification reciprocity shall be for a specified time

period and for a definitive purpose. The HSU Diving Safety Officer shall approve or disapprove requests for Visiting Diver Certification.

### 4.31 Visiting Diver Qualification

Visiting Divers requesting reciprocity certification may be asked to demonstrate their knowledge and skills for the planned dive(s). An example of items that may be demonstrated is presented in Appendix 7, HSU Diver Skills Verification . Prior to any diving under auspices of the University, divers must be evaluated by the HSU Diving Safety Officer or his/her designee to verify compliance with these standards

### 4.32 Joint Diving Operations

Two or more organizations 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.

### 4.33 Denial of Visiting Diver Certification Reciprocity

If a visiting Scientific Diver is denied permission to dive, the Diving Control Board shall notify the visiting Scientific Diver and their Diving Control Board with an explanation of all reasons for the denial.

## 4.4 Temporary University Diver Certification

Requirements of Section 5.10-University Diver Certification may be temporarily waived with the written approval of the Diving Safety Officer if the applicant has demonstrated proficiency in diving and can contribute measurably to a planned dive. A statement of the diver's qualifications shall be submitted to the Diving Safety Officer as a part of the Dive Plan. Temporary certification shall be restricted to the planned diving operation and shall comply with all other policies, regulations and standards of this manual, including medical evaluation requirements. The temporary waiver shall be granted for a specified time.

## 4.5 Revocation of Diver Certification

A diving certificate may be revoked or restricted for cause by the Diving Safety Officer or the Diving Control Board. Violations of standards set forth in this manual or violations of diving related public statutes may be considered cause. The Diving Safety Officer shall inform the diver in writing of the reason(s) for restriction or revocation. The diver will be given the opportunity to present his/her case in writing and in person for consideration by the DCB. All such written statements and requests, as identified in this section, are formal documents that will become a part of the diver's file.

Humboldt State University has a diver certification suspension and revocation procedure, Appendix 9, Procedure for Suspending HSU Diver Certification and Diving Activities.

## 4.6 Diver Re-Certification

If a diver's HSU diver certification expires or is revoked, they may be re-certified after complying with conditions the Diving Safety Officer or the Diving Control Board may impose. The diver shall be given an opportunity to present his/her case to the Diving Control Board before conditions for re-certification are stipulated, Appendix 10, Review and Appeal of HSU Diver Certification Suspension.

# 5.00 HSU Diver Certification Requirements

These requirements apply to all persons either in beginning diver training or previously certified divers seeking HSU University Diver, Scientific Diver or Diving Instructor Certification. Previously certified divers must verify with the Diving Safety Officer or his/her designee that they have met these requirements.

## 5.1 University Diver Certification

These requirements and standards are applicable for all divers under the auspices of the University.

### 5.11 Application

Application for certification shall be submitted to and approved by the Diving Safety Officer. Certification documents shall be kept in the diver's permanent HSU Diver Certification file.

### 5.12 HSU Diver Certification File

Certification forms are found as appendices in this manual or can be procured from the Diving Safety Officer. All certification or training files are subject to review by and are the responsibility of the Diving Safety Officer (Section 8.0). Certification documents in the diver's "HSU Diver Certification File" (file folder shall be a NAUI Student Record Folder or equivalent) shall be:

1. Diver Certification and Training Documentation (Appendix 1)
2. HSU Certification Application (Appendix 2)
3. Diving Medical Fitness Evaluation Report (Appendix 3)
4. HSU and NAUI Waiver, Release and Indemnity Agreement (Appendix 4)
5. Statement of Understanding of HSU Dive Manual (Appendix 5)
6. Diver Emergency Information Card (Appendix 6)
7. Swim Test (Appendix 7))
8. CPR ,First-aid, and DAN Oxygen Provider certificate of training (copies)
9. Minimum SCUBA Skills Verification (Appendix 7)
10. Diver Certification(s) (copies)
11. Equipment Inspection Records (copies)
12. HSU Dive Logs or equivalent for previous 12 months (Appendix 12)
13. All additional required documents and examinations

## 5.2 Approval of Diver Certification Application

Submission of documents and participation in knowledge or skill examinations does not automatically result in certification. Applicants must convince the Diving Safety Officer that they are sufficiently skilled and proficient to dive safely before they receive HSU Diver certification. Any applicant who does not possess the necessary judgment, knowledge or skill required for the safety of the diver and the Dive Team, may be denied HSU diving privileges.

## 5.3 Waiver of Diver Certification Requirements

If an applicant for certification can show evidence of qualifying experience, the Diving Safety Officer and the Diving Control Board may grant a written waiver for specific requirements of training and experience.

## 5.4 Pre -Certification or Pre -Training Evaluation

### 5.41 Medical Examination

An applicant for HSU diver certification shall be certified by a licensed physician to be medically qualified and fit for diving before proceeding with any hyperbaric exposure while breathing compressed gas or engaging in any open water activity. The medical review standards specified in this manual shall be completed (Section 14.00 and Appendix 3). University diving medical evaluation forms must be used and are available from an HSU Diving Instructor, the HSU Dive Manual or the Diving Safety Officer. Periodic medical re-examinations are required to maintain HSU Diver certification (Section 5.9.3).

### 5.42 Swimming Test

The applicant shall successfully perform the following tests, or their equivalent, in the presence of the Diving Safety Officer or an examiner approved by the Diving Safety Officer. A record of the applicant's performance on this test shall be placed in the applicant's permanent HSU Diver Certification file. Swim aids may not be used during the swimming tests.

1. Swim underwater for a distance of 75 feet without surfacing.
2. Swim on the surface 400 yards in less than 12 minutes without swim aids.
3. Tread water for 10 minutes using hands or 2 minutes without the use of hands, or swim aids.
4. Transport (tow) another person of equal size a distance of 75 feet in the water.

## 5.5 Minimum SCUBA Training

These are the minimum training requirements for all persons in diver training or certified for SCUBA diving under the auspices of HSU. The instructor may and is encouraged to expand the training beyond these minimums. A record of the diver's performance on each skill shall be placed in the diver's permanent HSU Diver Certification file.

### 5.51 Confined Water or Pool Training

At the completion of training, the trainee must satisfy the Diving Safety Officer or the HSU Diving Instructor of their ability to perform the following, as a minimum, in a pool or in sheltered water:

1. Enter water with full equipment.
2. Clear facemask of water.
3. Demonstrate air sharing including buddy breathing and the use of alternate air source, as both donor and recipient with and without a facemask.

4. Demonstrate ability to alternate between snorkel and SCUBA while swimming on the surface and with face underwater.
5. Demonstrate understanding of underwater signs and signals.
6. In-water rescue and transport of a diver simulating apnea, including simulated mouth-to-mouth resuscitation.
7. Demonstrate removing and replacing equipment while submerged and at the surface; this is to include mask, fins, weight belt or/and integrated weights and SCUBA tank.
8. Demonstrate competency in use of a buoyancy system.
9. Demonstrate a simulated out-of-air Emergency Swimming Ascent (ESA).
10. Demonstrate watermanship ability and in-water skill that is acceptable to the instructor.

## 5.52 Open Water Evaluation

An applicant must satisfy an instructor approved by the Diving Safety Officer, of their ability to competently perform at least the following skills in open water. The evaluation will be conducted under normal local diving conditions. A record of the applicant's performance on each skill, signed by the instructor and the diver being evaluated, shall be placed in their permanent HSU Diver Certification File.

1. Free Dive (Appendix 15) to a depth of 15 feet in open water without SCUBA.
2. Demonstrate proficiency in air sharing, as both donor and recipient.
3. Enter and leave open water through surf and, if available, leave and board a diving boat or platform while wearing SCUBA gear.
4. Swim on the surface 400 continuous yards while wearing SCUBA gear and breathing only from a snorkel.
5. Successfully complete six (6) open water SCUBA dives; with a minimum total time of four (4) hours in the water and three (3) hours cumulative bottom time on SCUBA. Not more than three (3) training dives shall be made in any one- dive day.
6. Demonstrate the judgment required to dive safely.
7. Demonstrate the ability to maneuver effectively at and below the surface.
8. Complete a simulated Emergency Swimming Ascent.
9. Demonstrate removal, replacement and clearing of mask and regulator while submerged.
10. Navigate effectively underwater and at the surface.
11. Demonstrate ability to achieve and maintain neutral buoyancy while submerged and at the surface, including a 5-minute neutral buoyancy hover at a 15-foot safety stop.
12. Demonstrate techniques of self-rescue and buddy rescue, including simulated in-water mouth-to-mouth resuscitation.
13. Plan and execute a dive.
14. Demonstrate removing and replacing equipment while submerged and at the surface; this is to include mask, weight belt and/or integrated weights and SCUBA tank.

## 5.53 Written Examination

During diver training, the trainee must pass a written examination that demonstrates knowledge of at least the following topics. Copies of written examinations shall be placed in the diver's permanent HSU Diver Certification file.

1. Function, care, use and maintenance of diving equipment.
2. Physics and physiology of diving.

3. Diving regulations and safety precautions.
4. Near-shore currents, waves and tidal affects.
5. Aquatic biological hazards.
6. Emergency management procedures, including: buoyant ascent, buddy breathing, alternate air ascent while air sharing and Emergency Swimming Ascents.
7. Currently accepted no-decompression procedures. The Humboldt State University Exceptional Exposure Correction (EEC) procedure of profiling dives (Appendix 14).
8. Underwater communications.
9. Aspects of fresh water and altitude diving.
10. Hazards of breath-hold dives and ascents.
11. Planning and supervision of diving operations.
12. Diving hazards.
13. Causes, signs and symptoms of, treatment and prevention for:
14. near drowning, air embolism, carbon dioxide excess, squeezes, oxygen poisoning, nitrogen narcosis, exhaustion and panic, respiratory fatigue, motion sickness, decompression sickness, hypothermia, and hypoxia/anoxia.

## 5.6 CPR Certification

The applicant must provide proof of current certification in single and two person cardio- pulmonary resuscitation (CPR). A record of the CPR certification shall be placed in the diver's permanent HSU Diver Certification file.

## 5.7 Scientific Diver Certification

Divers engaged in Scientific Diving (Section 2.1.1) qualify for Scientific Diver certification if they meet the application requirements and receive approval of the Diving Safety Officer. Before certification, the applicant must demonstrate to the satisfaction of the Diving Safety Officer the ability to safely dive as a Scientific Diver under local diving conditions. This is a permit to dive, usable only while it is current and for the purpose intended.

### 5.71 General Policy

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

### 5.72 Application

In addition to completing all the HSU "University Diver" certification application requirements and all other standards in this manual, applicants must verify or complete:

1. NAUI Master Diver certification or an equivalent certification prior to beginning Scientific Diver training.
2. A cumulative minimum time of one hundred (100) hours training beyond NAUI Master Diver certification training in the theoretical and practical aspects of Scientific Diving. This training may include: Underwater data and collecting techniques, identification and behavior of

common biota, installation of scientific apparatus, use of chemicals, site selection and relocation, aquatic ecology, tagging, photography, scientific dive planning, knowledge of current diving technology, coordination with other agencies, appropriate governmental regulations and small boat operations.

3. Practical training during Scientific Diver training shall include at least twelve (12) supervised ocean or open water dives in a variety of dive sites and diving conditions with a minimum cumulative bottom time of six(6) hours. No more than three (3) of these dives shall be made in one (1) day. These dives are made after the Master Diver certification.
4. Successful completion of examinations and skill testing approved by the Diving Safety Officer.
5. Open water and pool checkout dives, including emergency procedures.
6. Copy of current two person CPR, DAN Oxygen Provider and first-aid certifications or equivalent proof-of-training documentation.

## 5.8 University Diving Instructor

The Diving Control Board shall approve this certification upon recommendation of the Diving Safety Officer. This certification is required prior to presenting or supervising any diver training related activities under HSU auspices as the Lead Diver. All personnel involved in diving instruction under auspices of HSU shall be qualified for the type of instruction being given.

### 5.81 Application

In addition to completing all the HSU "University Diver" certification application requirements and all applicable standards in this manual, the Diving Control Board may require a confined (pool) water and open water demonstration of diving and instructional skills by the applicant. The Diving Safety Officer will observe or conduct this skills demonstration and evaluate the applicant's performance for the Diving Control Board. The Diving Control Board may also require the applicant to pass (>75%) a written examination to verify instructional and diving knowledge. Applicants must submit to the Diving Control Board:

1. Copy of a current active status NAUI Open Water SCUBA Instructor certification.
2. Copies of current two person CPR, DAN Oxygen Provider and First-Aid certificates of training.
3. A written statement of educational, employment and diving experience.
4. All required HSU employment statements and forms.

## 5.9 Continuation of University Diver, Scientific Diver and Instructor Certification

### 5.91 Term of HSU Diver Certification

All diving certification shall expire:

1. One (1) year from the date of issuance.
2. Six (6) months from the date of the last logged open water dive.
3. Upon expiration of required certifications or examinations.

## 5.92 Renewal of HSU Diver Certification

The Diving Safety Officer will renew HSU diver certifications if the applicants for renewal have fully complied with the standards of this manual.

## 5.93 Minimum Required Dives to Maintain HSU Diver Certification

During any 12-month period, each certified HSU diver must make a minimum of twelve (12) open water dives under HSU auspices and have submitted HSU Dive Logs for these dives. At least one dive must be logged near the maximum depth of the diver's certification during each 6-month period. Divers certified to 150 feet or over may satisfy these requirements with dives to 130 feet or over. Failure to meet the above requirements may be cause for revocation or restriction of certification.

## 5.94 DCB Waiver of Standards to Maintain HSU Diver Certification

The Diving Control Board may grant a waiver for specific requirements of training, examinations, depth certification, and minimum activity to maintain certification. Waiver requests shall be made in writing to the DCB and the Board shall make a written response to the request within ten (10) working days. The medical evaluation of fitness to dive, as described in Section 14, shall not be waived

## 5.95 Required Periodic Medical Re-Examination

All University divers shall pass a periodic medical re-examination, Section 14.20. After each major illness or injury as described in Section 14.30, an HSU certified diver shall submit to a medical interview or examination before resuming diving activities and submit the documents specified in Section 14.00.

1. Medical re-examination is required every five (5) years for those up to age 40.
2. Medical re-examination is required every three years (3) for those over age 40 but less than age 60.
3. Medical re-examination is required every two years (2) for those over age 60.

## 5.96 Required Annual Diving Instructional Personnel Training

All HSU diving instructional personnel (Appendix 15, Leadership Divers) shall attend an annual staff training conducted by the Diving Safety Officer. This annual training is required for HSU certified divers to qualify as Leadership Divers under the auspices of the University.

# 6.00 Diving Standards

## 6.1 Approval to Dive

No person shall engage in diving operations, hyperbaric exposure, diver and equipment testing or diver training under auspices of the HSU unless they have a current HSU Diver certification and are in compliance with all applicable provisions of this manual. Prior to all dives a HSU Dive Plan must submitted to and approved by the Diving Safety Officer (Section 3.60).

## 6.2 Specific Prohibited Activities

1. Smoking is prohibited at the dive location or during any diving related activity under the auspices of HSU.
2. Consumption of alcohol or being under-the-influence of alcohol is prohibited during any activity under the auspices of HSU.
3. Use of or being under-the-influence of any medications, drugs or controlled substances is prohibited during any diving related activity under the auspices of the HSU unless approved by a Diving Instructor and/or the Diving Safety Officer.
4. Except in an emergency, Dive Team members shall not leave the dive site or location without the approval of the Lead Diver or Diving Instructor.

## 6.3 Solo Diving Prohibition ("Buddy System" Required)

All diving conducted under auspices of the HSU shall be planned and executed in such a manner as to ensure that every diver maintains constant, effective communication with at least one certified and comparably equipped diver. This buddy system is based upon mutual assistance, especially in the case of an emergency. A diver shall not dive if they are not capable of rendering assistance to their dive buddy in the event of an emergency. If loss of effective communication occurs within a Dive Team, all divers shall surface as soon as it is safe to do so and re-establish contact within the Dive Team. Non-Hookah surface supplied diving is exempted from the requirements of this section (Section 10.20). Instructors are considered to be in compliance with this section while they conduct training and are supervising divers. Free Divers shall dive in buddy teams, but only one diver shall dive at a time (Section 9.60).

## 6.4 Diving in Enclosed, Overhead or Confined Spaces

If an underwater space is not large enough for two divers, a diver shall remain at the point of entry and in contact with the diver entering the confined space. All divers entering this space shall stay in visual or physical contact with an orientation line leading to an exit or back to the point of entry. This type of diving protocol requires the approval of the Diving Safety Officer. Diving in any overhead environments, such as caves, caverns or structures that restrict direct access to the surface, is prohibited unless approved by the Diving Safety Officer. This section does not apply to diving in kelp.

## 6.5 Termination of Dive

Any diver shall terminate a dive without fear of penalty whenever he/she believes it is unsafe to continue the dive. The termination of a dive shall not compromise the safety of any diver already in the water. The dive shall be terminated while there is still sufficient tank pressure or volume of gas to permit the diver to safely reach the surface including decompression time or to safely reach an additional air source at a decompression station.

## 6.6 Refusal to Dive

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

## 6.7 Emergencies and Deviations from Standards

Any diver may deviate from the requirements of this standard to the extent necessary to prevent or minimize a situation that is likely to cause death, serious physical harm, or major environmental damage. A diver deviating from the HSU diving standards or procedures shall submit a written report to the Diving Safety Officer within five (5) working days of the event explaining the circumstances and justifications for the deviations.
In addition:

1. The diver(s) deviating from these standards shall immediately notify the Lead Diver or Instructor and the Diving Safety Officer. In no event shall this notification be delayed more than 48 hours.
2. The Lead Diver or Instructor shall submit a written report to the Diving Safety Officer within 72 hours of when they become aware of the standards violation.
3. The Diving Safety Officer shall report violations of standards to the Diving Control Board after receiving the written reports concerning the violations. The Diving Safety Officer's report will include a synopsis of the  of events, copies of the written reports and recommended action to be taken in response to the violation of standards.

## 6.8 Minimum SCUBA Tank Pressure (500 pounds per square inch/psi)

Except for emergency reasons or to protect the safety of a diver, the minimum tank pressure at the termination of the dive shall be 500 psi. If tank pressure drops below 500 psi the Instructor or Lead Diver and Diving Safety Officer shall be notified.

## 6.9 Dive Flag

An appropriate dive flag shall be prominently displayed whenever diving is conducted under circumstances where required or where water traffic is probable. Use of a dive flag is recommended to increase the visibility of the surface floatation and to facilitate locating the Dive Team.

## 6.10 Flotation Devices

All divers, except Free Divers, are required to wear a Buoyancy Compensation Device (BCD) independent of the exposure suit. Free Diver floatation requirements are described in Section 9.20. Prior to use, the Diving Safety Officer or his/her designee shall approve the BCD and floatation device. All Buoyancy Compensation Devices must have a mechanical/power inflation system that the diver can activate with one hand, an automatic over-pressurization valve and a manually operated dump valve that can exhaust the gas from the flotation bag faster than the mechanical/ power inflator can inflate the bag.

## 6.11 Timing Devices, Depth Gauges and Tank Pressure Gauges

Each diver must have an underwater time-keeping device, a depth gauge and a submersible tank pressure gauge. This standard is not applicable to Free Divers.

## 6.12 Deep Diving

Dives in excess of 60 feet of sea water (fsw) must be planned and performed with the Diving Safety Officer or his/her designee in attendance. The divers must demonstrate, through written examination and skill evaluation, satisfactory knowledge of the special problems and safety requirements of deep diving. Prior to deep diving the DSO or his/her designee shall evaluate each Dive Team member's knowledge and in-water abilities to confirm that they are prepared to safely dive to the planned depth of the dive.

## 6.13 Dive Profiling

Appropriate Dive Profiling Tables shall be used for profiling SCUBA or Surface-Supplied dives using air as the breathing gas. Decompression dives require approval of the Diving Safety Officer and a surface interval in excess of twenty-four (24) hours is required following a decompression dive (Section 17.00).

## 6.14 Dive Tables (Not Applicable to Free Divers)

Appropriate dive profiling tables must be available at the dive location. In addition, each diver using air as the breathing gas shall carry the current NAUI (National Association of Underwater Instructors) dive tables on all dives. These tables shall be at least as safe as the United States Navy Diving Tables. If the breathing gas is not air, only dive tables that are appropriate for the breathing gas used and have been approved by the Diving Safety Officer shall be used. All dive tables must be approved by the Diving Safety Officer before they can be used to profile dives under the auspices of the University.

### *Altitude Tables*

All dives made above 1,000 feet above sea level (ABSL), or, if the diver will go above 1,000 ABSL within 24 hours after surfacing from the last dive or hyperbaric exposure, will be profiled using the Sea Level Equivalent Depth (SLED) Table 4.1 in the National Oceanic and Atmospheric Administration Diving Manual.

### *Arrival at Altitude Tables*

Appropriate "Arrival at Altitude" dive tables (Pressure Variations With Altitude, Table 4.2 in the National Oceanic and Atmospheric Administration Diving Manual) will be used to determine the diver's residual nitrogen level when the diver ascends above 1,000 ABSL and dives within 24 hours of arrival at altitude.

## 6.15 Diving Depth Certification

Humboldt State University diver certifications (except Free Divers) shall specify the maximum dive depth that the holder of the certification is authorized to dive. The certificate must bear the signature of the Diving Safety Officer or his/her designee.

### *Depth Certification Limits*

A diver under the auspices of HSU shall not dive to a depth that exceeds their depth certification, except under the following conditions:

1. Dives shall be planned and executed under close supervision of a diver certified to this depth, with the knowledge and permission of the DSO.

### *Maximum Dive Depth Certification Levels*

Regardless of the diving mode, all divers breathing compressed gas and diving under HSU auspices shall adhere to HSU maximum dive depth certification level qualifications. A certified diver diving under the auspices may progress to the next depth level after successfully completing the required dives for the next level.

1. Certification to 30 Foot Depth - Initial permit level, approved upon the successful completion of training required for "University Diver" Certification.
2. Certification to 60 Foot Depth - A diver holding a 30 foot certificate may be certified to a depth of 60 feet after successfully completing, under supervision, 12 logged training dives to depths between 31 and 60 feet, for a minimum total time of 4 hours.
3. Certification to 100 Foot Depth - A diver holding a 60 foot certificate may be certified to a depth of 100 feet after successfully completing, 4 dives to depths between 61 and 100 feet. The diver shall also demonstrate proficiency in the use of the appropriate Dive Tables.
4. Certification to 130 Foot Depth - A diver holding a 100 foot certificate may be certified to a depth of 130 feet after successfully completing, 4 dives to depths between 100 and130 feet. The diver shall also demonstrate proficiency in the use of the appropriate Dive Tables.
5. Certification to 150 Foot Depth - A diver holding a 130 foot certificate may be certified to a depth of 150 feet after successfully completing, 4 dives to depths between 130 and 150 feet. The diver must also demonstrate knowledge of the special problems of deep diving, and of special safety requirements.
6. Certification to 190 Foot Depth - A diver holding a 150 foot certificate may be certified to a depth of 190 feet after successfully completing, 4 dives to depths between 150 and 190 feet. The diver must also demonstrate knowledge of the special problems of deep diving, and of special safety requirements.

Diving on air is not permitted beyond a depth of 190 feet.

### *Re-Qualification of Depth Certification*

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

## 6.16 Collecting and Hunting

Dive Team members may not hunt any animals or remove plants, artifacts or substrate without the permission of the Diving Safety Officer, Lead Diver or their designee. All applicable laws, regulations or statutes shall be complied with during any hunting or collecting activities. Resource conservation and minimum impact on the environment shall always be considered.

### *Collecting*

Collecting is only permitted if the persons collecting have valid collecting permits and the restrictions of the permit are followed or if collection is otherwise permitted by law.

### *Hunting*

Hunting by Dive Team members requires specialized training, close supervision and approval of the Lead Diver, Diving Instructor or Diving Safety Officer.

1. Never attach game to a diver.
2. Never have a “loaded” (cocked) speargun out of the water.
3. Never let a spear point at another person, whether it is in or out of the gun.
4. Never shoot a spear shaft beyond the limit of visibility.
5. Spear tip protectors are required out of the water and when entering or leaving the water.
6. Do not leave collected game in the water while diving (abalone are an exception).
7. Use only breakaway links or quick disconnects to attach equipment to divers.

# 7.00 Diving Procedures

Adherence to these diving procedures is required during any diving related activity under HSU auspices. Dives should be planned to accommodate the competency of the least experienced or least trained diver.

## 7.1 Individual Responsibility

The responsibilities of the Lead Diver does not relieve a Dive Team member from their individual responsibility for the adequacy of their own preparation, compliance with standards and assuring for their personal safety before, during, and, after the dive.

## 7.2 Lead Diver Supervision

The Lead Diver shall be responsible to:

1. File and have approved an HSU Dive Plan (Section 7.5).
2. Coordinate with other known activities in the vicinity that may affect diving operations.
3. Verify the Dive Team qualifications.
4. Conduct the dive planning.
5. Brief and De-brief the Dive Team.
6. Assure adequacy of equipment.
7. Conduct the Pre-and Post-Dive Safety checks.
8. Assure compliance by Dive Team with all HSU standards.
9. Assure submission of required HSU Dive Logs (Section 8.3).
10. Assure return of all HSU equipment used by the Dive Team.
11. Assure that divers making an uncontrolled ascent, emergency ascent or exceeding the no-decompression diving limits comply with Section 7.9 and remain at the surface for a minimum of 60 minutes under the observation of another diver capable of providing transportation, CPR and oxygen ventilation. Further diving will be suspended until approved by the Lead Diver. The Lead Diver and involved Dive Team divers will submit a written report of the incident to the Diving Safety Officer.

## 7.3 Dive Team Qualifications

Each diver shall be trained, certified and qualified for the diving mode being used (Section 4.0). Each Dive Team member shall have the following minimum experience and training for:

1. The correct use of the instruments and equipment appropriate for the planned diving.
2. Dive planning and emergency procedures.
3. Current training in cardio-pulmonary resuscitation, DAN Oxygen Provider and diving-related first aid.
4. Dive Team members who are exposed to or control the exposure of others to hyperbaric conditions shall be trained in diving-related physics and physiology and recognition of pressure-related injuries.
5. Each diver shall be competent to safely dive under existing conditions.

## 7.4 Dive Planning

Dives should be planned around the competency of the least experienced diver. Before conducting any diving operations under the auspices, the lead diver for a proposed operation must formulate a dive plan that should include at the minimum considerations of the health and safety of the following:

1. Diving mode.
2. Surface and underwater conditions and hazards.
3. Quality and quantity of breathing gas supply.
4. Thermal protection.
5. Diving equipment.
6. Dive team assignments.
7. Residual inert gas status of dive team members.
8. Decompression schedules and altitude corrections.
9. Emergency procedures: Diving shall not be conducted unless procedures have been established for rescue of the Dive Team and emergency evacuation of the diver(s) to a hyperbaric chamber or appropriate medical facility. As part of the HSU Dive Plan (Sections 7.5, 15.10, Appendices 11 and 13) an Accident Management Plan for the dive site must be submitted to and approved by the Diving Safety Officer prior to any dives.

## 7.5 Dive Plans

Prior to any diving operations, the Lead Diver shall have an approved HSU Dive Plan (Section 3.6.1) HSU Dive Plans must be submitted to and approved by the Diving Safety Officer three (3) days prior to any dives (Appendix 11, HSU Dive Plan). Humboldt State University Dive Plan forms are available from the Diving Safety Officer. The HSU Dive Plan shall contain at the minimum the following information:

1) The qualifications and certifications of dive team members.
2) Emergency information for each dive team member, HSU Diver Emergency
3) Information Card (Appendix 6), including:
    a) Name, address, phone number and relationship of person to be notified in event of an emergency.
    b) Name and phone number of personal physician.
    c) Signed permission to be treated in a recompression chamber, in the event a Dive Team member is incapacitated and unable to give permission for treatment.
    d) Pertinent medical information or advisories.
4) Number of proposed dives.
5) Locations of proposed dives.
6) Depths and bottom times of dives.
7) Proposed work, equipment and boats to be employed, repetitive dive planning and any anticipated unusual or hazardous conditions.
8) A current Accident Management Plan for the location(s) to be dived.

## 7.6 Dive Briefing

The Lead Diver shall, at a minimum, brief the Dive Team members on:
Dive objectives.

1. Each element of the HSU Dive Plan.

2. Any unusual hazards or environmental conditions likely to affect the safety of the diving operation.
3. Any modifications to diving or emergency procedures necessitated by the specific diving operation.
4. Review physiological and psychological status of Dive Team. No Dive Team member shall engage in the diving operation if that member has any physical or psychological condition that can adversely affect the health or safety of any Dive Team member.
5. Requirement of all Dive Team members to immediately report any injuries, physical problems, and adverse physiological effects attributed to pressure-related exposure or the diving operations and any violations of these standards to the Lead Diver and Diving Safety Officer.
6. Review emergency procedures.
7. Establish depth and bottom time limitations and minimum breathing gas volume/pressure limits for each diver.

## 7.7 Equipment Requirements

Each diver is responsible for having all equipment required by these standards and all equipment shall be fully functional (Section 11). Each diver shall have the capability of achieving and maintaining positive buoyancy. All removable equipment will be secured to the diver with quick releases or breakaway devices.

## 7.8 Pre -Dive Safety Checks

Diver's Responsibility:

1. Each diver shall conduct a functional check of his or her diving equipment in the presence of the diving buddy or tender.
2. It is the diver's responsibility and duty to refuse to dive if conditions are unfavorable or if they would be violating the precepts of their training or of this manual.
3. No dive team member is required to be exposed to hyperbaric conditions unless directed by legal authorities for the prevention or treatment of a pressure related injury.
4. No dive team member shall be permitted to dive for the duration of any known condition or deficiency that is likely to adversely affect the health and safety of the diver or other Dive Team members.
5. Divers shall have sufficient breathing gas for the planned dive and to permit the diver to safely reach the surface including decompression stops and maintain the minimum tank pressure of 500 psi.

## 7.9 Post-Dive Safety Checks

Immediately after each dive, the dive team members shall report any physical problems, symptoms of pressure-related injuries, operational problems, equipment deficiencies or malfunctions and standards violations to the Lead Diver.

Divers exceeding the no-decompression limits, making an uncontrolled or emergency ascent shall remain at the surface and awake for at least sixty (60) minutes after diving and under continuous observation by a person who is prepared to transport or arrange transportation of the divers to an advanced life support facility or suitable hyperbaric treatment chamber and provide CPR and 100 %

oxygen ventilation if necessary. These divers may not dive for a minimum of 24 hours after surfacing. See Section 7.2.

The Lead Diver shall confirm the tissue gas status of each diver and, if required, restrict the diver's post-dive activities or repetitive dives based upon that gas status.

### 7.91 Flying After Diving

HSU Divers shall not fly for 24 hours after surfacing from their last dive or hyperbaric exposure. This does not apply to Free Dives.

## 7.10 Use of Dive Computers

Dive computers may be allowed in lieu of using dive tables for dive profiling if authorized by the Diving Safety Officer and if these standards are followed.

1. A diver shall not use both a computer and dive tables to profile dives within a 24-hour period.
2. Only those makes and models of dive computers specifically approved by the Diving
3. Safety Officer, or his/her designee, may be used.
4. Any diver desiring to use dive computers must apply to the Diving Safety Officer or his/her designee, for training, and a written test to demonstrate understanding and proficiency in the use of the specific computer to be used.
5. Divers relying on a dive computer to plan or profile a dive must use only their dive computer.
6. Divers in a Dive Team must follow the dive profiling required by the most conservative (shortest bottom time, shallowest maximum depth, longest safety/ decompression stops and slowest ascent rate) computer in use.
7. If a dive computer fails or malfunctions at any time during a dive, the dive must be terminated, and appropriate surfacing procedures must immediately be initiated.
8. If the dive computer fails, further diving is prohibited for at least 24 hours after surfacing from the last dive.
9. A dive computer may not be initialized and used as the primary means to plan dives or determine decompression status by a diver who has made any dives or has been above 1,000 feet above sea level (ABSL) within the past 24 hours.
10. Once a dive computer is in use, it may not be turned off until it indicates complete outgassing, or 24 hours have elapsed since the last dive, whichever comes first.
11. When using a dive computer, all non-emergency ascents should be made in accordance with the manufacturer's recommendation for that unit.
12. When using a dive computer, non-emergency ascents are to be at a rate specified for the make and model of dive computer being used.
13. Divers shall make a stop at 15 feet for 5 minutes when the dive is deeper than 30 feet and on all repetitive dives.
14. When possible the deepest dives should be made first, with subsequent dives getting progressively shallower. Multiple deep dives (> 60 feet) require special planning and approval.
15. All manufacturers' recommendations for dive computer usage shall be followed. If manufacturer's recommendations conflict with HSU standards, the Diving Safety officer must pre-approve any non-emergency deviations from the University diving standards.

# 8.00 Records and Documentation

All required HSU documents and forms may be acquired from the Diving Safety Officer. The Diving Safety Officer is responsible for retention of all records mandated by these standards and shall have access, unless otherwise prohibited, to all records of diving related activities under HSU auspices.

## 8.1 HSU Diver Certification File

The Diving Safety Officer or his/her designee shall maintain records for each certified HSU diver. The file shall include evidence of certification, log sheets, results of current physical examination, waiver, reports of disciplinary actions by the campus Diving Control Board and other documentation required by HSU standards. Each file will contain the HSU Diver Certification & Training Documentation Form.

### 8.11 Medical Records

Medical records shall be available to an attending physician of a diver or former diver when released in writing by the diver.

## 8.2 Records Retention and Availability

The University shall retain records and documents required by these standards for the following minimum periods, and as required by the CSU Records/Information Retention and Disposition Schedules:

1. Physician's written reports of medical examinations for Dive Team members - 5 years .
2. Diving Safety Manual - current document only.
3. Dive Log - 1 year, except 5 years where there has been an incident of pressure related injury.
4. Pressure-related injury report - 5 years.
5. Equipment inspection and testing records - current entry or tag, or until equipment is withdrawn from service.
6. Records of hospitalization - 5 years .

## 8.3 HSU Dive Logs

Each dive made under the auspices of the University shall be documented on the HSU Dive Log (Appendix 12). These standardized logs can be copied from this manual or procured from the DSO.

1. Divers shall log each open water dive. Open water dives include all SCUBA, Surface Supplied and Free Dives.
2. The back of the HSU Dive Log can be used for additional dive information.
3. Each diver shall submit completed HSU Dive Logs to the Diving Safety Officer or his/her designee within seven (7) days after the date of the last dive on the log. Completed HSU Dive Logs shall be placed in the diver’s HSU Diver Certification file.

### 8.31 Minimum Required Dive Log Information

1. Names of diver, Dive Team and Lead Diver.
2. Date, time, and location.

3. Diving modes used.
4. Description of diving activities.
5. Underwater and surface conditions.
6. Maximum depths, bottom time, and surface interval
7. Mixed gas profile, if applicable.
8. Dive tables or dive computer used.
9. Detailed report of any incident or potentially dangerous incident.

## 8.4 Required Accident Reporting

The Diving Safety Officer shall assure the completion and filing of the following specified accident or incident reports for reportable Diving Program events under the auspices of HSU. All diving related accidents or incidents occurring while under the auspices of the University must immediately be reported to the Diving Safety Officer by the Lead Diver and the affected members of the Dive Team. Written summaries of the events will be completed by witnessing or involved members of the Dive Team and submitted to the Diving Safety Officer within 24 hours of the accident or incident.

### 8.41 Pressure Related Injuries

If the signs and/or symptoms of a pressure related injury are present and an injury is suspected, the following additional information shall be recorded and retained with the HSU Dive Log for a period of five (5) years (Section 8.2):
Written descriptive report to include:

1. Name, address, phone numbers of the principal parties involved.
2. Summary of experience of divers involved.
3. Location, description of dive site, and description of conditions that led up to incident.
4. Description of symptoms, including depth and time of onset.
5. Description and results of treatment.
6. Disposition of case.
7. Recommendations to avoid repetition of incident.

### 8.42 Unconsciousness, Hospitalization or Recompression

A written summary specifying the circumstances of a diving related incident and the extent of any injuries or illness to a Dive Team member is required following:

1. Treatment by a physician or at a hospital.
2. Any period of unconsciousness.
3. Treatment in a recompression chamber.

# 9.00 Free Diving

Free Diving (breath-hold diving deeper than 1 meter) requires specialized training and equipment in addition to any other diver training. The Diving Safety Officer, or his/her designee, shall review and approve proposed Free Diving activities and instruction. Unless otherwise specified, all standards of this manual shall apply to Free Diving and Free Divers.

## 9.1 Medical Fitness Evaluation

All the medical evaluation standards of this manual apply, except for a restricted medical clearance for Free Diving activity conducted solely in a swimming pool. This exception only applies to Free Diving.

### 9.11 Restricted Medical Clearance for Swimming Pool-Only Free Diving

If a diver's only in-water activity is Free Diving in a swimming pool, they may participate in swimming pool-only Free Diving if they complete the Medical Evaluation Report of Fitness for SCUBA, Surface-Supplied and Free Diving (Appendix 3) and receive approval from a physician that allows Free Diving only in a swimming pool. This restricted, pool-only, medical approval does not apply to any form of diving while breathing compressed gas.

## 9.2 Required Surface Flotation

Each Free Diver when diving in open water shall have a Buoyancy Compensation Device (BCD) or surface float capable of supporting the diver, equipment and game at the surface. Floats or BCDs (if not worn) must have an anchoring or retention system, a dive flag when required and should have an emergency whistle.

## 9.3 Minimum Required Free Diver Equipment

Each Free Diver when diving in open water shall have:

1. Mask/fins/snorkel.
2. Weight belt (as required) w/right hand quick release.
3. Thermal protection (as required).
4. Surface flotation.
5. Dive knife or cutting device.
6. Emergency signaling whistle.

## 9.4 Free Diver Neutral Buoyancy

Free Divers shall be neutrally buoyant at 10fsw or deeper. All Free Divers will be positively buoyant when they are at a depth of less than 10fsw.

## 9.5 Method of Equipment Attachment

All equipment carried or attached to a Free Diver shall have a quick release or weak link to preclude equipment caused restraint, entanglement or entrapment of the diver.

## 9.6 Free Dives by Dive Team

Dive Team members shall only Free Dive one at a time. Non-diving team members shall remain at the surface and in a position to render assistance to the Free Diver making the dive.

## 9.7 Exemption to Free Diving Standards

Persons enrolled in non-diver aquatics training at the University may conduct Free Diving activities in the pool incidental to that training and are exempt from the standards of this manual. However, at a minimum, students should receive training in the causes, prevention and treatment of barotraumas, shallow-water blackout and near drowning. This exemption does not apply to any open water diving or diver training classes in either confined or open water.

# 10.00 Surface Supplied Diving

Surface Supplied Diving is when a diver is supplied compressed breathing gas from the surface.

## 10.1 HOOKAH Diving (Surface supplied SCUBA regulator)

HOOKAH divers shall comply with all SCUBA Diving procedures in this manual and shall not exceed depths of 190 fsw. Each HOOKAH diver shall:

1. Carry a reserve breathing gas supply appropriate for the planned dive.
2. Be hose tended by a Dive Team member trained as a tender.
3. Have a HOOKAH breathing gas supply (non-reserve) sufficient for the planned dive; including decompression or safety stops.

## 10.2 Non-HOOKAH Surface Supplied Diving

Non-HOOKAH surface supplied divers shall comply with all SCUBA diving procedures in this manual. Each non-HOOKAH Surface Supplied diver shall:

1. Carry a reserve breathing gas supply appropriate for the planned dive.
2. Be hose tended by a Dive Team member trained as a tender.
3. Have a breathing gas supply (non-reserve) that is sufficient for the planned dive including decompression stops.
4. Maintain voice communications with the surface tender.

### 10.21 Non-HOOKAH Solo Diving: Standby Safety Diver

When the only Dive Team member in the water is a Non-HOOKAH Surface Supplied Diver or if the surface supplied diver is not in communications with other divers in the water, a standby diver capable of assisting the diver in the water must be at the dive site, standing by the tender and ready to dive.

# 11.00 Diving Equipment

All equipment shall meet standards as determined by the Diving Safety Officer or the Diving Control Board. The DCB delegates the approval of makes and models of equipment required in this section to the DSO or his/her designee.

## 11.1 Equipment Inspections

All inspections, tests and maintenance required in this manual must be accomplished by a technician or facility approved by the Diving Safety Officer or Diving Control Board. Equipment that is subjected to extreme usage or adverse conditions may require more frequent testing and maintenance than specified in these standards. The person using the equipment has the ultimate responsibility for assuring that it is fully functional and meets all University and manufacturer standards.

### 11.11 Diver Inspection of Equipment

In addition to testing required in this manual, all equipment shall be regularly inspected and functionally checked before use by the person using the equipment.

### 11.12 Record Keeping

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

1. Air filtration systems
2. Gas control panels
3. Air storage cylinders
4. Regulators Analytical instruments
5. SCUBA tanks
6. Compressors
7. Submersible breathing masks
8. Computers
9. Submersible pressure gauges Depth gauges
10. Tank valves
11. Diving helmets

## 11.2 SCUBA Regulators

### 11.21 Approval

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

### 11.22 Inspection and Testing

SCUBA regulators shall be inspected and tested prior to the first use and every twelve (12) months thereafter

### 11.23 Alternate Air - Octopus Regulator

All regulators will have an alternate air second stage regulator that is independent of the BCD inflator, located on the diver's right side. These regulators must be clearly visible, easily accessible and attached with a quick release in the diver's chest area. Use of other alternate air or redundant air sources requires the approval of the Diving Safety Officer.

### 11.24 Submersible Pressure Gauge

All regulators attached to a tank will have a submersible tank pressure gauge. Gauges shall be inspected and tested before first use and every 12 months thereafter.

### 11.25 Low Pressure Inflator Hose

All regulators will have a low pressure inflator hoses for inflation of the diver's flotation device and, if applicable, dry suit. The inflator hoses shall have a quick disconnect device at the point of attachment to the flotation device or dry suit.

## 11.3 SCUBA Tanks

Compressed gas cylinders shall be designed, constructed and maintained in accordance with the applicable provisions of the applicable Unfired Pressure Safety Vessel Safety Orders (Title I of CAC).

### 11.31 Hydrostatic Testing

SCUBA cylinders must by hydrostatically tested every 5 years in accordance with United States Department of Transportation (DOT) standards.

### 11.32 Visual Inspection

SCUBA cylinders must have an internal and external inspection at intervals not to exceed twelve (12) months.

### 11.33 Tank Valve Testing

SCUBA cylinder valves shall be functionally tested at intervals not to exceed twelve (12) months.

## 11.4 Timing Devices, Depth and Pressure Gauges

Both members of the buddy team must have an underwater timing device, an approved depth indicator, and a submersible pressure gauge. All timing devices and gauges shall be inspected and tested before first use and every twelve (12) months thereafter.

## 11.5 Weight Systems and SCUBA Backpack or Jacket Releases

Weight systems and SCUBA backpacks or jackets shall be equipped with quick release devices designed to permit rapid jettisoning of the equipment. The quick release device must operate easily with a single

motion from either hand. All divers must be capable of replacing unintentionally released weights, or, other equipment, underwater without assistance from another diver.

### 11.51 Weight Belt Releases

Weight belts shall have a right hand release (releasing in the direction of the diver's right side).

### 11.52 Integrated weight systems in Buoyancy Compensators

Divers shall have no more than one third of their total weight in the quick ditch mechanisms, or designated weight pockets of the BCD. For example if a diver wears 30 pounds of weight, only 10 pounds may be in the BCD. The remaining two thirds of the required weight should be on a belt that can be ditched by a single motion of either hand. Deviations from this standard require specific approval from the DSO.

## 11.6 Flotation Devices

Each diver shall have the capability of achieving and maintaining neutral, positive and negative buoyancy. A dry suit does not meet this requirement. Free Divers do not have to become negatively buoyant.

### 11.61 Exhaust Valves

Personal flotation systems, buoyancy compensators, dry suits, or other variable volume buoyancy compensation devices, shall be equipped with an exhaust valve that can exhaust gas faster than the power inflator can inflate the device. Exhaust valves must function when diver is in a horizontal, prone position.

### 11.62 Over Pressurization Valves

Personal flotation systems must have an automatic over pressurization relief valve.

### 11.63 Inspection

These devices shall be functionally inspected and tested at intervals not to exceed twelve (12) months.

## 11.7 Breathing Masks and Helmets

Breathing masks and helmets shall have:

1. A non-return valve at the attachment point between helmet or mask and breathing gas hose, which shall close readily and positively.
2. An exhaust valve.
3. A minimum ventilation rate capable of maintaining the diver at the depth to which they are diving.
4.

## 11.8 Underwater Power Tools

1. Hand-held power tools and equipment used underwater shall be specifically designed for this purpose and approved by the Diving Safety Officer.

2. Hand-held power tools and equipment supplied with power from the surface shall be de-energized before being placed into or retrieved from the water.
3. Hand-held power tools shall not be supplied with power from the dive location until requested by the diver.

## 11.9 Dive Knife

Divers must carry a readily accessible dive knife or cutting device.

# 12.00 Air Quality Standards

Breathing air for SCUBA and other diving modes utilizing compressed air shall meet the following specifications as set forth in the Compressed Gas Association (CGA) Pamphlet G-7.1 and referenced in OSHA 29 CFR 1910.134. The current minimum standard is “Grade E”.

## 12.1 CGA Grade E Air

| CGA Grade E | |
|---|---|
| **Component** | **Maximum** |
| Oxygen | 20 - 22%/v |
| Carbon Monoxide | 10 PPM/v |
| Carbon Dioxide | 1000 PPM/v |
| Condensed Hydrocarbons | 5 mg/m3 |
| Total Hydrocarbons as Methane | 25 PPM/v |
| Water Vapor ppm | (2) |
| Objectionable Odors | None |

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

# 13.00 Compressor Systems

All compressors used in a diving operation, either mobile or fixed and used under the auspices of HSU must meet the standards specified in this manual.

## 13.1 Design and Location of Compressor

1. Low pressure compressors used to supply air to the diver shall be equipped with a volume tank with a check valve on the inlet side, a pressure gauge, a relief valve, and a drain valve.
2. Compressed air systems over 500 psig (pounds per square inch gauge) shall have slow-opening shut-off valves.
3. All air compressor intakes shall be located away from areas containing combustion exhaust or airborne contaminants.

## 13.2 Compressor Operation and Air Test Records

1. Gas analyses and air tests shall be performed on breathing air compressor at regular intervals of no more than 100 hours of operation or six months, whichever occurs first. The results of these tests shall be retained for one (1) year.
2. A log shall be maintained showing operation, repair, overhaul and filter maintenance temperature adjustment for each compressor.

## 13.3 Oxygen Safety

1. Equipment used with oxygen or mixtures containing over forty (40%) by volume oxygen shall be designed and maintained for oxygen service.
2. Components (except umbilicals) exposed to oxygen or mixtures containing over forty (40%) by volume oxygen at pressures above 150 psi shall be cleaned of flammable materials before being placed into service and maintained for oxygen service.
3. Oxygen systems over 125 psig shall have slow-opening shut-off valves.
4. Equipment required to meet oxygen safety requirements includes, but is not limited to: SCUBA tanks, cylinder valves, gas regulators, gauges, hoses, compressors, fill station components and gas lines or fixtures.

# 14.00 Medical Standards

All divers or Dive Team members must complete the medical examinations required in this manual, meet medical standards defined in this manual, and be declared medically fit to engage in diving activities by a licensed doctor of medicine recognized by the state of California, before any hyperbaric exposure under HSU auspices. The medical evaluation may deny or impose restrictions and limitations on the scope of allowed diving activity.

## 14.1 Examining Physician

All medical evaluations required by these standards shall be performed by, or under the direction of a doctor of medicine licensed by or who's license is recognized by the state of California. Preferably, the examining physician should have experience in diving medicine. The examining physician must verify with their signature on the HSU Medical Evaluation Report of Fitness for: SCUBA, Surface-Supplied & Free Diving; and Physician's Recommendation (Appendix 3.3.1) if the applicant is fit to dive and approved by them to dive.

### 14.11 Determination of Fitness to Dive: Physician Responsibility

The applicant examined must be able to safely dive under conditions of arduous physical and psychological stress. Specifically, the applicant must be capable of safely accommodating repeated hyperbaric/hypobaric, metabolic, cardio- vascular, pulmonary, muscular-skeletal stress while maintaining the cognitive and physiological ability to respond to a variety of problem solving demands and emergencies. The examining physician assumes the responsibility of verifying that the applicant is medically safe and fit to dive under the demands of all anticipated diving conditions.

## 14.2 Frequency of Medical Evaluation

Prior to any hyperbaric exposure breathing compressed gas, a diver must have the required medical evaluation and approval to dive. The Diving Safety Officer or his/her designee may accept equivalent medical evaluations completed within the prescribed time interval.

### 14.21 Under Age 40

Medical evaluation is required initially and every five (5) years.

### 14.22 Over Age 40 But Less Than Age 60

Medical evaluation is required initially and every three (3) years

### 14.23 Over Age 60

Medical evaluation is required initially and every two (2) years

## 14.3 Medical Evaluation Following Injury, Illness, Doctor Care or Hospitalization

Clearance to return to diving must be obtained from a physician following any major injury or illness and any condition requiring doctor or hospital care. If the injury, illness or condition is pressure or diving related, then the clearance to return to diving must come from a physician trained in diving medicine. The Diving Control Board or Diving Safety Officer may require a medical examination or evaluation to determine a diver's current fitness to dive.

## 14.4 Medical Evaluation Expenses

All costs of medical examinations shall be the responsibility of the applicant for certification. In the case of an employee who is required to dive as part of their employment, the employer must pay for the required medical evaluations.

## 14.5 Information Provided Examining Physician

The Diving Safety Officer shall provide a copy of the medical requirements of these standards to the examining physician.

## 14.6 Content of Medical Evaluation

The diver should be free of any chronic disabling disease or injury and be free of any condition contained in the list of conditions for which restrictions from diving are generally recommended and the safety of the applicant or Dive Team is compromised (Appendix 3). Initial medical examinations and periodic re-examinations shall consist of the following:

1. General medical history.
2. Diving Medical History (Appendix 3.1), including the Diving Safety Officer's Review.
3. Basic physical examination (required tests listed in Appendix 3).
4. Any additional tests the physician considers necessary.
5. Completion of the HSU Medical Evaluation Report of Fitness for: SCUBA, Surface-Supplied & Free Diving (Appendices 3.3 and 3.3.1) with the signature of the examining physician.
6. Applicant agreement for release of medical information to the Diving Safety Officer and the DCB.

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

1. Abnormalities of the tympanic membrane, such as perforation, presence of a monomeric membrane, or inability to auto inflate the middle ears.
2. Vertigo including Meniere's Disease.
3. Stapedectomy or middle ear reconstructive surgery.
4. Recent ocular surgery.
5. Psychiatric disorders including claustrophobia, suicidal ideation, psychosis, anxiety
6. states, untreated depression.
7. Substance abuse, including alcohol.
8. Episodic loss of consciousness.
9. History of seizure.

10. History of stroke or a fixed neurological deficit.
11. Recurring neurologic disorders, including transient ischemic attacks.
12. History of intracranial aneurysm, other vascular malformation or intracranial
13. hemorrhage.
14. History of neurological decompression illness with residual deficit.
15. Head injury with sequelae.
16. Hematologic disorders including coagulopathies.
17. Evidence of coronary artery disease or high risk for coronary artery disease.
18. Atrial septal defects.
19. Significant valvular heart disease - isolated mitral valve prolapse is not disqualifying.
20. Significant cardiac rhythm or conduction abnormalities.
21. Implanted cardiac pacemakers and cardiac defibrillators (ICD).
22. Inadequate exercise tolerance.
23. Severe hypertension.
24. History of spontaneous or traumatic pneumothorax.
25. Asthma.
26. Chronic pulmonary disease, including radiographic evidence of pulmonary blebs, bullae or cysts.
27. Diabetes mellitus.
28. Pregnancy.

## 14.7 Required Content of Medical Examinations

### 14.71 Initial And Periodic Re-Examination Under Age 40

1. Medical History
2. Complete Physical Exam, emphasis on neurological and otological components
3. Urinalysis
4. Any further tests deemed necessary by the physician.

### 14.72 Initial and Periodic Re-Examination Over Age 40

1. Medical History
2. Complete Physical Exam, emphasis on neurological and otological components.
3. Detailed assessment of coronary artery disease risk factors using Multiple-Risk-Factor Assessment (age, family history, lipid profile, blood pressure, diabetic screening, smoking history). Further cardiac screening may be indicated based on risk factor assessment.
4. Resting EKG
5. Chest X-ray
6. Urinalysis
7. Any further tests deemed necessary by the physician

## 14.8 Physician's Written Report

1. After any medical examination or evaluation required by these standards, the Diving Safety Officer shall obtain a written report stating the examining physician's opinion of the applicant’s fitness to dive, including any recommended restrictions or limitations (Appendix 3).

2. Upon request, the Diving Safety Officer or the HSU Student Health Center shall provide the applicant with a copy of the physician's written report.
3. A copy of all medical examination documents shall be retained in the applicant’s
4. HSU Diver Certification File.

# 15.00 Emergency Management

The safety of the Dive Team is the primary objective of this manual. While not every circumstance can be anticipated, accidents and emergencies can best be prevented by thorough preparation and training of divers and first-responders. Dive Team inter- dependency and a comprehensive Emergency Management Plan (Emergency Plan) does not replace the need for individual self-sufficiency during an emergency.

## 15.1 Approval and Filing of Emergency Plan

Each filed Dive Plan will have an attached Emergency Plan. The approval of the Dive Plan requires approval and verification of the Emergency Plan by the Diving Safety Officer or his/her designee.

## 15.2 Emergency Plan

Each diving activity requires an updated Emergency Management Plan. Specialized training is required before use of emergency equipment. The Emergency Plan should at a minimum contain or require:

1. First-responder first-aid training for each Dive Team member.
2. Communication links to advanced life-support entities.
3. Land, sea, or air transportation for victims.
4. Emergency equipment, including:
    a. First aid kit adequate for the diving operation shall be available at the dive site.
    b. The kit shall include a Divers Alert Network (DAN) first-aid booklet.
    c. An oxygen delivery system capable of delivering 100% oxygen to a breathing or non-breathing person for a minimum of 30 minutes, or, for 60 minutes if diving operations are further than 30 minutes travel time from advanced life support.
    d. In-water and on-shore signaling and recall devices.
    e. Pocket-masks with oxygen inlets.
    f. An extraction board if conditions dictate.
5. Current phone numbers, addresses, contact points for hospitals, emergency rooms, search and rescue personnel, ambulance services (including air ambulances) and recompression chamber facilities.
6. A treatment flow chart for diving accidents.

## 15.3 Diving Emergency Management Procedures

Each emergency incident requires unique responses, but at a minimum the emergency response should consider, planned for and implemented the following guidelines. These guidelines are specifically for divers suffering from, or possibly suffering from, Arterial Gas Embolism (AGE), Decompression Sickness (DCS) or Near Drowning; however, they may be appropriate for other injuries and illness.

### 15.31 First Response

1. Identify all possible victims (check Dive Team) and declare an emergency.
2. Protect victims and rescuers from further harm.
3. Contact local Emergency Medical Services (EMS) for transport of victim(s) to a medical facility.
4. Confirm or establish victim's airway (A), breathing (B), circulation (C).

5. Administer CPR if needed
6. Control bleeding and treat for shock.
7. Administer 100% oxygen ventilation following the DAN guidelines.
8. Contact Divers Alert Network (DAN) to facilitate evacuation to nearest hyperbaric chamber

## 15.32 Advanced Life Support

1. Advise the evacuation teams, medics and physicians that 100% oxygen ventilation is required for the victim(s).
2. Advise the evacuation teams, medics and physicians that recompression treatment may be necessary for the victim(s) and provide them with a copy of the Emergency Plan and DAN emergency phone number (919) 684-9111.
3. Send the Emergency Notification (Appendix 6) card with victim(s).

## 15.33 Reporting and Follow-up

1. Secure all of the victim's equipment.
2. Keep Dive Team members who were diving under observation for six (6) hours by persons capable of rendering emergency medical assistance.
3. Record names and contact numbers for persons involved or who were witnesses.
4. Notify the DSO or his/her designee.
5. Complete a written report that describes the details of the incident and immediately forward to the DSO and DCB.

# 16.00 NITROX DIVING GUIDELINES

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

## 16.1 Prerequisites

1. Eligibility:
    a. Only a certified Scientific Diver or Scientific Diver In Training (Sections 4.00 and 5.00) diving under the auspices of a member organization is eligible for authorization to use nitrox. After completion, review and acceptance of application materials, training and qualification, an applicant will be authorized to use nitrox within their depth authorization, as specified in Section 5.40.
2. Application and Documentation
    a. Application and documentation for authorization to use nitrox should be made on forms specified by the Diving Control Board.

## 16.2 Requirements for Authorization to Use Nitrox

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

### 16.21 Training

The diver must complete additional theoretical and practical training beyond the Scientific Diver In Training air certification level, to the satisfaction of the member organizations DSO and DCB).

### 16.22 Examination

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

1. Written examinations covering the information presented in the classroom training session(s) (i.e., gas theory, oxygen toxicity, partial pressure determination, etc.);
2. Practical examinations covering the information presented in the practical training session(s) (i.e., gas analysis, documentation procedures, etc.);
3. Openwater checkout dives, to appropriate depths, to demonstrate the application of theoretical and practical skills learned.

### 16.23 Minimum Activity to Maintain Authorization

The diver should log at least one nitrox dive per year. Failure to meet the minimum activity level may be cause for restriction or revocation of nitrox authorization.

## 16.3 Nitrox Training Guidelines

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

### 16.31 Classroom Instruction

1. Topics should include, but are not limited to: review of previous training; physical gas laws pertaining to nitrox; partial pressure calculations and limits; equivalent air depth (EAD) concept and calculations; oxygen physiology and oxygen toxicity; calculation of oxygen exposure and maximum safe operating depth (MOD); determination of decompression schedules (both by EAD method using approved air dive tables, and using approved nitrox dive tables); dive planning and emergency procedures; mixing procedures and calculations; gas analysis; personnel requirements; equipment marking and maintenance requirements; dive station requirements.
2. DCB may choose to limit standard nitrox diver training to procedures applicable to diving, and subsequently reserve training such as nitrox production methods, oxygen cleaning, and dive station topics to divers requiring specialized authorization in these areas.

### 16.32 Practical Training

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

1. Oxygen analysis of nitrox mixtures.
2. Determination of MOD, oxygen partial pressure exposure, and oxygen toxicity time limits, for various nitrox mixtures at various depths.
3. Determination of nitrogen-based dive limits status by EAD method using air dive tables, and/or using nitrox dive tables, as approved by the DCB.
4. Nitrox dive computer use may be included, as approved by the DCB.
5. Written Examination (based on classroom instruction and practical training)

### 16.33 Written Examination

Before authorization, the trainee should successfully pass a written examination demonstrating knowledge of at least the following:

1. Function, care, use, and maintenance of equipment cleaned for nitrox use.
2. Physical and physiological considerations of nitrox diving (ex.: O2 and CO2 toxicity).
3. Diving regulations and procedures as related to nitrox diving, either scuba or surface-supplied (depending on intended mode).
4. Given the proper information, calculation of:
    a. Equivalent air depth (EAD) for a given fO2 and actual depth;
    b. pO2 exposure for a given fO2 and depth;
    c. Optimal nitrox mixture for a given pO2 exposure limit and planned depth;
    d. Maximum operational depth (MOD) for a given mix and pO2 exposure limit;
    e. For nitrox production purposes, percentages/psi of oxygen present in a given mixture, and psi of each gas required to produce a fO2 by partial pressure mixing.

f. Dive table and dive computer selection and usage;
5. Nitrox production methods and considerations.
6. Oxygen analysis.
7. Nitrox operational guidelines, dive planning, and dive station components.

### 16.34 Openwater Dives

A minimum of two supervised openwater dives using nitrox is required for authorization. The mode used in the dives should correspond to the intended application (i.e., scuba or surface-supplied). If the MOD for the mix being used can be exceeded at the training location, direct, in-water supervision is required.

### 16.35 Surface-Supplied Training

All training as applied to surface-supplied diving (practical, classroom, and openwater) will follow the HSU surface-supplied diving standards.

## 16.4 Scientific Nitrox Diving Regulations

### 16.41 Dive Personnel Requirements

Nitrox Diver In Training - A Diver In Training, who has completed the requirements of Section 5.5 and the training and authorization sections of these guidelines, may be authorized by the DSO to use nitrox under the direct supervision a Scientific Diver who also holds nitrox authorization. Dive depths should be restricted to those specified in the diver's authorization.

Scientific Diver - A Scientific Diver who has completed the requirements of Section 5.7 and the training and authorization sections of these guidelines, may be authorized by the DSO to use nitrox. Depth authorization to use nitrox should be the same as those specified in the diver's authorization, as described in Section. 5.40.

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

In addition to responsibilities listed in Section 3.6, the Lead Diver should:
1. As part of the dive planning process, verify that all divers using nitrox on a dive are properly qualified and authorized;
2. As part of the pre-dive procedures, confirm with each diver the nitrox mixture the diver is using, and establish dive team maximum depth and time limits, according to the shortest time limit or shallowest depth limit among the team members.
3. The Lead Diver should also reduce the maximum allowable pO2 exposure limit for the dive team if on-site conditions so indicate (see Sec. 16.4.2.).

## 16.42 Dive Parameters

### *Oxygen Exposure Limits*

1. The inspired oxygen partial pressure experienced at depth should not exceed 1.6 ATA. All dives performed using nitrox breathing mixtures should comply with the current NOAA Diving Manual "Oxygen Partial Pressure Limits for 'Normal' Exposures"
2. The maximum allowable exposure limit should be reduced in cases where cold or strenuous dive conditions, or extended exposure times are expected. The DCB should consider this in the review of any dive plan application, which proposes to use nitrox. The Lead Diver should also review on-site conditions and reduce the allowable pO2 exposure limits if conditions indicate.
3. If using the equivalent air depth (EAD) method the maximum depth of a dive should be based on the oxygen partial pressure for the specific nitrox breathing mix to be used.

### *Bottom Time Limits*

1. Maximum bottom time should be based on the depth of the dive and the nitrox mixture being used.
2. Bottom time for a single dive should not exceed the NOAA maximum allowable "Single Exposure Limit" for a given oxygen partial pressure, as listed in the current NOAA Diving Manual.

### *Dive Tables and Gases*

1. A set of DCB approved nitrox dive tables should be available at the dive site.
2. When using the equivalent air depth (EAD) method, dives should be conducted using air dive tables approved by the DCB.
3. If nitrox is used to increase the safety margin of air-based dive tables, the MOD and oxygen exposure and time limits for the nitrox mixture being dived should not be exceeded
4. Breathing mixtures used while performing in-water decompression, or for bail-out purposes, should contain the same or greater oxygen content as that being used during the dive, within the confines of depth limitations and oxygen partial pressure limits set forth in Section 16.4.2 Dive Parameters.

### *Nitrox Dive Computers*

1. Dive computers may be used to compute decompression status during nitrox dives. Manufacturers' guidelines and operations instructions should be followed.
2. Use of Nitrox dive computers should comply with dive computer guidelines included in the AAUS Standards.
3. Nitrox dive computer users should demonstrate a clear understanding of the display, operations, and manipulation of the unit being used for nitrox diving prior to using the computer, to the satisfaction of the DSO or designee.
4. If nitrox is used to increase the safety margin of an air-based dive computer, the MOD and oxygen exposure and time limits for the nitrox mixture being dived shall not be exceeded.
5. Dive computers capable of pO2 limit and fO2 adjustment should be checked by the diver prior to the start each dive to assure compatibility with the mix being used.

### *Repetitive Diving*

1. Repetitive dives using nitrox mixtures should be performed in compliance with procedures required of the specific dive tables used.
2. Residual nitrogen time should be based on the EAD for the specific nitrox mixture to be used on the repetitive dive, and not that of the previous dive.
3. The total cumulative exposure (bottom time) to a partial pressure of oxygen in a given 24 hour period should not exceed the current NOAA Diving Manual 24-hour Oxygen Partial Pressure Limits for "Normal" Exposures.
4. When repetitive dives expose divers to different oxygen partial pressures from dive to dive, divers should account for accumulated oxygen exposure from previous dives when determining acceptable exposures for repetitive dives. Both acute (CNS) and chronic (pulmonary) oxygen toxicity concerns should be addressed.

### *Oxygen Parameters*

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

| | |
|---|---|
| Air Purity: | CGA Grade E (Section 3.60) |
| Condensed Hydrocarbons | 5mg/m3 |
| Hydrocarbon Contaminants | No greater than 0.1 mg/m3 |

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

1. Personnel Requirements
    a. Individuals responsible for producing and/or analyzing nitrox mixtures should be knowledgeable and experienced in all aspects of the technique.
    b. Only those individuals approved by the DSO and/or DCB should be responsible for mixing and/or analyzing nitrox mixtures.
2. Production Methods - It is the responsibility of the DCB to approve the specific nitrox production method used.
3. Analysis Verification by User
    a. It is the responsibility of each diver to analyze prior to the dive the oxygen content of his/her scuba cylinder and acknowledge in writing the following information for each cylinder: fO2, MOD, cylinder pressure, date of analysis, and user's name.
    b. Individual dive log reporting forms should report fO2 of nitrox used, if different than 21%.

## 16.5 Nitrox Diving Equipment

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

1. Labeled SCUBA Cylinders
2. Oxygen Analyzers

### 16.51 Oxygen Cleaning and Maintenance Requirements

#### *Requirement for Oxygen Service*

All equipment, which during the dive or cylinder filling process is exposed to concentrations greater than 40% oxygen at pressures above 150 psi, should be cleaned and maintained for oxygen service.
Equipment used with oxygen or mixtures containing over 40% by volume oxygen shall be designed and maintained for oxygen service. Oxygen systems over 125 psig shall have slow-opening shut-off valves. This should include the following equipment: scuba cylinders, cylinder valves, scuba and other regulators, cylinder pressure gauges, hoses, diver support equipment, compressors, and fill station components and plumbing.

#### *Scuba Cylinder Identification Marking*

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

1. Cylinders should be marked “NITROX”, or “EANx”, or “Enriched Air”.
2. Nitrox identification color-coding should include a 4-inch wide green band around the cylinder, starting immediately below the shoulder curvature. If the cylinder is not yellow, the green band should be bordered above and below by a 1-inch yellow band.
3. The alternate marking of a yellow cylinder by painting the cylinder crown green and printing the word “NITROX” parallel to the length of the cylinder in green print is acceptable.
4. Other markings, which identify the cylinder as containing gas mixes other than Air, may be used as the approval of the DCB.
5. A contents label should be affixed, to include the current fO2, date of analysis, and MOD.
6. The cylinder should be labeled to indicate whether the cylinder is prepared for oxygen or nitrox mixtures containing greater than 40% oxygen.

#### *Regulators*

Regulators to be used with nitrox mixtures containing greater than 40% oxygen should be cleaned and maintained for oxygen service, and marked in an identifying manner.

#### *Other Support Equipment*

1. An oxygen analyzer is required which is capable of determining the oxygen content in the scuba cylinder. Two analyzers are recommended to reduce the likelihood of

errors due to a faulty analyzer. The analyzer should be capable of reading a scale of 0 to 100% oxygen, within 1% accuracy.
2. All diver and support equipment should be suitable for the fO2 being used.

### *Compressor system*

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

### *Fill Station Components*

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

# 17.00 STAGED DECOMPRESSION DIVING

Decompression diving shall be defined as any diving during which the diver cannot perform a direct return to the surface without performing a mandatory decompression stop to allow the release of inert gas from the diver's body.
The following procedures shall be observed when conducting dives requiring planned decompression stops.

## 17.1 Minimum Experience and Training Requirements

### 17.11 Prerequisites:

1. Scientific Diver qualification according to Section 5.7.
2. Minimum of 100 logged dives.
3. Demonstration of the ability to safely plan and conduct dives deeper than 100 feet.
4. Nitrox certification/authorization according to AAUS Section 7.00 recommended.

### 17.12 Training shall be appropriate for the conditions in which dive operations are to be conducted.

### 17.13 Minimum Training shall include the following:

1. A minimum of 6 hours of classroom training to ensure theoretical knowledge to include: physics and physiology of decompression; decompression planning and procedures; gas management; equipment configurations; decompression method, emergency procedures. It is recommended that at least one training session be conducted in a pool or sheltered water setting, to cover equipment handling and familiarization, swimming and buoyancy control, to estimate gas consumption rates, and to practice emergency procedures.
2. At least 6 open-water training dives simulating/requiring decompression shall be conducted, emphasizing planning and execution of required decompression dives, and including practice of emergency procedures.
3. Progression to greater depths shall be by 4-dive increments at depth intervals as specified in Section 6.15.
4. No training dives requiring decompression shall be conducted until the diver has demonstrated acceptable skills under simulated conditions.
5. The following are the minimum skills the diver must demonstrate proficiently during dives simulating and requiring decompression:
    - Buoyancy control
    - Proper ascent rate
    - Proper depth control
    - Equipment manipulation
    - Stage/decompression bottle use as pertinent to planned diving operation
    - Buddy skills
    - Gas management
    - Time management
    - Task loading
    - Emergency skills
6. Divers shall demonstrate to the satisfaction of the DSO or the DSO's designee proficiency in planning and executing required decompression dives appropriate to the conditions in which diving operations are to be conducted.

7. Upon completion of training, the diver shall be authorized to conduct required decompression dives with DSO approval.

## 17.2 Minimum Equipment Requirements

1. Valve and regulator systems for primary (bottom) gas supplies shall be configured in a redundant manner that allows continuous breathing gas delivery in the event of failure of any one component of the regulator/valve system.
2. Cylinders with volume and configuration adequate for planned diving operations.
3. One of the second stages on the primary gas supply shall be configured with a hose of adequate length to facilitate effective emergency gas sharing in the intended environment.

### 17.21 Minimum dive equipment shall include:

1. Snorkel is optional at the DCB's discretion, as determined by the conditions and environment.
2. Diver location devices adequate for the planned diving operations and environment.
3. Compass

### 17.22 Redundancy in the following components is desirable or required at the discretion of the DCB or DSO:

1. Decompression Schedules
2. Dive Timing Devices
3. Depth gauges
4. Buoyancy Control Devices
5. Cutting devices
6. Lift bags and line reels

## 17.3 Minimum Operational Requirements

1. Approval of dive plan applications to conduct required decompression dives shall be on a case-by-case basis.
2. The maximum pO2 to be used for planning required decompression dives is 1.6. It is recommended that a pO2 of less than 1.6 be used during bottom exposure.
3. Diver's gas supplies shall be adequate to meet planned operational requirements and foreseeable emergency situations.
4. Decompression dives may be planned using dive tables, dive computers, and/or PC software approved by the DSO/DCB.
5. Breathing gases used while performing in-water decompression shall contain the same or greater oxygen content as that used during the bottom phase of the dive.
6. The dive team prior to each dive shall review emergency procedures appropriate for the planned dive.
7. If breathing gas mixtures other than air are used for required decompression, their use shall be in accordance with those regulations set forth in the appropriate sections of this standard.
8. The maximum depth for required decompression using air as the bottom gas shall be 190 feet.
9. Use of additional nitrox and/or high-oxygen fraction decompression mixtures as travel and decompression gases to decrease decompression obligations is encouraged.
10. Use of alternate inert gas mixtures to limit narcosis is encouraged for depths greater than 150 feet.

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

# 18.00 MIXED GAS DIVING

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

## 18.1 Minimum Experience and Training Requirements

### 18.11 Prerequisites:

1. Nitrox certification and authorization (Section 16.00)
2. If the intended use entails required decompression stops, divers will be previously certified and authorized in decompression diving (Section 17.00).
3. Divers shall demonstrate to the DCB's satisfaction skills, knowledge, and attitude appropriate for training in the safe use of mixed gases.

### 18.12 Classroom training including:

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

### 18.13 Practical Training:

1. Confined water session(s) in which divers demonstrate proficiency in required skills and techniques for proposed diving operations.
2. A minimum of 6 open water training dives.
3. At least one initial dive shall be in 130 feet or less to practice equipment handling and emergency procedures.
4. Subsequent dives will gradually increase in depth, with a majority of the training dives being conducted between 130 feet and the planned operational depth.
5. Planned operational depth for initial training dives shall not exceed 260 feet.
6. Diving operations beyond 260 feet requires additional training dives.
7.

## 18.2 Equipment and Gas Quality Requirements

1. Equipment requirements shall be developed and approved by the DCB, and met by divers, prior to engaging in mixed-gas diving. Equipment shall meet other pertinent requirements set forth elsewhere in this standard.

2. The quality of inert gases used to produce breathing mixtures shall be of an acceptable grade for human consumption.
3.

## 18.3 Minimum Operational Requirements

1. Approval of dive plan applications to conduct mixed gas dives shall be on a case-by-case basis.
2. All applicable operational requirements for nitrox and decompression diving shall be met.
3. The maximum pO2 to be used for planning required decompression dives is 1.6. It is recommended that a pO2 of less than 1.6 be used during bottom exposure.
4. Maximum planned Oxygen Toxicity Units (OTU) will be considered based on mission duration.
5. Divers decompressing on high-oxygen concentration mixtures shall closely monitor one another for signs of acute oxygen toxicity.
6. If a period of more than 6 months has elapsed since the last mixed gas dive, a series of progressive workup dives to return the diver(s) to proficiency status prior to the start of project diving operations are recommended.

# 19.00 OTHER DIVING TECHNOLOGY

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

## 19.1 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).

## 19.2 Ice And Polar Diving

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

## 19.3 Overhead Environments

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

## 19.4 Saturation Diving

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

# 20.00 REBREATHERS

1. This section defines specific considerations regarding the following issues for the use of rebreathers:
    a. Training and/or experience verification requirements for authorization
    b. Equipment requirements
    c. Operational requirements and additional safety protocols to be used
2. Application of this standard is in addition to pertinent requirements of all other sections of the AAUS Standards for Scientific Diving, Volumes 1 and 2.
3. For rebreather dives that also involve staged decompression and/or mixed gas diving, all requirements for each of the relevant diving modes shall be met. Diving Control Board reserves the authority to review each application of all specialized diving modes, and include any further requirements deemed necessary beyond those listed here on a case-by-case basis.
4. No diver shall conduct planned operations using rebreathers without prior review and approval of the DCB.
5. 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.

## 20.1 Definitions and General Information

1. 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.
    a. Advantages of rebreathers may include increased gas utilization efficiencies that are often independent of depth, extended no-decompression bottom times and greater decompression efficiency, and reduction or elimination of exhaust bubbles that may disturb aquatic life or sensitive environments.
    b. Disadvantages of rebreathers include high cost and, in some cases, a high degree of system complexity and reliance on instrumentation for gas composition control and monitoring, which may fail. The diver is more likely to experience hazardous levels of hypoxia, hyperoxia, or hypercapnia, due to user error or equipment malfunction, conditions which may lead to underwater blackout and drowning. Inadvertent flooding of the breathing loop and wetting of the carbon dioxide absorbent may expose the diver to ingestion of an alkaline slurry ("caustic cocktail").
    c. An increased level of discipline and attention to rebreather system status by the diver is required for safe operation, with a greater need for self-reliance. Rebreather system design and operation varies significantly between make and model. For these reasons when evaluating any dive plan incorporating rebreathers, risk-management emphasis should be placed on the individual qualifications of the diver on the specific rebreather make and model to be used, in addition to specific equipment requirements and associated operational protocols.
2. 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 normally limited to a maximum operation depth of 20fsw due to the risk of unsafe hyperoxic exposure.

3. 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 by means which differ between SCR models, but the mechanism usually provides a semi-constant fraction of oxygen (FO2) in the breathing loop at all depths, similar to open-circuit SCUBA.
4. Closed-Circuit Mixed Gas Rebreathers. Closed-circuit mixed gas rebreathers (CCR) recycle all of the exhaled gas and replace metabolized oxygen via an electronically controlled valve, governed by electronic oxygen sensors. Manual oxygen addition is available as a diver override, in case of electronic system failure. A separate inert gas source (diluent), usually containing primarily air, heliox, or trimix, is used to maintain oxygen levels at safe levels when diving below 20fsw. CCR systems operate to maintain a constant oxygen partial pressure (PPO2) during the dive, regardless of depth.

## 20.2 Prerequisites

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).

### 20.21 Training Prerequisites:

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

## 20.3 Training

Successful completion of the following training program qualifies the diver for rebreather diving using the system on which the diver was trained, in depths of 130fsw and shallower, for dives that do not require decompression stops, using nitrogen/oxygen breathing media.

1. Satisfactory completion of a rebreather training program authorized or recommended by the manufacturer of the rebreather to be used, or other training approved by the DCB. 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.

### 20.31 Classroom training shall include:

1. A review of those topics of diving physics and physiology, decompression management, and dive planning included in prior scientific diver, nitrox, staged decompression and/or mixed

gas training, as they pertain to the safe operation of the selected rebreather system and planned diving application.

2. In particular, causes, signs and symptoms, first aid, treatment and prevention of the following must be covered:
    a. Hyperoxia (CNS and Pulmonary Oxygen Toxicity)
    b. Middle Ear Oxygen Absorption Syndrome (oxygen ear)
    c. Hyperoxia-induced myopia
    d. Hypoxia
    e. Hypercapnia
    f. Inert gas narcosis
    g. Decompression sickness
    h. Rebreather-specific information required for the safe and effective operation of the system to be used, including:
    i. System design and operation, including:
    j. Counterlung(s)
    k. CO2 scrubber
    l. CO2 absorbent material types, activity characteristics, storage, handling and disposal
    m. Oxygen control system design, automatic and manual
    n. Diluent control system, automatic and manual (if any)
    o. Pre-dive set-up and testing
    p. Post-dive break-down and maintenance
    q. Oxygen exposure management
    r. Decompression management and applicable decompression tracking methods
    s. Dive operations planning
    t. Problem recognition and management, including system failures leading to hypoxia, hyperoxia, hypercapnia, flooded loop, and caustic cocktail
    u. Emergency protocols and bailout procedures

## 20.32 Practical Training (with model of rebreather to be used)

1. A minimum number of hours of underwater time.

| Type | Pool/Confined Water | O/W Training | O/W Supervised |
|---|---|---|---|
| Oxygen Rebreather | 1 dive, 90 min | 4 dives, 120 min.* | 2 dives, 60 min |
| Semi-Closed Circuit | 1 dive, 90-120 min | 4 dives, 120 min.** | 4 dives, 120 min |
| Closed-Circuit | 1 dive, 90-120 min | 8 dives, 380 min.*** | 4 dives, 240 min |
| * Dives should not exceed 20 fsw.<br>** First two dives should not exceed 60 fsw. Subsequent dives should be at progressively greater depths, with at least one dive in the 80 to 100 fsw range.<br>*** Total underwater time (pool and open water) of approximately 500 minutes. First two open water dives should not exceed 60 fsw. Subsequent dives should be at progressively greater depths, with at least 2 dives in the 100 to 130 fsw range. | | | |

2. Amount of required in-water time should increase proportionally to the complexity of rebreather system used.
3. Training shall be in accordance with the manufacturer's recommendations.

## 20.33 Practical Evaluations

Upon completion of practical training, the diver must demonstrate to the DCB or its designee proficiency in pre-dive, dive, and post-dive operational procedures for the particular model of rebreather to be used. Skills shall include, at a minimum:

1. Oxygen control system calibration and operation checks
2. Carbon dioxide absorbent canister packing
3. Supply gas cylinder analysis and pressure check
4. Test of one-way valves
5. System assembly and breathing loop leak testing
6. Pre-dive breathing to test system operation
7. In-water leak checks
8. Buoyancy control during descent, bottom operations, and ascent
9. System monitoring and control during descent, bottom operations, and ascent
10. Proper interpretation and operation of system instrumentation (PO2 displays, dive computers, gas supply pressure gauges, alarms, etc, as applicable)
11. Unit removal and replacement on the surface.
12. Bailout and emergency procedures for self and buddy, including:
13. System malfunction recognition and solution
14. Manual system control
15. Flooded breathing loop recovery (if possible)
16. Absorbent canister failure
17. Alternate bailout options
18. Symptom recognition and emergency procedures for hyperoxia, hypoxia, and hypercapnia
19. Proper system maintenance, including:
20. Full breathing loop disassembly and cleaning (mouthpiece, check-valves, hoses, counterlung, absorbent canister, etc.)
21. Oxygen sensor replacement (for SCR and CCR)
22. Other tasks required by specific rebreather models

## 20.34 Written Evaluation

A written evaluation approved by the DCB with a pre-determined passing score, covering concepts of both classroom and practical training, is required.

## 20.35 Supervised Rebreather Dives

1. Upon successful completion of open water training dives, the diver is authorized to conduct a series of supervised rebreather dives, during which the diver gains additional experience and proficiency.
2. Supervisor for these dives should be the DSO or designee, and should be an active scientific diver experienced in diving with the make/model of rebreather being used.
3. Dives at this level may be targeted to activities associated with the planned science diving application. See the following table for number and cumulative water time for different rebreather types.

| Type | Pool/Confined Water | O/W Training | O/W Supervised |
|---|---|---|---|
| Oxygen Rebreather | 1 dive, 90 min | 4 dives, 120 min.* | 2 dives, 60 min |
| Semi-Closed Circuit | 1 dive, 90-120 min | 4 dives, 120 min.** | 4 dives, 120 min |
| Closed-Circuit | 1 dive, 90-120 min | 8 dives, 380 min.*** | 4 dives, 240 min |

* Dives should not exceed 20 fsw.
** First two dives should not exceed 60 fsw. Subsequent dives should be at progressively greater depths, with at least one dive in the 80 to 100 fsw range.
*** Total underwater time (pool and open water) of approximately 500 minutes. First two open water dives should not exceed 60 fsw. Subsequent dives should be at progressively greater depths, with at least 2 dives in the 100 to 130 fsw range.

4. Maximum ratio of divers per designated dive supervisor is 4:1. The supervisor may dive as part of the planned operations.

## 20.4 Extended Range, Required Decompression and Helium-Based Inert Gas

Rebreather dives involving operational depths in excess of 130 fsw, requiring staged decompression, or using diluents containing inert gases other than nitrogen are subject to additional training requirements, as determined by DCB on a case-by-case basis. Prior experience with required decompression and mixed gas diving using open-circuit SCUBA is desirable, but is not sufficient for transfer to dives using rebreathers without additional training.

1. As a prerequisite for training in staged decompression using rebreathers, the diver shall have logged a minimum of 25 hours of underwater time on the rebreather system to be used, with at least 10 rebreather dives in the 100 fsw to 130 fsw range.
2. As a prerequisite for training for use of rebreathers with gas mixtures containing inert gas other than nitrogen, the diver shall have logged a minimum of 50 hours of underwater time on the rebreather system to be used and shall have completed training in stage decompression methods using rebreathers. The diver shall have completed at least 12 dives requiring staged decompression on the rebreather model to be used, with at least 4 dives near 130 fsw.
3. Training shall be in accordance with standards for required-decompression and mixed gas diving, as applicable to rebreather systems, starting at the130 fsw level.

## 20.5 Maintenance of Proficiency

1. To maintain authorization to dive with rebreathers, an authorized diver shall make at least one dive using a rebreather every 8 weeks. For divers authorized for the conduct of extended range, stage decompression or mixed-gas diving, at least one dive per month should be made to a depth near 130 fsw, practicing decompression protocols.
2. For a diver in arrears, the DCB shall approve a program of remedial knowledge and skill tune-up training and a course of dives required to return the diver to full authorization. The extent of this program should be directly related to the complexity of the planned rebreather diving operations.

## 20.6 Equipment Requirements

### 20.61 General Requirements

1. Only those models of rebreathers specifically approved by DCB shall be used.
2. Rebreathers should be manufactured according to acceptable Quality Control/Quality Assurance protocols, as evidenced by compliance with the essential elements of ISO 9004. Manufacturers should be able to provide to the DCB supporting documentation to this effect.

3. Unit performance specifications should be within acceptable levels as defined by standards of a recognized authority (CE, US Navy, Royal Navy, NOAA, etc…).
4. Prior to approval, the manufacturer should supply the DCB with supporting documentation detailing the methods of specification determination by a recognized third-party testing agency, including unmanned and manned testing. Test data should be from a recognized, independent test facility.
5. The following documentation for each rebreather model to be used should be available as a set of manufacturer's specifications. These should include:
    a) Operational depth range
    b) Operational temperature range
    c) Breathing gas mixtures that may be used
    d) Maximum exercise level which can be supported as a function of breathing gas and depth
    e) Breathing gas supply durations as a function of exercise level and depth
    f) CO2 absorbent durations, as a function of depth, exercise level, breathing gas, and water temperature
    g) Method, range and precision of inspired PPO2 control, as a function of depth, exercise level, breathing gas, and temperature
    h) Likely failure modes and backup or redundant systems designed to protect the diver if such failures occur
    i) Accuracy and precision of all readouts and sensors
    j) Battery duration as a function of depth and temperature
    k) Mean time between failures of each subsystem and method of determination
6. A complete instruction manual is required, fully describing the operation of all rebreather components and subsystems as well as maintenance procedures.
7. A maintenance log is required. The unit maintenance shall be up-to-date based upon manufacturer’s recommendations.

## 20.62 Minimum Equipment

1. A surface/dive valve in the mouthpiece assembly, allowing sealing of the breathing loop from the external environment when not in use.
2. An automatic gas addition valve, so that manual volumetric compensation during descent is unnecessary.
3. Manual gas addition valves, so that manual volumetric compensation during descent and manual oxygen addition at all times during the dive are possible.
4. The diver shall carry alternate life support capability (open-circuit bail-out or redundant rebreather) sufficient to allow the solution of minor problems and allow reliable access to a pre-planned alternate life support system.

## 20.63 Oxygen Rebreathers

Oxygen rebreathers shall be equipped with manual and automatic gas addition valves.

## 20.64 Semi-Closed Circuit Rebreathers.

SCR's shall be equipped with at least one manufacturer-approved oxygen sensor sufficient to warn the diver of impending hypoxia. Sensor redundancy is desirable, but not required.

### 20.65 Closed Circuit Mixed-gas Rebreathers.

1. CCR shall incorporate a minimum of three independent oxygen sensors.
2. A minimum of two independent displays of oxygen sensor readings shall be available to the diver.
3. Two independent power supplies in the rebreather design are desirable. If only one is present, a secondary system to monitor oxygen levels without power from the primary battery must be incorporated.
4. CCR shall be equipped with manual diluent and oxygen addition valves, to enable the diver to maintain safe oxygen levels in the event of failure of the primary power supply or automatic gas addition systems.
5. Redundancies in onboard electronics, power supplies, and life support systems are highly desirable.

## 20.7 Operational Requirements

### 20.71 General Requirements

1. All dives involving rebreathers must comply with applicable operational requirements for open-circuit SCUBA dives to equivalent depths.
2. No rebreather system should be used in situations beyond the manufacturer's stated design limits (dive depth, duration, water temperature, etc).
3. Modifications to rebreather systems shall be in compliance with manufacturer's recommendations.
4. Rebreather maintenance is to be in compliance with manufacturer's recommendations including sanitizing, replacement of consumables (sensors, CO2 absorbent, gas, batteries, etc) and periodic maintenance.
5. Dive Plan. In addition to standard dive plan components stipulated in AAUS Section 2.0, all dive plans that include the use of rebreathers must include, at minimum, the following details:
   a) Information about the specific rebreather model to be used
   b) Make, model, and type of rebreather system
   c) Type of CO2 absorbent material
   d) Composition and volume(s) of supply gases
   e) Complete description of alternate bailout procedures to be employed, including manual rebreather operation and open-circuit procedures
6. Other specific details as requested by DCB

### 20.72 Buddy Qualifications.

1. A diver whose buddy is diving with a rebreather shall be trained in basic rebreather operation, hazard identification, and assist/rescue procedures for a rebreather diver.
2. If the buddy of a rebreather diver is using open-circuit scuba, the rebreather diver must be equipped with a means to provide the open-circuit scuba diver with a sufficient supply of open-circuit breathing gas to allow both divers to return safely to the surface.

### 20.73 Oxygen Exposures

1. Planned oxygen partial pressure in the breathing gas shall not exceed 1.4 atmospheres at depths greater than 30 feet.
2. Planned oxygen partial pressure set point for CCR shall not exceed 1.4 ata. Set point at depth should be reduced to manage oxygen toxicity according to the NOAA Oxygen Exposure Limits.
3. Oxygen exposures should not exceed the NOAA oxygen single and daily exposure limits. Both CNS and pulmonary (whole-body) oxygen exposure indices should be tracked for each diver.

## 20.74 Decompression Management

1. DCB shall review and approve the method of decompression management selected for a given diving application and project.
2. Decompression management can be safely achieved by a variety of methods, depending on the type and model of rebreather to be used. Following is a general list of methods for different rebreather types:
    a. Oxygen rebreathers: Not applicable.
    b. SCR (presumed constant FO2):
        i. •Use of any method approved for open-circuit scuba diving breathing air, above the maximum operational depth of the supply gas.
        ii. •Use of open-circuit nitrox dive tables based upon expected inspired FO2. In this case, contingency air dive tables may be necessary for active-addition SCR's in the event that exertion level is higher than expected.
        iii. •Equivalent air depth correction to open-circuit air dive tables, based upon expected inspired FO2 for planned exertion level, gas supply rate, and gas composition. In this case, contingency air dive tables may be necessary for active-addition SCR's in the event that exertion level is higher than expected.
3. CCR (constant PPO2):
        i. •Integrated constant PPO2 dive computer.
        ii. •Non-integrated constant PPO2 dive computer.
        iii. •Constant PPO2 dive tables.
        iv. •Open-circuit (constant FO2) nitrox dive computer, set to inspired FO2 predicted using PPO2 set point at the maximum planned dive depth.
        v. •Equivalent air depth (EAD) correction to standard open-circuit air dive tables, based on the inspired FO2 predicted using the PPO2 set point at the maximum planned dive depth.
        vi. •Air dive computer, or air dive tables used above the maximum operating depth (MOD) of air for the PPO2 setpoint selected.

## 20.75 Maintenance Logs, CO2 Scrubber Logs, Battery Logs, and Pre-And Post-Dive Checklists

Logs and checklists will be developed for the rebreather used, and will be used before and after every dive. Diver shall indicate by initialing that checklists have been completed before and after each dive. Such documents shall be filed and maintained as permanent project records. No rebreather shall be dived which has failed any portion of the pre-dive check, or is found to

not be operating in accordance with manufacturer's specifications. Pre-dive checks shall include:

1. Gas supply cylinders full
2. Composition of all supply and bail-out gases analyzed and documented
3. Oxygen sensors calibrated
4. Carbon dioxide canister properly packed
5. Remaining duration of canister life verified
6. Breathing loop assembled
7. Positive and negative pressure leak checks
8. Automatic volume addition system working
9. Automatic oxygen addition systems working
10. Pre-breathe system for 3 minutes (5 minutes in cold water) to ensure proper oxygen addition and carbon dioxide removal (be alert for signs of hypoxia or hypercapnia)
11. Other procedures specific to the model of rebreather used
12. Documentation of ALL components assembled
13. Complete pre-dive system check performed
14. Final operational verification immediately before to entering the water:
15. PO2 in the rebreather is not hypoxic
16. Oxygen addition system is functioning;
17. Volumetric addition is functioning
18. Bail-out life support is functioning

## 20.76 Alternate Life Support System

The diver shall have reliable access to an alternate life support system designed to safely return the diver to the surface at normal ascent rates, including any required decompression in the event of primary rebreather failure. The complexity and extent of such systems are directly related to the depth/time profiles of the mission. Examples of such systems include, but are not limited to:

1. Open-circuit bailout cylinders or sets of cylinders, either carried or pre-positioned
2. Redundant rebreather
3. Pre-positioned life support equipment with topside support

## 20.77 CO2 Absorbent Material

1. CO2 absorption canister shall be filled in accordance with the manufacturer's specifications.
2. CO2 absorbent material shall be used in accordance with the manufacturer's specifications for expected duration.
3. If CO2 absorbent canister is not exhausted and storage between dives is planned, the canister should be removed from the unit and stored sealed and protected from ambient air, to ensure the absorbent retains its activity for subsequent dives.
4. Long-term storage of carbon dioxide absorbents shall be in a cool, dry location in a sealed container. Field storage must be adequate to maintain viability of material until use.

## 20.78 Consumables (e.g., batteries, oxygen sensors, etc.)

Other consumables (e.g., batteries, oxygen sensors, etc.) shall be maintained, tested, and replaced in accordance with the manufacturer's specifications.

### 20.79 Unit Disinfections

The entire breathing loop, including mouthpiece, hoses, counterlungs, and CO2 canister, should be disinfected periodically according to manufacturer's specifications. The loop must be disinfected between each use of the same rebreather by different divers.

## 20.8 Oxygen Rebreathers

1. Oxygen rebreathers shall not be used at depths greater than 20 feet.
2. Breathing loop and diver's lungs must be adequately flushed with pure oxygen prior to entering the water on each dive. Once done, the diver must breathe continuously and solely from the intact loop, or re-flushing is required.
3. Breathing loop shall be flushed with fresh oxygen prior to ascending to avoid hypoxia due to inert gas in the loop.

## 20.9 Semi-Closed Circuit Rebreathers

1. The composition of the injection gas supply of a semi-closed rebreather shall be chosen such that the partial pressure of oxygen in the breathing loop will not drop below 0.2 ata, even at maximum exertion at the surface.
2. The gas addition rate of active addition SCR (e.g., Draeger Dolphin and similar units) shall be checked before every dive, to ensure it is balanced against expected workload and supply gas FO2.
3. The intermediate pressure of supply gas delivery in active-addition SCR shall be checked periodically, in compliance with manufacturer's recommendations.
4. Maximum operating depth shall be based upon the FO2 in the active supply cylinder.
5. Prior to ascent to the surface the diver shall flush the breathing loop with fresh gas or switch to an open-circuit system to avoid hypoxia. The flush should be at a depth of approximately 30 fsw during ascent on dives deeper than 30 fsw, and at bottom depth on dives 30 fsw and shallower.

## 20.10 Closed-Circuit Rebreathers

1. The FO2 of each diluent gas supply used shall be chosen so that, if breathed directly while in the depth range for which its use is intended, it will produce an inspired PPO2 greater than 0.20 ata but no greater than 1.4 ata.
2. Maximum operating depth shall be based on the FO2 of the diluent in use during each phase of the dive, so as not to exceed a PO2 limit of 1.4 ata.
3. Divers shall monitor both primary and secondary oxygen display systems at regular intervals throughout the dive, to verify that readings are within limits, that redundant displays are providing similar values, and whether readings are dynamic or static (as an indicator of sensor failure).
4. The PPO2 set point shall not be lower than 0.4 ata or higher than 1.4 ata.

# 21.00 SCIENTIFIC CAVE AND CAVERN DIVING STANDARD

This standard helps to ensure all scientific diving in overhead environments is conducted in a manner which will maximize the protection of scientific divers from accidental injury and/or illness and provide the basis allowing the working reciprocity between AAUS organizational members.
If a conflict exists between this standard and other standards in this manual, the information set forth in this standard only takes precedence when the scientific diving being conducted takes place wholly or partly within an underwater cave or cavern environment.

A dive team shall be considered to be cave or cavern diving if at any time during the dive they find themselves in a position where they cannot complete a direct, unobstructed ascent to the surface because of rock formations.

Humboldt State University requires that no person shall engage in scientific cave or cavern diving unless that person holds a recognized certificate/authorization issued pursuant to the provisions of this manual.

The diver must demonstrate to the DCB or its designee that the diver possesses the proper attitude, judgment, and discipline to safety conduct cave and cavern diving in the context of planned operations.

Operational requirements for cave and cavern diving have been established through accident analysis of previous cave diving accidents.

## 21.1 Definitions

**Alternate Gas Supply** - Fully redundant system capable of providing a gas source to the diver should their primary gas supply fail.
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.
**Cave** – A dive shall be considered a cave dive if any one or more of the environmental limits specified in the definition of cavern are exceeded or otherwise not followed. Linear penetrations limits shall not exceed the limits of each diver's training.
**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** - An entrance and first chamber to a cave where:

1. Sunlight from the entrance is visible to all dive team members at all times during the dive.
2. Members of the dive team do not pass through any restrictions that don't allow the divers to swim side by side during the dive, nor are there any restrictions between the divers and the most expeditious exit to the surface.
3. Maximum depth achieved shall not exceed the depth ratings of dive team.

**Cavern Dive** - A dive which takes place partially or wholly underground, in which the following environmental parameters are met:

1. Natural sunlight is continuously visible from the entrance.
2. Environmental conditions will be evaluated by the DSO or designee and appropriate limits incorporated into the dive plan.

**Dual Valve 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.
**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).
**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.
**Jump/Gap Reel** -Spool or reel used to connect one guide line to another thus ensuring a continuous line to the exit.
**Knife/Line Cutter** - Small, sharp blade capable of easily cutting a guideline and that is accessible to the diver.
**Lava Tube** - Type of cave or cavern formed by the surface hardening of a stream of flowing molten rock, which may later become flooded due to static sea level changes.
**Line Marker** - Any one of several types of markers attached to a guideline, which provides additional navigational information to the dive team, most commonly the direction out to the nearest surface.
**Mine Diving** - Diving in the flooded portions of a man made mine. Necessitates use of techniques detailed for cave diving.
**Penetration Distance** - Linear distance from the entrance intended or reached by a dive team during a dive at a dive site.
**Primary Reel** - Initial guideline used by the dive team from open water to maximum penetration or a permanently installed guideline.
**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 Cave or Cavern Diver In Training** - Authorized to dive in the cave or cavern environment under the direct supervision of qualified instructional personnel for training purposes only.
**Scientific Cavern Diver** - Authorization to dive in an overhead environment as defined in cavern.
**Scientific Cave Diver** - Authorization to dive in an overhead environment as defined in cave.
**Sidemount Diving** - 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.
Solution Cave - Cave formed in carbonate or carbonate cemented bedrock, formed by the dissolution of the rock by groundwater.
**Spring** - Cave with water flowing with a generally continuous outflow.
**Sump** - An area in a dry cave that can no longer be negotiated without the use of diving equipment.
**Well** - A vertical or nearly vertical shaft, usually manmade, through which a diver can access a dive site.

## 21.2 Cave and Cavern Environment Hazards

**Current/Flow** - Underwater caves have currents that vary in strength and direction. Of particular note is a condition known as siphoning. Siphoning caves have flow or current directed into the cave. This can cause poor visibility as a result of mud and silt being drawn into the cave entrance.

**Silt** - The presences of silt, sand, mud, clay, etc. on the cave floor can cause visibility to be reduced to nothing in a very short time.

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

**Cave-ins** - Cave-ins are a normal part of cave evolution; however experiencing a cave-in during diving operations is extremely unlikely.

## 21.3 Minimum Experience and Training Requirements

### 21.31 Cavern Diver

***Prerequisites***

The applicant for training shall have met the requirements in Section 5.00 of the AAUS Standards for Scientific Diving Certification and Operation of Scientific Diving Programs, fourth edition (2003), and hold as a minimum a scientific diver permit.

***Cavern Training***

1. The applicant is to participate in the following areas of training, or their equivalent:
2. Classroom Lecture and Critique—The applicant shall participate in classroom discussion or equivalent type activities covering these topics: Policy for cavern diving, cavern environment and environmental hazards, accident analysis, psychological considerations, equipment, body control, communications, cavern diving techniques, navigation and guidelines, dive planning, cave geology, cave hydrology, cave biology, and emergency procedures.
3. Land Drills—The applicant shall participate in drills above water using the guideline and reel. Drills are to emphasize proper use of the reel, techniques and considerations for laying a guideline, guideline following, buddy communication, and emergency procedures.
4. Cavern Dives—A minimum of four (4) cavern dives, preferably to be conducted in a minimum of two (2) different caverns. Skills the applicant should demonstrate include: Safety drill (S-drill), gear matching, bubble check prior to entering the cavern on each dive, proper buoyancy compensator use, proper trim and body positioning, hovering and buoyancy with hand tasks, specialized propulsion techniques (modified flutter kick, modified frog kick, pull and glide, ceiling walk or shuffle), proper guideline and reel use, ability to follow the guideline with no visibility, sharing air while following a guideline, and sharing air while following the guideline with no visibility light and hand signal use, and ability to comfortably work in a cavern without assistance.
5. Written Examination - A written evaluation approved by the DCB with a predetermined passing score, covering concepts of both classroom and practical training is required.

### 21.32 Cave Diver

***Prerequisites***
The applicant for training shall hold as a minimum a cavern diver permit.

***Cave Training***
1. The applicant is to participate in the following areas of training, or their equivalent:
2. Classroom Lecture and Critique—The applicant shall participate in classroom discussion or equivalent type activities covering these topics: Review of the topics listed in cavern diver training and differing techniques and procedures used in cave diving, additional equipment procedures used in cave diving, cave diving equipment configurations, procedures for conducting diving operations involving complex navigation and use of line markers, advanced gas management and a thorough review of dive tables, decompression tables, and decompression theory.
3. Land Drills—The applicant shall participate in drills above water included in cavern training. Drills are to emphasize proper use of the reel in lost diver procedures, as well as line placements and station location as required for surveying.
4. Cave Dives—A minimum of twelve (12) cave dives, to be conducted in a minimum of four (4) different cave sites with differing conditions recommended. Skills the applicant should demonstrate include: Review of skills listed in cavern training, and special techniques in buoyancy control, referencing and back-up navigation, air sharing in a minor restriction using a single file method, special propulsion techniques in heavy outflow, anti-silting techniques, line jumping techniques and protocols, surveying, and ability to critique their dives. Emergency procedures training shall include proficiency in lost line, lost diver, gas sharing, light failure, valve manipulation, and no/low visibility situations.
5. Written Examination - A written evaluation approved by the DCB with a predetermined passing score, covering concepts of both classroom and practical training is required.

## 21.4 Equipment Requirements

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

### 21.41 Cavern Diving Equipment

The following equipment shall be required, in excess of that detailed for open water SCUBA diving in Volume 1, Section 3.00. Each member of the dive team shall have:
1. At minimum, a single tank equipped with an “H” valve or an alternate air supply.
2. A BCD capable of being inflated from the tank.
3. Slate and pencil.
4. Two battery powered secondary lights of an approved type.
5. Knife or line cutter.
6. One primary reel of at least 350 feet for each team.
7. Snorkel—No snorkel shall be worn while inside underwater cave or cavern.

### 21.42 Cave Diving Equipment

The following equipment shall be required, in excess of that detailed for cavern diving: Each member of the dive team shall have:

1. Cylinders with dual orifice isolation valve manifold or independent SCUBA systems each capable of maintaining enough gas for the diver during exit and ascent to the surface.
2. Two completely independent regulators, at least one of each having submersible tank pressure gauge, a five foot or longer second stage hose, low pressure inflator for the BCD.
3. A primary light with sufficient burn time for the planned dive.
4. Safety reel with at least 150 feet of line.
5. Appropriate submersible dive tables and/or dive computer (computers w/ backup tables).
6. Line markers.
7. Snorkel—No snorkel shall be worn while inside underwater cave or cavern.

## 21.5 Operational Requirements and Safety Protocols

All members of the dive team must have met the applicable all sections of Volume One and applicable sections of Volume Two of the AAUS manual and be authorized for that type of diving by the DCB before conducting scientific cave dives.

### 21.51 Cavern Diver Procedures

1. Cavern diving shall not be conducted at depths greater than 100 feet.
2. Dive teams shall perform a safety drill prior to each cave or cavern penetration that includes equipment check, gas management, and dive objectives.
3. Each team within the cavern zone must utilize a continuous guideline appropriate for the environment leading to a point from which an uninterrupted ascent to the surface may be made.
4. Gas management must be appropriate for the planned dive with special considerations made for; DPV's, siphon diving, rebreathers, etc.
5. The entire dive team is to immediately terminate the dive whenever any dive team member feels an unsafe condition is present.

### 21.52 Cave Diving Procedures

1. Dive teams shall perform a safety drill prior to each cave or cavern penetration that includes equipment check, gas management, and dive objectives.
2. Diver teams must run or follow a continuous guideline from the surface pool to maximum penetration.
3. Gas management must be appropriate for the planned dive with special considerations made for: DPV's, siphon diving, rebreathers, etc.
4. Each diver must carry one primary and two back up lights.
5. Divers utilizing side mount diving or other dual independent diving systems must have the approval of the Diving Safety Officer or his/her designee.
6. The entire dive team is to immediately terminate the dive whenever any dive team member feels an unsafe condition is present.

# List of Appendices


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|---|---|
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## Appendix 1: HSU Diver Certification & Training Documentation

Diver's Name: _____

| Document (Appendix) | |
|---|---|
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| CPR Training | |
| Oxygen Provider Training | |
| HSU Diver Certification Level: | |

# Appendix 2: HSU Diver Certification Application

| | |
|---|---|
| Name: | HSU ID Number: |
| Local Address: | Birth Date: |
| Permanent Address (if different) | Cell Phone: |
| E-Mail: | Home Phone: |
| Occupation: | |
| Employer: | |
| In case of emergency notify: | Relationship: |
| Phone: | |
| (If applicable)<br>Your Doctor: | Phone: |
| Address:_____ | |

**Diving Related Certification or Experience: (Use back of form if needed)**

| Scuba Certification/ Relevant Experience | Agency | Location | Date Certified |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

| | Agency | Date Certified | Expiration Date |
|---|---|---|---|
| First Aid Training: | | | |
| CPR Training: | | | |
| Oxygen Provider Training: | | | |

I understand that I need to complete a Diving Medical Evaluation (Appendix 3) and be approved for diving by a licensed physician before any diving or hyperbaric exposure under the auspices of HSU and that I must comply with all standards and policies of this manual.

| | |
|---|---|
| Signature of Applicant | DATE |

*Note: If you have special individual needs or disabilities, please see the Diving Safety Officer to arrange possible accommodation.

# Appendix 3: HSU Medical Evaluation of Fitness for SCUBA, Surface-Supplied & Free Diving

Section 14, Medical Standards, of the Humboldt State University Diving Safety Manual defines the standards for determining the medical fitness of a person to dive under the auspices of the University. Appendix 3 of the Manual lists the guidelines for the medical evaluation and requirements for medical clearance and approval to dive. The following HSU documents must be included in the physician's evaluation and report of fitness to dive. These documents shall be filed in the Applicant's HSU Diver Certification file.

A-3.1 Diving Medical History Form.

A-3.2 Diving Medical Examination Overview for the Examining Physician, provides the physician with a synopsis of factors which may affect the evaluation of the applicant. It includes a listing of medical conditions which may or should disqualify the applicant for diving and medical references to guide the physician.

It should be stressed that the examining physician must verify that the applicant does not have any medical conditions or limitations that would endanger their safety if they dive. Safety of the diver and Dive Team is the only consideration in determining fitness to dive.

The HSU Diving Safety Officer can provide additional information concerning the demands and rigors of diving, the types of hyperbaric and hypobaric injuries experienced by divers and of the standards described in the Manual.

A-3.3 AAUS/HSU Medical Evaluation of Fitness for Scuba Diving Report

# Appendix 3.1: DIVING MEDICAL HISTORY FORM

(To Be Completed By Applicant-Diver)

| Name | Sex | Age | Wt. | Ht. |
|---|---|---|---|---|
| Email: | Date: | Phone: | | |

TO THE APPLICANT:

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

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

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

| | Yes | No | Please indicate whether or not the following apply to you | Comments |
|---|---|---|---|---|
| | | | | |
| 1 | | | Convulsions, seizures, or epilepsy | |
| 2 | | | Fainting spells or dizziness | |
| 3 | | | Been addicted to drugs | |
| 4 | | | Diabetes | |
| 5 | | | Motion sickness or sea/air sickness | |
| 6 | | | Claustrophobia | |
| 7 | | | Mental disorder or nervous breakdown | |
| 8 | | | Are you pregnant? | |
| 9 | | | Do you suffer from menstrual problems? | |
| 10 | | | Anxiety spells or hyperventilation | |
| 11 | | | Frequent sour stomachs, nervous stomachs or vomiting spells | |
| 12 | | | Had a major operation | |

| | Yes | No | Please indicate whether or not the following apply to you | Comments |
|---|---|---|---|---|
| 13 | | | Presently being treated by a physician | |
| 14 | | | Taking any medication regularly (even non-prescription) | |
| 15 | | | Been rejected or restricted from sports | |
| 16 | | | Headaches (frequent and severe) | |
| 17 | | | Wear dental plates | |
| 18 | | | Wear glasses or contact lenses | |
| 19 | | | Bleeding disorders | |
| 20 | | | Alcoholism | |
| 21 | | | Any problems related to diving | |
| 22 | | | Nervous tension or emotional problems | |
| 23 | | | Take tranquilizers | |
| 24 | | | Perforated ear drums | |
| 25 | | | Hay fever | |
| 26 | | | Frequent sinus trouble, frequent drainage from the nose, post-nasal drip, or stuffy nose | |
| 27 | | | Frequent earaches | |
| 28 | | | Drainage from the ears | |
| 29 | | | Difficulty with your ears in airplanes or on mountains | |
| 30 | | | Ear surgery | |
| 31 | | | Ringing in your ears | |
| 32 | | | Frequent dizzy spells | |
| 33 | | | Hearing problems | |
| 34 | | | Trouble equalizing pressure in your ears | |
| 35 | | | Asthma | |
| 36 | | | Wheezing attacks | |
| 37 | | | Cough (chronic or recurrent) | |
| 38 | | | Frequently raise sputum | |
| 39 | | | Pleurisy | |

| | Yes | No | Please indicate whether or not the following apply to you | Comments |
|---|---|---|---|---|
| 40 | | | Collapsed lung (pneumothorax) | |
| 41 | | | Lung cysts | |
| 42 | | | Pneumonia | |
| 43 | | | Tuberculosis | |
| 44 | | | Shortness of breath | |
| 45 | | | Lung problem or abnormality | |
| 46 | | | Spit blood | |
| 47 | | | Breathing difficulty after eating particular foods, after exposure to particular pollens or animals | |
| 48 | | | Are you subject to bronchitis | |
| 49 | | | Subcutaneous emphysema (air under the skin) | |
| 50 | | | Air embolism after diving | |
| 51 | | | Decompression sickness | |
| 52 | | | Rheumatic fever | |
| 53 | | | Scarlet fever | |
| 54 | | | Heart murmur | |
| 55 | | | Large heart | |
| 56 | | | High blood pressure | |
| 57 | | | Angina (heart pains or pressure in the chest) | |
| 58 | | | Heart attack | |
| 59 | | | Low blood pressure | |
| 60 | | | Recurrent or persistent swelling of the legs | |
| 61 | | | Pounding, rapid heartbeat or palpitations | |
| 62 | | | Easily fatigued or short of breath | |
| 63 | | | Abnormal EKG | |
| 64 | | | Joint problems, dislocations or arthritis | |
| 65 | | | Back trouble or back injuries | |
| 66 | | | Ruptured or slipped disk | |

| | Yes | No | Please indicate whether or not the following apply to you | Comments |
|---|---|---|---|---|
| 67 | | | Limiting physical handicaps | |
| 68 | | | Muscle cramps | |
| 69 | | | Varicose veins | |
| 70 | | | Amputations | |
| 71 | | | Head injury causing unconsciousness | |
| 72 | | | Paralysis | |
| 73 | | | Have you ever had an adverse reaction to medication? | |
| 74 | | | Do you smoke? | |
| 75 | | | Have you ever had any other medical problems not listed? If so, please list or describe below; | |
| 76 | | | Is there a family history of high cholesterol? | |
| 77 | | | Is there a family history of heart disease or stroke? | |
| 78 | | | Is there a family history of diabetes? | |
| 79 | | | Is there a family history of asthma? | |
| 80 | | | Date of last tetanus shot? | |
| Vaccination dates? | | | | |

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

_____
_____
_____
_____

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

| | |
|---|---|
| Signature | Date |

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

## Appendix 3.2: DIVING MEDICAL EXAM OVERVIEW FOR THE EXAMINING PHYSICIAN

**TO THE EXAMINING PHYSICIAN:**

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

| Diving Safety Officer | Phone Number |
|---|---|
| Richard Alvarez | 707 826-4539 |
| Email | |
| rma1@humboldt.edu | |

Scuba and other modes of compressed-gas diving can be strenuous and hazardous. A special risk is present if the middle ear, sinuses, or lung segments do not readily equalize air pressure changes. The most common cause of distress is Eustachian insufficiency. Recent deaths in the scientific diving community have been attributed to cardiovascular disease. Please consult the following list of conditions that usually restrict candidates from diving. (Adapted from Bove, 1998: bracketed numbers are pages in Bove)

CONDITIONS WHICH MAY DISQUALIFY CANDIDATES FROM DIVING

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

19. Implanted cardiac pacemakers and cardiac defibrillators (ICD). [39, 40]
20. Inadequate exercise tolerance. [34]
21. Severe hypertension. [35]
22. History of spontaneous or traumatic pneumothorax. [45]
23. Asthma. [42 - 44]
24. Chronic pulmonary disease, including radiographic evidence of pulmonary blebs, bullae, or cysts. [45,46]
25. Diabetes mellitus. [46 - 47]
26. Pregnancy. [56]

SELECTED REFERENCES IN DIVING MEDICINE

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


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

# Appendix 3.3: AAUS/HSU MEDICAL EVALUATION OF FITNESS FOR SCUBA DIVING REPORT

| Name of Applicant (Print or Type) | Date of Medical Evaluation (Month/Day/Year) |
|---|---|
| | |

To The Examining Physician: Scientific divers require periodic scuba diving medical examinations to assess their fitness to engage in diving with self-contained underwater breathing apparatus (scuba). Their answers on the Diving Medical History Form may indicate potential health or safety risks as noted. Scuba diving is an activity that puts unusual stress on the individual in several ways. Your evaluation is requested on this Medical Evaluation form. Your opinion on the applicant's medical fitness is requested. Scuba diving requires heavy exertion. The diver must be free of cardiovascular and respiratory disease (see references, following page). An absolute requirement is the ability of the lungs, middle ears and sinuses to equalize pressure. Any condition that risks the loss of consciousness should disqualify the applicant. Please proceed in accordance with the AAUS Medical Standards (Sec. 6.00). If you have questions about diving medicine, please consult with the Undersea Hyperbaric Medical Society or Divers Alert Network.

TESTS: THE FOLLOWING TESTS ARE REQUIRED:

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

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

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

- Chest x-ray (Required only during first exam over age 40)
- Resting EKG
- Assessment of coronary artery disease using Multiple-Risk-Factor Assessment1

(age, lipid profile, blood pressure, diabetic screening, smoking)

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

PHYSICIAN'S STATEMENT (please indicate):

_____01 Diver IS medically qualified to dive for: _____ 2 years (over age 60)
_____ 3 years (age 40-59)
_____ 5 years (under age 40)

_____ 02 Diver IS NOT medically qualified to dive: _____Permanently _____Temporarily.

I have evaluated the abovementioned individual according to the American Academy of Underwater Sciences/Humboldt State University medical standards and required tests for scientific diving (Sec. 14.00 and Appendix 3) and, in my opinion, find no medical conditions that may be disqualifying for participation in scuba diving. I have discussed with the patient any medical condition(s) that would not disqualify him/her from diving but which may seriously compromise subsequent health. The patient understands the nature of the hazards and the risks involved in diving with these conditions.

| | | | |
|---|---|---|---|
| MD or DO | | Address | |
| Signature | | Telephone Number | |
| Name (Print or Type) | | E-Mail Address | |
| My familiarity with applicant is: _____This exam only _____Regular physician for _____ years | | | |
| My familiarity with diving medicine is: | | | |

APPLICANT'S RELEASE OF MEDICAL INFORMATION FORM

_____

Name of Applicant (Print or Type)

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

Signature of Applicant

_____Date_____

REFERENCES

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

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

# Appendix 4: CSU/HSU and NAUI Waiver, Release and Indemnity Agreement

For consideration of permitting
(Diver/Student):_____
to enroll in and participate in diving activities and/or class instruction of Free Diving and/or SCUBA diving given byHSU, NAUI and instructor/s:_____
in the city of Arcata, county of Humboldt, in the state of California, such activities are to begin on (date) _____, the undersigned hereby voluntarily releases, discharges, waives and relinquishes any and all actions or causes of action for personal injury, property damage or wrongful death occurring to him or her, which injury, property damage or wrongful death arises as a result of engaging in, or receiving instructions in said diving activity and any activities incidental to such activities or instructions, wherever, whenever or however such may occur. The undersigned does for him/herself, his/her heirs, executors, administrators and assigns hereby release, waive, discharge and relinquish any action or causes of action, which may hereafter arise for him/herself and for his/her estate, and agrees that under no circumstances will he/she or his/her heirs, executors, administrators and assigns prosecute or present any claim for personal injury, property damage or wrongful death against HSU and instructor/s: _____or against any of its agents, servants or employees for any of said causes of action, whether the same shall arise by the negligence of any of said persons or organizations, or otherwise.

IT IS THE INTENTION OF (Diver/Student) _____, BY SIGNING THIS DOCUMENT, TO EXEMPT AND RELIEVE THE ORGANIZATION AND INSTRUCTOR/S NAMED HEREIN AND THEIR AGENTS, SERVANTS AND EMPLOYEES, FROM LIABILITY FOR PERSONAL INJURY, PROPERTY DAMAGE OR WRONGFUL DEATH CAUSED BY NEGLIGENCE. BY SIGNING THIS DOCUMENT, THE DIVER/STUDENT ACKNOWLEDGES THAT HE/SHE ASSUMES THE RISK OF PERSONAL INJURY, PROPERTY DAMAGE OR WRONGFUL DEATH UPON HIM/HERSELF.

The undersigned, for him/herself, his/her heirs, executors, administrators or assigns agrees that in the event any claim for personal injury, property damage or wrongful death shall be prosecuted against the organization or instructor/s named above, he/she shall indemnify and hold them harmless from any and all claims or causes of action by whomever or wherever ma de or presented for personal injuries, property damage or wrongful death.

The undersigned acknowledges that he/she has read the foregoing paragraphs and fully understands the legal rights that he/she is giving up by signing this document. He/she further warrants that he/she has been fully and completely advised of the potential hazards and dangers incidental to engaging in the activity and/or instruction of Free Diving, SCUBA diving, Surface-supplied diving or diving related activities.

| Signature of Student (Participant) | Date | Signature of Witness | Date |
|---|---|---|---|
| | | | |
| Printed Name of Student(Participant) | | Printed Name of Witness | |
| | | | |
| Signature of Parent or Guardian (If Student is a minor) | | | Date |

# Appendix 5: HSU Diving Standards & Diving Safety Manual Statement of Understanding

I (Diver's Name)_____, have in my possession a current copy of the Humboldt State University Diving Safety Manual .

I have read and fully understand the contents of the Diving Safety Manual and agree to comply with all guidelines, regulations, procedures, and standards in the manual. I understand that failure to comply with the regulations of the manual may be cause for revocation, suspension, or restriction of my HSU diving certification by action of the campus Diving Safety Officer or the HSU Diving Control Board.

| | |
|---|---|
| Signature | Witness Signature |
| | |
| Printed Name | Witness Printed Name |
| | |
| Date Signed | Date Signed |

# Appendix 6: HSU Diver Emergency Information

| | | | |
|---|---|---|---|
| Name | | Birth date | |
| Address | | Phone | |
| In case of Emergency Contact: | | Phone | |
| | | Cell Phone | |
| Relationship | | Address | |
| Medical Alert Information | | Required Medications | |
| Known Allergies | | | |
| Personal Physician | | Phone: | |

"In an emergency, I hereby authorize medical treatment and/or treatment in a recompression chamber."

| | |
|---|---|
| | |
| Signature | Witness Signature |
| | |
| Printed Name | Witness Printed Name |
| | |
| Date Signed | Date Signed |
| | |
| Parent/Guardian (if under age of 18) | Date Signed |

| ***Emergency Information To Be Sent With Victim*** | |
|---|---|
| Background information on accident | |
| Describe signs and symptom and note time | |
| Describe First Aid given and note time | |

# Appendix 7: HSU Diver Certification Skills Verification

All University Divers (AAUS Diver in Training) must complete the following skills at a minimum as either part of the NAUI Master Diver course, or must show competency in order to begin Scientific Diver Training.

| Skill | Date | Location | Diver Initials |
|---|---|---|---|
| ***Confined Water*** | | | |
| *1. Swimming Test* | | | |
| Swim underwater without swim aids for a distance of 75 feet without surfacing. | | | |
| Swim 400 yards in less than 12 minutes without swim aids. | | | |
| Tread water for 10 minutes | | | |
| Without the use of swim aids, transport another person of equal size a distance of 75 feet in the water. | | | |
| Swim underwater for a distance of 150 feet on four breaths using freediving equipment. | | | |
| *2. Free Diving* | | | |
| Entries | | | |
| Giant Stride | | | |
| Back Roll | | | |
| Seated Entry | | | |
| Surface swimming (450 yds non-stop) equipped as a freediver | | | |
| Free dive: 25 yds UW | | | |
| Unconscious Freediver Recovery from at least 10ft | | | |
| Surface Dives | | | |
| Pike Dive | | | |
| Weight belt R/R (surface & UW) | | | |
| Mask R&R @ 10 ft | | | |
| Bail In (enter water with freediving gear in hand and don equipment) | | | |
| Deep water exit | | | |
| *2. SCUBA Diving (Confined Water)* | | | |
| Gear assembly | | | |
| Buddy check | | | |
| Entries | | | |
| Giant Stride | | | |
| Back Roll | | | |
| Neutral buoyancy @ 10 ft | | | |
| Regulator R&R | | | |
| Sweep | | | |
| Reach | | | |

| | | | |
|---|---|---|---|
| Mask R&R (UW) | | | |
| Mask off: Regulator R&R | | | |
| Weight belt R&R (surface) | | | |
| Weight belt R&R (UW) | | | |
| Tank R&R (surface) | | | |
| Tank R&R (UW) | | | |
| Buddy breathing: stationary | | | |
| Mask off BB | | | |
| Buddy breathing: swim | | | |
| Octopus breathing: stationary | | | |
| Mask off Octo | | | |
| Octopus breathing: 50 yd swim | | | |
| Octopus breathing: ascent | | | |
| Emergency swimming: ascent | | | |
| *3. Diver Rescue* | | | |
| Approaches: surface | | | |
| Victim wt belt removal: surface | | | |
| Assists (50yds) | | | |
| Cramp removal | | | |
| Victim wt belt removal: UW | | | |
| Victim BCD inflation: surface | | | |
| Unconscious UW diver recovery (10 ft) | | | |
| ***Open Water*** | | | |
| *1. Scuba* | | | |
| Gear assembly | | | |
| Buddy check | | | |
| Entries | | | |
| Surf | | | |
| Rocky Shore | | | |
| Boat | | | |
| Neutral Buoyancy Check | | | |
| Surface swimming 400 yds (using snorkel) | | | |
| Controlled Descent | | | |
| Airspace Equalization | | | |
| Regulator R&R | | | |
| Reach | | | |
| Sweep | | | |
| Mask R&R | | | |
| Weight Belt R&R | | | |
| Surface | | | |
| Underwater | | | |
| Neutral Buoyancy | | | |
| Fin tip Rise | | | |
| Gear R&R | | | |
| Surface | | | |

| | | | |
|---|---|---|---|
| Underwater | | | |
| Octopus breathing: stationary | | | |
| Octopus breathing: 50 yd swim | | | |
| Octopus breathing: ascent | | | |
| Emergency Swimming Ascent | | | |
| Navigation | | | |
| Reciprocal Course | | | |
| Square Course | | | |
| Buddy Awareness | | | |
| Plan and Execute an Open Water Dive | | | |
| Search Patterns | | | |
| Series of U's | | | |
| Expanding Squares | | | |
| Exits | | | |
| Surf | | | |
| Rocky | | | |
| Ladder | | | |
| *2.Free Diving* | | | |
| Pike Dive 5X | | | |
| U/C Diver Recovery | | | |
| Cramp removal | | | |
| Self and Buddy | | | |
| Open Water Dives | | | |
| Dive #1 | | | |
| Dive #2 | | | |
| Dive #3 | | | |
| Dive #4 | | | |
| Dive #5 | | | |
| Dive #6 | | | |
| Dive #7 | | | |
| Dive #8 | | | |
| Dive #9 | | | |
| Dive #10 | | | |
| Dive #11 | | | |
| Dive #12 | | | |
| NAUI Master Diver Written Score: | | | |
| The above diver has completed all indicated skills to the satisfaction of the HSU Instructor or DSO, and has shown competency and comfort in those skills indicated. | | | |
| | | | |
| Instructor/DSO Signature | | Date | Inst. # |

# Appendix 8: HSU/AAUS REQUEST FOR DIVING RECIPROCITY FORM VERIFICATION OF DIVER TRAINING AND EXPERIENCE

Diver:_____ Date:_____

This letter serves to verify that the above listed person has met the training and pre-requisites as indicated below, and has completed all requirements necessary to be certified as a *(Scientific Diver / Diver in Training)* as established by the *Humboldt State University* Diving Safety Manual, and has demonstrated competency in the indicated areas. Humboldt State University is an AAUS OM and meets or exceeds all AAUS training requirements.

**The following is a brief summary of this diver's personnel file regarding dive status at Humboldt State University:**

(Date)

_____ Original diving authorization
_____ Written scientific diving examination
_____ Last diving medical examination Medical examination expiration date_____
_____ Most recent checkout dive
_____ Scuba regulator/equipment service/test
_____ CPR training (Agency) _____ CPR Exp. _____
_____ Oxygen administration (Agency) _____ 02 Exp. _____
_____ First aid for diving _____ F.A. Exp. _____
_____ Date of last dive _____ Depth
Number of dives completed within previous 12 months?_____ Depth Certification_____ fsw
Total number of career dives? _____

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

Please indicate any pertinent specialty certifications or training:

Emergency Information:
Name: Relationship:
Telephone: (work) (home)
Address:

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

Diving Safety Officer:

_____ _____
(Signature) (Date)

_____ _____
(Print) Email/Phone

# Appendix 9: HSU Procedure for Suspending HSU Diver Certification and Diving Activities

The purpose of this protocol is to provide a clear and definitive procedure for the suspension of diving operations and/or diver certification(s) under the auspices of Humboldt State University.

Suspension of Diving Activities

When can diving activities be suspended?

Diving operations and/or diver certification(s) can be suspended if the health or safety of the dive team or individual diver may be in jeopardy and when California State University or Humboldt State University regulations are violated.

Who can suspend diving activities?

Suspension can be initiated by any of the following:

- Diving Safety Officer (Section 3.3.2)
- Diving Control Board (Section 3.4.2)
- Dive Team Members (Section 6.5)
- Lead Diver (Section 3.6)

How are diving activities suspended?

1. Initial notification and suspension of diving operations and/or diver certification(s) may be delivered verbally or in writing. If the notification of suspension is written, the document shall be signed by the person suspending the activities and the dive team member(s) receiving the suspension notification. All parties signing the document shall be given a copy of the document.
2. Within forty-eight (48) hours after the suspension of diving activities, a written explanation and justification of the suspension shall be delivered to the Diving Control Board (DCB) Chair or the Diving Safety Officer (DSO).
3. The DCB shall deliver written notification of the suspension to the Lead Diver and dive team member(s) affected by the suspension. This written notification shall be delivered within five (5) working days after the date that the DCB or DSO was notified (in writing) of the suspension. The DCB Chair, DSO, Lead Diver, and suspended divers shall sign and receive a copy of the document.

The suspension notification shall contain the following:

1. The name(s) of the diver(s) whose diving privilege(s) is/are suspended;
2. The identification of the dive plan or diving operation that was suspended.
3. An explanation of why the diving activities/certification(s) were suspended.
4. The length of the suspension and conditions or actions necessary for reinstatement of diving privileges (certification).

# Appendix 10: HSU Review and Appeal of Diver Certification Suspension

STEP #1 - Suspended Diver(s) shall respond in writing to the DCB within five (5) working days of receipt of the written suspension notification from the DCB. The written response shall include, but not be limited to:

1. A review of the events or conditions which led to the suspension and were listed in the suspension notification.
2. How these events or conditions will be rectified, corrected, and prevented.
3. A request, if desired, to appear before the DCB to provide information regarding the suspension or to appeal the suspension.

STEP #2 –The Diving Control Board shall meet within ten (10) working days of receipt of the written response from the suspended diver(s) to review the information provided.

STEP #3 The Diving Control Board shall set a hearing date, if a hearing is requested by the suspended diver(s). This request for a hearing date must be written and delivered to the DCB. The board shall set a hearing date within fifteen (15) working days after receipt of such request.

STEP #4 –The Diving Control Board shall consider any written information or appeal from the suspended divers and shall modify, cancel, or reaffirm the suspension of diving activities. The DCB shall deliver to the suspended diver(s), within five (5) working days, a written review of its decision which shall include, but not be limited to:

1. Any modifications to the written suspension notification from the DCB.
2. A response to the written information or information delivered during the appeal hearing by the suspended diver(s).
3. The terms and duration of the suspension.
4. The conditions necessary for re-certification of the suspended divers for diving under the auspices of HSU.

# Appendix 11: HSU DIVE PLAN

| Lead Diver: | Certification |
|---|---|
| Other Dive Team Members: | |
| | |
| | |
| | |
| | |
| | |
| | |

| Date(s) Of Dive(s) | |
|---|---|
| Location(s) of Dive(s) | |
| Estimated Depth and Bottom Time for Each Dive | |
| Summary of Dive Objectives and Activities. (List equipment, boats and support equipment to be used, description of repetitive dive profile and any anticipated hazards.) Attach additional information as needed: | |
| | |

Current Emergency Management Plan Attached or on File? _____Yes _____No

Lead Diver's Signature: _____ DATE: _____

Approved By:
HSU Diving Safety Officer: _____ DATE: _____

| DSO Comments: | |
|---|---|

* See back of this form for restrictions and to list additional information

# Appendix 12: HSU Dive Log

Each dive made under the auspices of the University shall be documented on the HSU Dive Log. These standardized logs can be copied from this manual or procured from the DSO.

1. Divers shall log each open water dive. Open water dives include all SCUBA, Surface Supplied and Free Dives.
2. Document the following:
    a. Date of dive
    b. Buddy's name
    c. Location of dive
    d. Course or Project
    e. Breathing Gas
    f. Diving Mode
    g. What the objective of the dive was (Training, Proficiency, Scientific)
    h. Maximum Depth and Bottom Time
    i. If dive tables are used as the profiling method, document the appropriate letter groups and RNT for each dive.
    j. If a dive computer is used for profiling dives fill in the appropriate boxes of maximum depth and bottom time, but you will not be able to complete the letter group or RNT boxes. Place an N/A in these boxes.
    k. Indicated how deep and how long a safety stop was conducted for the dive
    l. Sea State/Surf Height (if observed)
    m. Underwater visibility (if measured)
    n. Water Temperature (if measured)
3. The back of the HSU Dive Log can be used for additional dive information and comments
4. In the case of a diving incident or injury a detailed description of the event and the actions taken should be written on the reverse of the log.
5. Each diver shall submit completed HSU Dive Logs to the Diving Safety Officer or his/her designee within seven (7) days after the date of the last dive on the log. Completed HSU Dive Logs shall be placed in the diver's HSU Diver Certification file.

Humboldt State University Scientific Diving Program

# Dive Log

| Name: | | Month: | | | | | Year: | | | Type of Tables/Computer: | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Date | Buddy | Location | Course or Project Name | Breathing Gas (Air/Nitrox) | Diving Mode (Scuba, Freediving, Surface Supplied, Hookah) | Training, Proficiency, Scientific | Surface Interval | Group In | Max. Depth | Bottom Time | RNT | Group Out | Safety Stop fsw / min | Sea State Surf Height | Visibilty | Water Temp | Altitude | Comments |
| | | | | | | | | | | | | | | | | | | |
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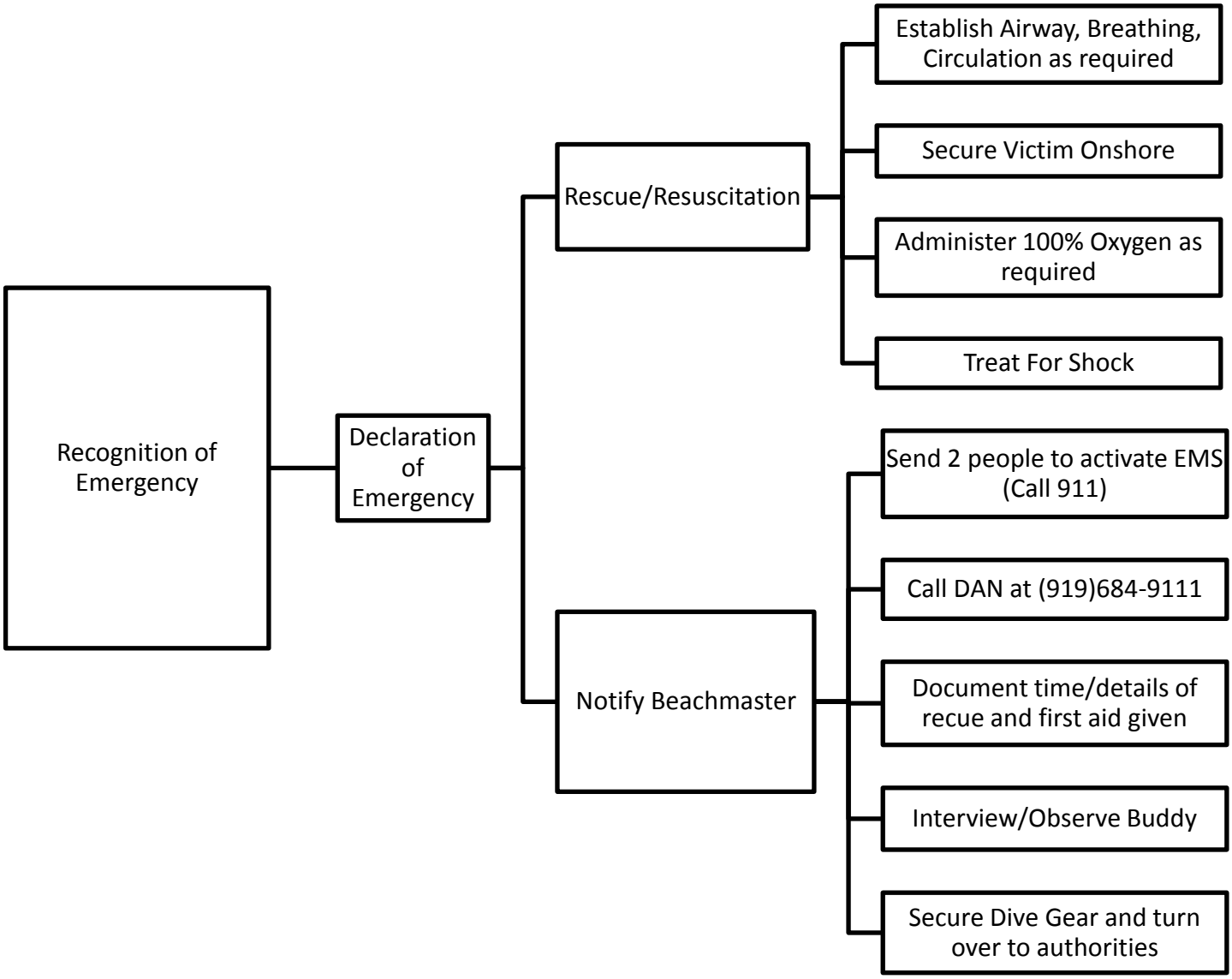
Have you been hospitalized or have you had any serious illnesses (YES/NO)? If the answer is "Yes" please discuss this with the Diving Safety Officer before resuming diving. Please fill out this log sheet as completely as possible.

# Appendix 13: HSU Diving Accident Management Plan




| CITY: | Gold Beach | Crescent City | Trinidad | Eureka | Trinity Lake | Fort Bragg | Monterey |
|---|---|---|---|---|---|---|---|
| HOSPITAL: | Curry General | Sutter Coast | Mad River | St Joseph | Trinity County | Mendocino Coast | Mont. Commun |
| PHONE: | (541) 247-6621 | (707) 464-8888 | (707) 822-3621 | (707) 445-8121 | (530) 623-5541 | (707) 961-1234 | (831) 624-5311 |

USCG Astoria: (503) 861-2242
USCG Humboldt Bay: (707) 839-6100
USCG Search and Rescue Fort Bragg: (707) 964-6611

# Appendix 14

## DEFINITION OF TERMS

**Air sharing** - Sharing of an air supply between divers.
**ATA(s**) - "Atmospheres Absolute", Total pressure exerted on an object, by a gas or mixture of gases, at a specific depth or elevation, including normal atmospheric pressure.
**Breath-hold Diving** - A diving mode in which the diver uses no self-contained or surface-supplied air or oxygen supply.
**Buddy Breathing** - Sharing of a single air source between divers.
**Buddy Diver** - Second member of the dive team.
**Buddy System** -Two comparably equipped scuba divers in the water in constant communication.
**Buoyant Ascent** - An ascent made using some form of positive buoyancy.
**Burst Pressure** - Pressure at which a pressure containment device would fail structurally.
**Certified Diver** - A diver who holds a recognized valid certification from an organizational member or internationally recognized certifying agency.
**Controlled Ascent** - Any one of several kinds of ascents including normal, swimming, and air sharing ascents where the diver(s) maintain control so a pause or stop can be made during the ascent.
**Cylinder** - A pressure vessel for the storage of gases.
**Decompression Chamber** - A pressure vessel for human occupancy. Also called a hyperbaric chamber or decompression chamber.
**Decompression Sickness** - A condition with a variety of symptoms, which may result from gas, and bubbles in the tissues of divers after pressure reduction.
**Dive** - A descent into the water, an underwater diving activity utilizing compressed gas, an ascent, and return to the surface.
**Dive Computer**- A microprocessor based device which computes a diver's theoretical decompression status, in real time, by using pressure (depth) and time as input to a decompression model, or set of decompression tables, programmed into the device.
**Dive Location** - A surface or vessel from which a diving operation is conducted.
**Dive Site** - Physical location of a diver during a dive.
**Dive Table** - A profile or set of profiles of depth-time relationships for ascent rates and breathing mixtures to be followed after a specific depth-time exposure or exposures.
**Diver** - An individual in the water who uses apparatus, including snorkel, which supplies breathing gas at ambient pressure.
**Diver-In-Training** - An individual gaining experience and training in additional diving activities under the supervision of a dive team member experienced in those activities.
**Diver-Carried Reserve Breathing 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.
**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 (Section 3.4).
**Diving Safety Officer (DSO)** - Individual responsible for the safe conduct of the scientific diving program of the membership organization (Section 3.3).
**EAD** - Equivalent Air Depth (see below).
**Emergency Ascent** - An ascent made under emergency conditions where the diver exceeds the normal ascent rate.

**Enriched Air (EANx)** - A name for a breathing mixture of air and oxygen when the percent of oxygen exceeds 21%. This term is considered synonymous with the term "nitrox" (Section 7.00).
**Equivalent Air Depth (EAD)** - Depth at which air will have the same nitrogen partial pressure as the nitrox mixture being used. This number, expressed in units of feet seawater or saltwater, will always be less than the actual depth for any enriched air mixture.
**fN2** - Fraction of nitrogen in a gas mixture, expressed as either a decimal or percentage, by volume.
**fO2** - Fraction of oxygen in a gas mixture, expressed as either a decimal or percentage, by volume.
**FFW** – Feet or freshwater, or equivalent static head.
**FSW** - Feet of seawater, or equivalent static head.
**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.
**Lead Diver** - Certified scientific diver with experience and training to conduct the diving operation.
**Maximum Working Pressure** - Maximum pressure to which a pressure vessel may be exposed under standard operating conditions.
**Organizational Member** - An organization which is a current member of the AAUS, and which has a program, which adheres to the standards of the AAUS as, set forth in the AAUS Standards for Scientific Diving Certification and Operation of Scientific Diving Programs.
**Mixed Gas** - MG
**Mixed-Gas Diving** - A diving mode in which the diver is supplied in the water with a breathing gas other than air.
**MOD** - Maximum Operating Depth, usually determined as the depth at which the pO2 for a given gas mixture reaches a predetermined maximum.
**MSW** - Meters of seawater or equivalent static head.
**Nitrox** - Any gas mixture comprised predominately of nitrogen and oxygen, most frequently containing between 21% and 40% oxygen. Also be referred to as Enriched Air Nitrox, abbreviated EAN.
**NOAA Diving Manual**: Refers to the NOAA Diving Manual, Diving for Science and Technology, 2001 edition. National Oceanic and Atmospheric Administration, Office of Undersea Research, US Department of Commerce.
**No-Decompression limits** - Depth-time limits of the "no-decompression limits and repetitive dive group designations table for no-decompression air dives" of the U.S. Navy Diving Manual or equivalent limits.
**Normal Ascent** - An ascent made with an adequate air supply at a rate of 60 feet per minute or less.
**Oxygen Clean** - All combustible contaminants have been removed.
**Oxygen Compatible** - A gas delivery system that has components (o-rings, valve seats, diaphragms, etc.) that are compatible with oxygen at a stated pressure and temperature.
**Oxygen Service** - A gas delivery system that is both oxygen clean and oxygen compatible.
**Oxygen Toxicity Unit** - OTU
**Oxygen Toxicity** - Any adverse reaction of the central nervous system ("acute" or "CNS" oxygen toxicity) or lungs ("chronic", "whole-body", or "pulmonary" oxygen toxicity) brought on by exposure to an increased (above atmospheric levels) partial pressure of oxygen.
**Pressure-Related Injury** - 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.
**pN2** - Inspired partial pressure of nitrogen, usually expressed in units of atmospheres absolute.
**pO2** - Inspired partial pressure of oxygen, usually expressed in units of atmospheres absolute.
**Psi** - Unit of pressure, “pounds per square inch.
**Psig** - Unit of pressure, “pounds per square inch gauge.
**Recompression Chamber** - see decompression chamber.
**Scientific Diving** - Scientific diving is defined (29CFR1910.402) as diving performed solely as a necessary part of a scientific, research, or educational activity by employees whose sole purpose for diving is to perform scientific research tasks.
**Scuba Diving** - A diving mode independent of surface supply in which the diver uses open circuit self-contained underwater breathing apparatus.
**Standby Diver** - A diver at the dive location capable of rendering assistance to a diver in the water.
Surface Supplied Diving - 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.
**Umbilical** - Composite hose bundle between a dive location and a diver or bell, or between a diver and a bell, which supplies a diver or bell with breathing gas, communications, power, or heat, as appropriate to the diving mode or conditions, and includes a safety line between the diver and the dive location.
**Working Pressure** - Normal pressure at which the system is designed to operate.Definition of Terms

# Appendix 15: AAUS STATISTICS COLLECTION CRITERIA AND DEFINITIONS COLLECTION CRITERIA:

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

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

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

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

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

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

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

DEFINITIONS:

Dive Classification:

- Scientific Dives: Dives that meet the scientific diving exemption as defined in 29 CFR 1910.402. Diving tasks traditionally associated with a specific scientific discipline are considered a scientific dive. Construction and trouble-shooting tasks traditionally associated with commercial diving are not considered a scientific dive.
- Training and Proficiency Dives: Dives performed as part of a scientific diver training program, or dives performed in maintenance of a scientific diving certification/authorization.

- Breathing Gas:
  - Air: Dives where the bottom gas used for the dive is air.
  - Nitrox: Dives where the bottom gas used for the dive is a combination of nitrogen and oxygen other than air.
  - Mixed Gas: Dives where the bottom gas used for the dive is a combination of oxygen, nitrogen, and helium (or other "exotic" gas), or any other breathing gas combination not classified as air or nitrox.
- Diving Mode:
  - Open Circuit Scuba: Dives where the breathing gas is inhaled from a self contained underwater breathing apparatus and all of the exhaled gas leaves the breathing loop.

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

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

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

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

Incident Classification Rating Scale:

Minor: Injuries that the OM considers being minor in nature. Examples of this classification of incident would include, but not be limited to:

- Mask squeeze that produced discoloration of the eyes.
- Lacerations requiring medical attention but not involving moderate or severe bleeding.
- Other injuries that would not be expected to produce long term adverse effects on the diver's health or diving status.

Moderate: Injuries that the OM considers being moderate in nature. Examples of this classification would include, but not be limited to:

- DCS symptoms that resolved with the administration of oxygen, hyperbaric treatment given as a precaution.
- DCS symptoms resolved with the first hyperbaric treatment.
- Broken bones.
- Torn ligaments or cartilage.
- Concussion.
- Ear barotrauma requiring surgical repair.

Serious: Injuries that the OM considers being serious in nature. Examples of this classification would include, but not be limited to:

- Arterial Gas Embolism.
- DCS symptoms requiring multiple hyperbaric treatment.
- Near drowning.
- Oxygen Toxicity.
- Hypercapnea.
- Spinal injuries.
- Heart attack.
- Fatality.