



# Diving Safety Manual

---

Alaska Pacific University  
4101 University Dr.  
Anchorage, AK 99508  
[www.alaskapacific.edu](http://www.alaskapacific.edu)  
(907) 564-8292

## Foreword

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

This document represents the minimal safety standards for scientific diving at the present day. As diving science progresses, so shall this manual, and it is the responsibility of every member of the American Academy of Underwater Sciences (AAUS) to see that it always reflects state of the art, safe diving practice.

Guidelines for diving technologies sanctioned by AAUS but not included in this manual, e.g., Aquarium Diving, Saturation Diving, and Rebreather diving (<http://www.aaus.org>), may be added to future revisions of this manual as that diving technique becomes necessary.

The policies, procedures and standards set forth in this Scientific Diving Safety Manual are intended to govern the training and diving operations of all personnel participating in the Scientific Diving Program at the Alaska Pacific University (APU). It applies to all divers operating under APU auspices, including visiting divers, and to those APU campus officers responsible for the administration of this scuba program.

## Acknowledgements

APU thanks the dedicated individuals who have been involved with the APU Dive Safety Program since its inception in 2000 and whose efforts in revising this manual gained AAUS organizational acceptance in 2010.

## Revision History

First edition October 2010

Revision June 2015:

- Inserted Table of Contents.

- Inserted a description at the beginning of Volume I and Volume II

- Removed Sections 7 and 9-13 from Volume II.

- Inserted Section 14: Scientific Dive Program at APU in Volume II

- Inserted instructions for medical exam at the beginning of Appendices.

- Formatted document for consistency

- Edited the Foreword and Sections 1.10, 1.20, 2.6 and 3.6 for consistency with the 2013 AAUS Standards.

- Section 3.10 - added "and serviced according to manufacturers' recommendations"

- Section 4.0 - removed specific requirements for Entry-Level Training. Adopted WRSTC/ISO standards by reference.

- Section 5.0 - merged requirements for Entry-Level Diver Training with Scientific Diver Training.

- Section 6.0 – revised for consistency with AAUS Standards following Revision after Medical Review Panel review

- Appendix 1 – revised for consistency with AAUS Standards following Revision May 2013

- Appendix 2 – revised for consistency with AAUS Standards following Revision Dec 2009

- Appendices 3 – 9 revised for consistency with AAUS Standards

- Appendix 4 – added physician contact details

- Appendix 7 – added local emergency numbers

# Table of Contents

---

Volume I.....	1
Section 1.00    General Policy .....	1
1.10 The Scientific Diving Standards.....	1
1.20 Operational Control .....	2
1.30 Consequence of Violation of Regulations by Scientific Divers .....	5
1.40 Consequences of Violation of Regulations by Organizational Members .....	5
1.50 Record Maintenance .....	5
Section 2.00    Diving Regulations for Scuba.....	7
2.10 Introduction .....	7
2.20 Pre-dive Procedures .....	7
2.30 Diving Procedures.....	8
2.40 Post-dive Procedures.....	8
2.50 Emergency Procedures.....	9
2.60 Flying After Diving .....	9
2.70 Recordkeeping and Requirements .....	9
Section 3.00    Diving Equipment.....	11
3.10 General Policy.....	11
3.20 Equipment.....	11
3.30 Auxiliary Equipment .....	12
3.40 Support Equipment .....	12
3.50 Equipment Maintenance.....	12
3.60 Air Quality Standards .....	13
Section 4.00    Entry-Level Training Requirements.....	14
4.10 General Policy.....	14
4.20 References.....	14
Section 5.00    Scientific Diver Certification .....	15
5.10 Prerequisites .....	15
5.20 Training.....	15
5.30 Examinations .....	18
5.40 Diver Permits/ Certifications .....	19
5.50 Depth Certifications.....	19
5.60 Continuation of Certificate .....	20
5.70 Revocation of Certification .....	20
5.80 Recertification .....	20

5.90 Waiver of Requirements/Temporary Diver.....	21
Section 6.00    Medical Standards .....	22
6.10 Medical Requirements .....	22
6.20 Frequency of Medical Evaluations.....	22
6.30 Information Provided to Examining Physician.....	22
6.40 Content of Medical Evaluations .....	22
6.50 Conditions Which May Disqualify Candidates From Diving .....	23
6.60 Laboratory Requirements for Diving Medical Evaluation and Intervals. ....	24
6.70 Physician's Written Report. ....	24
Volume II.....	24
Sections 7.00 and 9.00 through 13.00 .....	24
Section 8.00    Aquarium Diving Operations .....	26
8.10 General Policy.....	26
8.20 The Buddy System In Scientific Aquarium Diving .....	26
8.30 Diving Equipment.....	26
8.40 Scientific Aquarium Diver Certification.....	26
8.50 Scientific Aquarium Diving Using Other Diving Technology.....	27
Section 14.00    Scientific Diving Program at Alaska Pacific University .....	28
Appendices .....	30
Instructions for Medical Exam:.....	31
APPENDIX 1: Diving Medical Exam Overview for the Examining Physician .....	A1-1
APPENDIX 2: AAUS Medical Evaluation of Fitness for Scuba Diving Report .....	A2-1
APPENDIX 3: Diving Medical History Form .....	A3-1
APPENDIX 4: Recommended Physicians With Expertise in Diving Medicine .....	A4-1
APPENDIX 5: Definition of Terms.....	A5-1
APPENDIX 6: Letter of Reciprocity/Verification of Training.....	A6-1
APPENDIX 7: Diving Emergency Management Procedures .....	A7-1
APPENDIX 8: Dive Computer Guidelines .....	A8-1
APPENDIX 9: AAUS Statistics Collection Criteria and Definitions.....	A9-1

# Volume I.

---

*Volume I contains the minimal guidelines set forth by the American Academy of Underwater Sciences for the development of a Scientific Diving Safety Manual at Alaska Pacific University. Sections 1.00 through 6.00 and the Appendices are required (see section 1.20).*

## Section 1.00 General Policy

### 1.10 The Scientific Diving Standards

#### 1.11 Purpose

The purpose of these Scientific Diving Standards is to ensure that all scientific diving is conducted in a manner that will maximize protection of scientific divers from accidental injury and/or illness, and to set forth standards for training and certification which will allow a working reciprocity between APU and other American Academy of Underwater Sciences (AAUS)-recognized scientific diving programs. Fulfillment of the purposes shall be consistent with the furtherance of research and safety.

This standard sets minimal standards for the establishment of the APU Scientific Diving Program, the organization for the conduct of this program, and the basic regulations and procedures for safety in scientific diving operations. It also establishes a framework for reciprocity between AAUS organizational members that adhere to these minimum standards.

This manual been modified from the 2013 AAUS standard, which was developed and written by the AAUS by compiling the policies set forth in the diving manuals of several university, private, and governmental scientific diving programs. These programs share a common heritage with the scientific diving program at the Scripps Institution of Oceanography (SIO). Adherence to the SIO standards has proven both feasible and effective in protecting the health and safety of scientific divers since 1954.

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

#### **Scientific Diving Definition**

Scientific diving is defined by (29 CFR 1910.402) as diving performed solely as a necessary part of a scientific, research, or educational activity by employees whose sole purpose for diving is to perform scientific research tasks.

#### **Scientific Diving Exemption**

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

- a. The Diving Control Board (DCB) consists of a majority of active scientific divers and has autonomous and absolute authority over the scientific diving program's operation.
- b. The purpose of any project using scientific diving is the advancement of science; therefore, information and data resulting from any project are non-proprietary.

- c. The tasks of a scientific diver are those of an observer and data gatherer. Construction and trouble-shooting tasks traditionally associated with commercial diving are not included within scientific diving.
- d. Scientific divers, based on the nature of their activities, must use scientific expertise in studying the underwater environment and therefore, are scientists or scientists-in-training.

In addition, the APU 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.

### **Review of Standards**

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

## **1.20 Operational Control**

### **Organizational Member Auspices Defined**

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

It is APU's responsibility to adhere to the AAUS Standards for Scientific Diving Certification and Operation of Scientific Diving Programs. The administration of the local diving program will reside with APU's Diving control Board (DCB).

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

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

APU shall develop and maintain a scientific diving safety manual that provides for the development and implementation of policies and procedures that will enable the dive program to meet requirements of local environments and conditions as well as to comply with the AAUS scientific diving standards. The APU diving safety manual shall include, but not be limited to:

- 1. The AAUS Standards may be used as a set of minimal guidelines for the development of APU's scientific diving safety manual. Volume 1, Sections 1.00 through 6.00 and the Appendices are required for all manuals. Volume 2, Sections 7.00 through 13.00 are required only when the organizational member conducts that diving activity. Organizational member specific sections are placed in Volume 2.

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

### **The Diving Safety Officer**

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

Qualifications:

- a. Shall be appointed by the responsible administrative officer or his/her designee, with the advice and counsel of the diving control board.
- b. Shall be trained as a scientific diver.
- c. Shall be a full member as defined by the AAUS.
- d. Shall be an active underwater instructor from a nationally recognized agency.

Duties and Responsibilities

- a. Shall be responsible, through the DCB, to the responsible administrative officer or his/her designee, for the conduct of the APU scientific diving program. The routine operational authority for this program, including the conduct of training and certification, approval of dive plans, maintenance of diving records, and ensuring compliance with this manual and all relevant regulations of APU, rests with the Diving Safety Officer.
- b. May permit portions of this program to be carried out by a qualified delegate, although the Diving Safety Officer may not delegate responsibility for the safe conduct of the local diving program.
- c. Shall be guided in the performance of the required duties by the advice of the DCB, but operational responsibility for the conduct of the local diving program will be retained by the Diving Safety Officer.
- d. Shall suspend diving operations which he/she considers to be unsafe or unwise.

### **Diving Control Board**

The Diving Control Board (DCB) shall consist of a majority of active scientific divers. Voting members shall include the Diving Safety Officer, the responsible administrative officer, or his/her designee, and should include other representatives of the diving program such as qualified divers and members selected by procedures established by APU. A chairperson and a secretary may be chosen from the membership of the board according to local procedure.

- Has autonomous and absolute authority over the scientific diving program's operation.
- Shall approve and monitor diving projects.
- Shall review and revise the diving safety manual.

- Shall assure compliance with the manual.
- Shall certify the depths to which a diver has been trained.
- Shall take disciplinary action for unsafe practices.
- Shall assure adherence to the buddy system for scuba diving.
- Shall act as the official representative of APU in matters concerning the scientific diving program.
- Shall act as a board of appeal to consider diver-related problems.
- Shall recommend the issue, reissue, or the revocation of diving certifications.
- Shall recommend changes in policy and amendments to the AAUS and APU's scientific diving safety manual as the need arises.
- Shall establish and/or approve training programs through which the applicants for certification can satisfy the requirements of APU's diving safety manual.
- Shall suspend diving programs which it considers to be unsafe or unwise.
- Shall establish criteria for equipment selection and use.
- Shall recommend new equipment or techniques.
- Shall establish and/or approve facilities for the inspection and maintenance of diving and associated equipment.
- Shall ensure that APU's air station(s) meet air quality standards as described in Section 3.60 of this manual.
- Shall periodically review the Diving Safety Officer's performance and program.
- Shall sit as a board of investigation to inquire into the nature and cause of diving accidents or violations of APU's diving safety manual.

## **Instructional Personnel**

### *Qualifications*

All personnel involved in diving instruction under the auspices APU shall be qualified for the type of instruction being given.

### *Selection*

Instructional personnel will be selected by the responsible administrative officer, or his/her designee, who will solicit the advice of the DCB in conducting preliminary screening of applicants for instructional positions.

## **Lead Diver**

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

- Coordination with other known activities in the vicinity, which are likely to interfere with diving operations.
- Ensuring all dive team members possess current certification and are qualified for the type of diving operation.
- Planning dives in accordance with section 2.21

- Ensuring safety and emergency equipment is in working order and at the dive site.
- 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.
- Suspending diving operations if in his/her opinion conditions are not safe.
- Reporting to the DSO and DCB any physical problems or adverse physiological effects including symptoms of pressure-related injuries.

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

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

A scientific diver from one Organizational Member shall apply for permission to dive under the auspices of another Organizational Member by submitting to the Diving Safety Officer of the host Organizational Member a document containing all the information described in Appendix 6 (Letter of Reciprocity) signed by the Diving Safety Officer or Chairperson of the home Diving Control Board.

A visiting scientific diver may be asked to demonstrate his/her knowledge and skills for the planned diving.

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

### **Waiver of Requirements**

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

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

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

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

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

### **1.50 Record Maintenance**

The Diving Safety Officer or his/her designee shall maintain permanent records for each individual scientific diver certified. The file shall include evidence of certification level, log sheets, results of current physical examination, reports of disciplinary actions by APU's Diving Control Board, and other pertinent information deemed necessary.

## **Availability of Records**

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

## Section 2.00 Diving Regulations for Scuba (Open Circuit, Compressed Air)

### 2.10 Introduction

No person shall engage in scientific diving operations under the auspices of the APU scientific diving program unless he/she holds a current certification issued pursuant to the provisions of this manual.

### 2.20 Pre-dive Procedures

#### Dive Plans

Dives should be planned around the competency of the least experienced diver. Before conducting any diving operations under the auspices of APU, the lead diver for a proposed operation must formulate a dive plan which should include the following:

- Divers qualifications, and the type of certificate or certification held by each diver.
- Emergency plan (see Appendix 7) with the following information:

**1** Name, telephone number, and relationship of person to be contacted for each diver in the event of an emergency.

**2** Nearest operational recompression chamber

**3** Nearest accessible hospital

**4** Available means of transport

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

#### Pre-dive Safety Checks

##### *Diver's Responsibility:*

**1** Each scientific diver shall conduct a functional check of his/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, in his/her judgment, conditions are unfavorable, or if he/she would be violating the precepts of his/her training, or of this manual.

**3** No dive team member shall be required to be exposed to hyperbaric conditions against his/her will, except when necessary to prevent or treat a pressure-related injury.

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

##### *Equipment Evaluations:*

**1** Each diver shall ensure that his/her equipment is in proper working order and that the equipment is suitable for the type of diving operation.

2 Each diver shall have the capability of achieving and maintaining positive buoyancy.

*Site Evaluation:*

1. The environmental conditions at the site will be evaluated.

## 2.30 Diving Procedures

### **Solo Diving Prohibition**

All diving activities shall assure adherence to the buddy system (two comparably equipped scuba divers in the water in constant communication) for scuba diving. This buddy system is based upon mutual assistance, especially in the case of an emergency.

### **Safety Stop**

A 3-5 minute stop during ascent shall be made in the 30 to 10 fsw depth range on every dive greater than 60 fsw

### **Refusal to Dive**

The decision to dive is that of the diver. A diver may refuse to dive, without fear of penalty, whenever he/she feels it is unsafe for them to make the dive (see Sec. 2.22.1).

### **Safety**

The ultimate responsibility for safety rests with the individual diver. It is the diver's responsibility and duty to refuse to dive if, in his/her judgment, conditions are unsafe or unfavorable, or if he/she would be violating the precepts of his/her training or the regulations in this manual.

### **Termination of the Dive**

It is the responsibility of the diver to terminate the dive, without fear of penalty, whenever he/she feels it is unsafe to continue the dive, unless it compromises the safety of another diver already in the water (see Sec. 2.22.1).

The dive shall be terminated while there is still sufficient cylinder pressure to permit the diver to safely reach the surface, including decompression time, or to safely reach an additional air source at the decompression station.

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

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

## 2.40 Post-dive Procedures

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

After the completion of a dive, each diver shall report any physical problems, symptoms of decompression sickness, or equipment malfunctions.

When diving outside the no-decompression limits, the divers should remain awake for at least one hour after diving, and in the company of a dive team member who is prepared to transport him/her to a hyperbaric chamber if necessary.

## 2.50 Emergency Procedures

APU has developed emergency procedures which follow the standards of care of the community and must include procedures for emergency care, recompression and evacuation for each dive location (See Appendix 7).

## 2.60 Flying After Diving

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

## 2.70 Recordkeeping and Requirements

### Personal Diving Log

Each certified scientific diver shall log every dive made under the auspices of APU's program, and is encouraged to log all other dives. Standard forms will be provided by the APU program. Log sheets shall be submitted to the Diving Safety Officer to be placed in the diver's permanent file. Details of the submission procedures are left to the discretion of the Diving Safety Officer. The diving log shall be in a form specified by the APU's DCB and shall include at least the following:

- Name of diver, partner, and Lead Diver.
- Date, time, and location.
- Diving modes used.
- General nature of diving activities.
- Approximate surface and underwater conditions.
- Maximum depths, bottom time and surface interval time.
- Diving tables or computers used.
- Detailed report of any near or actual incidents.

### Required Incident Reporting

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

*Additional information must meet the following reporting requirements:*

- The APU DCB shall record and report occupational injuries and illnesses in accordance with requirements of the appropriate Labor Code section.
- If pressure-related injuries are suspected, or if symptoms are evident, the following additional information shall be recorded and retained by APU, with the record of the dive, for a period of 5 years:

1. Complete AAUS Incident Report Form at <http://www.aaus.org>.

2. Written descriptive report to include:

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

APU shall investigate and document any incident of pressure-related injury and prepare a report which is to be forwarded to the AAUS during the annual reporting cycle. This report must first be reviewed and released by APU's Diving Control Board.

## Section 3.00 Diving Equipment

### 3.10 General Policy

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

### 3.20 Equipment

#### Regulators

- Only those makes and models specifically approved by the Diving Safety Officer and the Diving Control Board shall be used.
- Scuba regulators shall be inspected and tested prior to first use and every twelve months thereafter.
- Regulators will consist of a primary second stage and an alternate air source (such as an octopus second stage or redundant air supply).

#### Breathing Masks and Helmets

*Breathing masks and helmets shall have:*

- A non-return valve at the attachment point between helmet or mask and hose, which shall close readily and positively.
- An exhaust valve.
- A minimum ventilation rate capable of maintaining the diver at the depth to which he/she is diving.

#### Scuba Cylinders

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

#### Backpacks

- Backpacks without integrated flotation devices and weight systems shall have a quick release device designed to permit jettisoning with a single motion from either hand.

#### Gauges

Gauges shall be inspected and tested before first use and every twelve months thereafter.

#### Flotation Devices

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

#### Timing Devices, Depth and Pressure Gauges

- Both members of the diving pair must have an underwater timing device, an approved depth indicator, and a submersible pressure gauge.

#### **Determination of Decompression Status: Dive Tables, Dive Computers**

- A set of diving tables, approved by the Diving Control Board, must be available at the dive location.
- Dive computers may be utilized in place of diving tables, and must be approved by the Diving Control Board. AAUS recommendations on dive computers are available at <http://www.aaus.org>.

### **3.30 Auxiliary Equipment**

#### **Hand held underwater power tools.**

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

### **3.40 Support Equipment**

#### **First aid supplies.**

- A first aid kit and emergency oxygen shall be available.

#### **Diver's Flag**

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

#### **Compressor Systems - APU Controlled**

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

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

### **3.50 Equipment Maintenance**

#### **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:

- Regulators
- Submersible pressure gauges
- Depth gauges

- Scuba cylinders
- Cylinder valves
- Diving helmets
- Submersible breathing masks
- Compressors
- Gas control panels
- Air storage cylinders
- Air filtration systems
- Analytical instruments
- Buoyancy control devices
- Dry suits

### Compressor Operation and Air Test Records

Gas analyses and air tests shall be performed on APU-controlled 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 entered in a formal log and be maintained.

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

### 3.60 Air Quality Standards

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

<b>CGA Grade E</b>	
Component	Maximum
Oxygen	20 - 22%/v
Carbon Monoxide	10 PPM/v
Carbon Dioxide	1000 PPM/v
Condensed Hydrocarbons	5 mg/m <sup>3</sup>
Total Hydrocarbons as Methane	25 PPM/v
Water Vapor ppm	(2)
Objectionable Odors	None

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

## Section 4.00      Entry-Level Training Requirements

### 4.10 General Policy

Training and certification as an entry-level diver is a prerequisite to AAUS Scientific Diver Training. In lieu of writing/promulgating AAUS specific standards for entry-level divers, AAUS references here, the standards for entry-level diver training as defined by the WRSTC and/or ISO. AAUS programs who wish to train entry-level divers may do so using one of the following options:

- a) under the auspices and standards of an internationally recognized diver training agency.
- b) under the auspices of AAUS using the minimum guidelines presented by the most current version of the RSTC/WRSTC and/or ISO entry-level diver standards.

### 4.20 References

“Minimum Course Content for Open Water Diver Certification” - World Recreational Scuba Training Council (WRSTC), [www.wrstc.com](http://www.wrstc.com).

“Safety related minimum requirements for the training of recreational scuba divers - Part 2: Level 2 - Autonomous diver”. ISO 24801-2:2007 - International Organization for Standardization (ISO) - [www.iso.org](http://www.iso.org).

## Section 5.00 Scientific Diver Certification

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

### 5.10 Prerequisites

#### **Administrative**

The applicant/candidate must complete all administrative and legal documentation required by the Organizational Member.

#### **Diver Certification**

The applicant/candidate must, at minimum, show documented proof of entry-level diver certification from an internationally recognized training agency. As an alternative, AAUS OMs who wish to train and certify entry-level divers under AAUS auspices may do so under the guidelines presented in Section 4.0.

#### **Medical Examination**

The applicant/candidate must be medically qualified for diving as described in Section 6.0 of the AAUS Standards for Scientific Diving.

#### **Swimming/Watermanship Evaluation**

The applicant for training shall successfully perform the following in the presence of the Diving Safety Officer, instructor, or other examiner approved by the DSO. All tests to be performed without swim aids, however, where exposure protection is needed, the applicant must be appropriately weighted to provide for neutral buoyancy.

- a) Swim underwater for a distance of 25 yards/meters without surfacing.
- b) Swim 400 yards/meters in less than 12 minutes.
- c) Tread water for 10 minutes, or 2 minutes without the use of hands.
- d) Transport another person of equal size a distance of 25 yards/meters in the water.

### 5.20 Training

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

#### **Theoretical Training/Knowledge Development**

##### *Required Topics:*

1. Diving Emergency Care Training
  - Cardiopulmonary Resuscitation (CPR)
  - Standard or Basic First Aid
  - Recognition of DCS and AGE
  - Accident Management
  - Field Neurological Exam
  - Oxygen Administration
2. Dive Rescue

3. Dive Physics
4. Dive Physiology
5. Dive Environments
6. Decompression Theory and its Application
7. AAUS Scientific Diving Regulations and History
  - Scientific Dive Planning
  - Coordination with other Agencies
  - Appropriate Governmental Regulations
8. Scientific Method
9. Data Gathering Techniques (Only items specific to area of study required)
  - Transect Sampling (Quadrating)
  - Transecting
  - Mapping
  - Coring
  - Photography
  - Tagging
  - Collecting
  - Animal Handling
  - Archaeology
  - Common Biota
  - Organism identification
  - Behavior
  - Ecology
  - Site Selection, Location and Re-location
  - Specialized equipment for data gathering
  - HazMat Training
  - HP Cylinders
  - Chemical Hygiene, Laboratory Safety (use of chemicals)

***Suggested Topics:***

10. Specific Dive Modes (methods of gas delivery)
  - Open Circuit
  - Hookah
  - Surface Supplied Diving
11. Small Boat Operation
12. Rebreathers
  - Closed
  - Semi-closed
13. Specialized Breathing Gas
  - Nitrox
  - Mixed Gas
14. Specialized Environments and Conditions
  - Blue Water Diving
  - Ice and Polar Diving (Cold Water Diving)
  - Zero Visibility Diving
  - Polluted Water Diving
  - Saturation Diving
  - Decompression Diving

- Overhead Environments
  - Aquarium Diving
  - Night Diving
  - Kelp Diving
  - Strong Current Diving (Live-boating)
  - Potential Entanglement
15. Specialized Diving Equipment
- Full face mask
  - Dry Suit
  - Communications

## **Practical Training/ Skill Development**

### *Confined Water Evaluation*

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

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

### *Open Water Evaluation*

The trainee must satisfy an instructor approved by the Diving Safety Officer of their ability to perform at least the following in open water:

- a) Surface dive to a depth of 10 feet in open water without scuba.
- b) Demonstrate proficiency in air sharing as both donor and receiver.
- c) Enter and leave open water or surf, or leave and board a diving vessel, while wearing scuba gear.
- d) Kick on the surface 400 yards while wearing scuba gear, but not breathing from the scuba unit.
- e) Demonstrate judgment adequate for safe diving.
- f) Demonstrate, where appropriate, the ability to maneuver efficiently in the environment at and below the surface.
- g) Complete a simulated emergency swimming ascent.
- h) Demonstrate clearing of mask and regulator while submerged.

- i) Demonstrate ability to achieve and maintain neutral buoyancy while submerged.
- j) Demonstrate techniques of self-rescue and buddy rescue.
- k) Navigate underwater.
- l) Plan and execute a dive.

### *Checkout Dive/ Additional Experience*

Practical training must include an Open Water checkout dive(s), with evaluation of the skills listed in Open Water Evaluation, with the DSO or qualified delegate followed by at least 11 ocean or open water dives in a variety of dive sites and diving conditions, for a cumulative bottom time of 6 hours. Dives following the checkout dive must be supervised by a certified Scientific Diver with experience in the type of diving planned, with the knowledge and permission of the DSO.

## **5.30 Examinations**

### **Written Exams**

Before completing training, the trainee must pass a written examination that demonstrates knowledge of at least the following:

1. Function, care, use, and maintenance of diving equipment.
2. Physics and physiology of diving.
3. Diving regulations and precautions.
4. Near-shore currents and waves.
5. Dangerous marine animals.
6. Emergency procedures, including buoyant ascent and ascent by air sharing.
7. Currently accepted decompression procedures.
8. Demonstrate the proper use of dive tables.
9. Underwater communications.
10. Aspects of freshwater and altitude diving.
11. Hazards of breath-hold diving and ascents.
12. Planning and supervision of diving operations.
13. Diving hazards.
14. Cause, symptoms, treatment, and prevention of the following: near drowning, air embolism, carbon dioxide excess, squeezes, oxygen poisoning, nitrogen narcosis, exhaustion and panic, respiratory fatigue, motion sickness, decompression sickness, hypothermia, and hypoxia/anoxia.
15. Suggested topics (from Sec. 5.20) at the DSO's discretion.

### **Equipment**

The trainee will be subject to examination/review of:

1. Personal diving equipment
2. Task specific equipment

## 5.40 Diver Permits/ Certifications

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.

### **Scientific Diver-In-Training Permit**

This is a permit to dive, usable only while it is current and for the purpose intended. This permit signifies that a diver has completed and been certified as at least an entry level diver through an internationally recognized certifying agency or scientific diving program, and has the knowledge skills and experience necessary to continue training as a scientific diver under supervision, as approved by the DSO.

### **Scientific Diver Certification**

This permit signifies a diver has completed all requirements in Section 5.0 and is authorized by the AAUS OM to engage in scientific diving without supervision, as approved by the DSO. Submission of documents and participation in aptitude examinations does not automatically result in certification. The applicant must convince the Diving Safety Officer and members of the DCB that they are sufficiently skilled and proficient to be certified. This skill will be acknowledged by the signature of the Diving Safety Officer. Any applicant who does not possess the necessary judgment, under diving conditions, for the safety of the diver and their partner, may be denied organizational member scientific diving privileges.

## 5.50 Depth Certifications

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

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

*Certification to 30 Foot Depth* - Initial permit level, approved upon the successful completion of training listed in Sections 4.00 and 5.00.

*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.

*Certification to 100 Foot Depth* - A diver holding a 60 foot certificate may be certified to depths 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.

*Certification to 130 Foot Depth* - A diver holding a 100 foot certificate may be certified to a depth of 130 feet after successfully completing, 4 dives to depths between 100 and 130 feet. The diver shall also demonstrate proficiency in the use of the appropriate Dive Tables.

*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.

*Certification to 190 Foot Depth* - A diver holding a 150 foot certificate may be certified to a depth of 190 feet after successfully completing, 4 dives to depths between 150 and 190 feet. The diver must also demonstrate knowledge of the special problems of deep diving, and of special safety requirements.

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

## 5.60 Continuation of Certificate

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

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

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

Once the initial certification requirements of Sec. 5.00 are met, divers whose depth certification has lapsed due to lack of activity may be re-qualified by completing a check-out dive by an appropriate skilled and proficient examiner designated by the APU DSO or DCB. Special exceptions may be granted by the DCB as noted in Sec. 1.20, Waiver of Requirements. Divers who fail to make at least one dive near the maximum depth of their certification during each 6-month period shall be recertified at the previous or reduced depth level.

### **Medical Examination**

All certified scientific divers shall pass a medical examination at the intervals specified in Section 6.00. After each major illness or injury, as described in Sec. 6.0, a certified scientific diver shall receive clearance to return to diving from a physician before resuming diving activities.

### **Emergency Care Training**

The scientific diver must provide proof of training in the following:

- Adult CPR (must be current).
- Emergency oxygen administration (must be current)
- First aid for diving accidents (must be current)

## 5.70 Revocation of Certification

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

## 5.80 Recertification

If a diver's certificate expires or is revoked, he/she may be re-certified after complying with such conditions as the Diving Safety Officer or the DCB may impose. The diver shall be given an

opportunity to present his/her case to the DCB before conditions for re-certification are stipulated.

### **5.90 Waiver of Requirements/Temporary Diver**

A temporary diver permit constitutes a waiver of the requirements of Section 5.0 and is issued only following a demonstration of the required proficiency in diving. It is valid only for a limited time, as determined by the Diving Safety Officer. This permit is not to be construed as a mechanism to circumvent existing standards set forth in this standard.

Requirements of Section 5.0 may be waived by the Diving Safety Officer if the person in question has demonstrated proficiency in diving and can contribute measurably to a planned dive. A statement of the temporary diver's qualifications shall be submitted to the Diving Safety Officer as a part of the dive plan. Temporary permits shall be restricted to the planned diving operation and shall comply with all other policies, regulations, and standards of this standard, including medical requirements.

## Section 6.00 Medical Standards

### 6.10 Medical Requirements

#### General

- The APU DCB shall determine that divers have passed a current diving physical examination and have been declared by the examining physician to be fit to engage in diving activities as may be limited or restricted in the medical evaluation report.
- All medical evaluations required by this standard shall be performed by, or under the direction of, a licensed physician of the applicant-diver's choice, preferably one trained in diving/undersea medicine.
- The diver should be free of any chronic disabling disease and be free of any conditions contained in the list of conditions for which restrictions from diving are generally recommended. (Appendix 1)

### 6.20 Frequency of Medical Evaluations

Medical evaluation shall be completed:

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

### 6.30 Information Provided to Examining Physician

APU shall provide a copy of the medical evaluation requirements of this manual to the examining physician. (Appendices 1, 2, and 3).

### 6.40 Content of Medical Evaluations

Medical examinations conducted initially and at the intervals specified in Section 6.12 shall consist of the following:

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

## 6.50 Conditions Which May Disqualify Candidates From Diving (Adapted from Bove 1998)<sup>1</sup>

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

---

<sup>1</sup> Bove, A.A. ed. 1998. MEDICAL EXAMINATION OF SPORT SCUBA DIVERS, San Antonio, TX: Medical Seminars, Inc.

## 6.60 Laboratory Requirements for Diving Medical Evaluation and Intervals.

### Initial 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.

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

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

### First exam 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<sup>1,2</sup> (age, family history, lipid profile, blood pressure, diabetic screening, smoking history). Further cardiac screening may be indicated based on risk factor assessment.
4. Resting EKG
5. Chest X-ray
6. Urinalysis
7. Any further tests deemed necessary by the physician

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

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<sup>2,3</sup> (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. Urinalysis
6. Any further tests deemed necessary by the physician

## 6.70 Physician's Written Report.

After any medical examination relating to the individual's fitness to dive, APU shall obtain a written report prepared by the examining physician, which shall contain the examining physician's opinion of the individual's fitness to dive, including any recommended restrictions or limitations. This will be reviewed by the DCB.

APU shall make a copy of the physician's written report available to the individual.

---

<sup>2</sup> Grundy, R.J. et. al. 1999. Assessment of Cardiovascular Risk by Use of Multiple-Risk-Factor Assessment Equations. AHA/ACC Scientific Statement.  
<http://www.acc.org/clinical/consensus/risk/risk1999.pdf>

<sup>3</sup> Bove, A.A. 2011. The cardiovascular system and diving risk. Undersea and Hyperbaric Medicine 38(4): 261-269.

# Volume II.

---

*Volume II contains the American Academy of Underwater Sciences Standards for a range of specialized scientific diving activities listed in Sections 7.00 through 13.00. Section 14.00 describes the APU Scientific Diving Program.*

## Sections 7.00 and 9.00 through 13.00

In addition to the minimal guidelines contained in Volume I, AAUS sets forth standards in Volume II to oversee a range of specialized scientific diving activities, listed below. AAUS guidelines state that Sections 7 through 13 are required only when the organizational member conducts that diving activity. At this point in time, scientific diving at Alaska Pacific University does not involve these specialized activities, and therefore Sections 7 and 9-13 are not included in the APU Scientific Diving Safety Manual. If at some point in the future, APU commences diving activities covered by Sections 7 and 9-13 a revised Scientific Diving Safety Manual will be submitted to the APU DCB and to AAUS for review.

### Section 7.00 Nitrox Diving Guidelines

- 7.10 Prerequisites
- 7.20 Requirements for Authorization to Use Nitrox
- 7.30 Nitrox Training Guidelines
- 7.40 Scientific Nitrox Diving Regulations
- 7.50 Nitrox Diving Equipment

### Section 9.00 Staged Decompression Diving

- 9.10 Minimum Experience and Training Requirements
- 9.20 Minimum Equipment Requirements
- 9.30 Minimum Operational Requirements

### Section 10.00 Mixed Gas Diving

- 10.10 Minimum Experience and Training Requirements
- 10.20 Equipment and Gas Quality Requirements
- 10.30 Minimum Operational Requirements

### Section 11.00 Other Diving Technology

- 11.10 Blue Water Diving
- 11.20 Ice And Polar Diving
- 11.30 Overhead Environments
- 11.40 Saturation Diving
- 11.50 Hookah
- 11.60 Surface Supplied Diving

Section 12.00 Rebreathers

12.10 Definitions and General Information

12.20 Prerequisites

12.30 Equipment Requirements

12.40 Operational Requirements

12.50 Oxygen Rebreathers

12.60 Semi-Closed Circuit Rebreathers

12.70 Closed-Circuit Rebreathers

Section 13.00 Scientific Cave and Cavern Diving Standard

13.10 Definitions

13.20 Cave and Cavern Environment Hazards

13.30 Minimum Experience and Training Requirements

13.40 Equipment Requirements

13.50 Operational Requirements and Safety Protocols

## Section 8.00     Aquarium Diving Operations

### 8.10 General Policy

**Section 8.00 applies to Scientific Aquarium Divers only.**

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

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

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

### 8.20 The Buddy System In Scientific Aquarium Diving

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

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

### 8.30 Diving Equipment

Section 3.20 is modified to read as follows:

In an aquarium of a known maximum obtainable depth:

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

### 8.40 Scientific Aquarium Diver Certification

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

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

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

## 8.50 Scientific Aquarium Diving Using Other Diving Technology

### Surface Supplied Scientific Aquarium Diving

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

- a) Divers using the surface supplied mode shall be equipped with a diver-carried independent reserve breathing gas supply.

Scientific aquarium divers using conventional scuba masks, full-face masks, or non-lockdown type helmets are exempt from this standard provided:

- There are no overhead obstructions or entanglements.
  - The diver is proficient in performing a Controlled Emergency Swimming Ascent from at least as deep as the maximum depth of the aquarium.
  - The diver is proficient in performing out of air emergency drills, including ascent and mask/helmet removal.
  - Each surface supplied diver shall be hose-tended by a separate dive team member while in the water. Scientific aquarium divers are exempt from this standard, provided the tender is monitoring only one air source, there is mutual assistance between divers and there are no overhead obstructions or entanglements.
- b) Divers using the surface supplied mode shall maintain communication with the surface tender.

The surface supplied breathing gas supply (volume and intermediate pressure) shall be sufficient to support all surface supplied divers in the water for the duration of the planned dive.

- a) During surface supplied diving operations when only one diver is in the water, there must be a standby diver in attendance at the dive location. Scientific aquarium divers are exempt from this standard, provided the tender is equipped, ready and able to conduct a prompt and effective in-water retrieval of the diver at all times during the dive.”
- b) Surface supplied equipment must be configured to allow retrieval of the diver by the surface tender without risk of interrupting air supply to the diver.
- c) All surface supplied applications used for scientific aquarium diving shall have a non-return valve at the attachment point between helmet or mask hose, which shall close readily and positively.

## Section 14.00 Scientific Diving Program at Alaska Pacific University

### Courses offered at APU

#### **MAR 110 – Recreational Scuba Diving**

This course meets the entry-level training requirements as specified in Section 4.10 as a prerequisite to AAUS Scientific Diver Training. Entry-level diver training in this course is conducted under the auspices and standards of an internationally recognized diver training agency as referenced in Section 4.20.

#### *Course Description*

This course introduces entry level skills for scuba diving and snorkeling in cold water. Course meets Professional Association of Diving Instructors (PADI) standards for Open Water Diver certification and a Dry Suit Specialty. Emphasis is on student skill development and safety. *This is a performance based course*, and students must pass the performance requirements to pass the class. Topics covered include proper planning, use of recreational dive tables, hyperbaric theory, and cold water diving. Course fee includes PADI certification fees, transportation to the ocean dive sites, and all student gear rental for the session. Students must provide their own mask, snorkel, fins and gloves; wetsuits and footwear are suggested for pool sessions. Prerequisites: Swim 400 yards in less than 12 minutes. Tread water for 10 minutes. Offered Fall.

#### **MAR22400 – Scientific Diving I**

This course in conjunction with MAR32800/ES62800 meets the minimum required training and performance standards for AAUS Scientific Divers referenced in Section 5.00 of this manual. MAR22400 covers the Theoretical Training/Knowledge Development and Confined Water Evaluation portions of the mandatory minimum cumulative time of 100 hours referenced in Section 5.2.

#### *Course Description*

This course, in combination with MAR 32800, meets the American Academy of Underwater Scientists (AAUS) training and performance standards for AAUS Scientific Divers, and includes theoretical aspects and practical training for a minimum cumulative time of 100 hours. Topics include diving emergency care training (including CPR, Basic First Aid, recognition of DCS and AGE, accident management, field neurological exam, oxygen administration), dive rescue, dive physics, dive physiology, dive environments, decompression theory and its application, AAUS Scientific Diving regulations and history, scientific method, and data gathering techniques. This course includes all the theory, pool training sessions and a Confined Water evaluation. Students will gain Diver-In-Training (DIT) status in the APU Scientific Diving Program. Prerequisite – entry-level diver certification through an internationally recognized diver training agency (such as PADI, NAUI etc.), a dive medical examination (for a minimum cost of \$150), and a swimming evaluation: swim 400 yards in less than 12 minutes, swim underwater for a distance of 25 yards, tread water for 10 minutes, or 2 minutes without the use of hands, and transport another person of equal size a distance of 25 yards in the water. Course fees cover: pool sessions, gear rental, tanks, O2, CPR and First Aid certifications. \*Course fees do not cover the dive medical. Offered Spring.

## **MAR32800/ES62800 – Scientific Diving II**

This course in conjunction with MAR22400 meets the minimum required training and performance standards for AAUS Scientific Divers referenced in Section 5.00 of this manual. MAR32800/ES62800 covers the Open Water Evaluation and Checkout Dive/Additional Experience portions of the mandatory minimum cumulative time of 100 hours referenced in Section 5.2. Students will participate in a dive rescue exercise and will complete the required minimum of 12 dives for a cumulative bottom time of 6 hours referenced in Section 5.2.

### *Course Description from APU Catalog*

This course, in combination with MAR 24000, meets the American Academy of Underwater Scientists (AAUS) training and performance standards for AAUS Scientific Divers, and includes theoretical aspects and practical training for a minimum cumulative time of 100 hours. Topics include diving emergency care training, dive rescue, data gathering techniques specific to sub-tidal environments, small-boat operation, and the following dive environments: cold water/dry suit diving, kelp diving and night diving. This course involves a field trip to Kasitsna Bay Laboratory, where the practical aspects of training shall be completed, including a dive rescue scenario, an Open Water Evaluation and an Open Water checkout dive, followed by at least 11 ocean or open water dives in a variety of dive sites and diving conditions for a cumulative bottom time of 6 hours. Students will become active status divers in the APU Scientific Diving Program. PADI certification cards for Advanced Open Water Diver, Rescue Diver Specialty and Dry Suit Specialty can be issued for additional fees. Course fees cover: gear rental, tanks, lodging and food during Kasitsna Bay trip. \*Course fees do not cover transportation to the lab. Prerequisite - MAR 24000.

# Appendices

---

Appendix 1 through 9  
Required For All Organizational Members

## Instructions for Medical Exam:

Please take Appendices 1-3 to a physician of your choice for your Diving Medical Exam. A list of recommended physicians is found in Appendix 4. Prior to your medical exam, Appendix 1 must be signed by the DSO and Appendix 3 must be signed and completed by you. Once your medical exam has been completed, Appendix 2 must be signed and completed by your physician. *Only Appendix 2 must be returned to the DSO.* Appendix 3 is confidential and can be retained for your records along with the remaining paperwork.

# APPENDIX 1: Diving Medical Exam Overview for the Examining Physician

## TO THE EXAMINING PHYSICIAN

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

Eloise Brown  
(Diving Safety Officer, Alaska Pacific University)  
\_\_\_\_\_  
(signature)

(907) 564-8292  
(phone number)  
\_\_\_\_\_  
(date M/D/Y)

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<sup>1</sup>; bracketed numbers indicate 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 neurological 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]

<sup>1</sup> Bove, A.A. ed. 1998. MEDICAL EXAMINATION OF SPORT SCUBA DIVERS, San Antonio, TX: Medical Seminars, Inc.

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.
- Grundey, 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 2: AAUS Medical Evaluation of Fitness for Scuba Diving Report

---

Name of Applicant (Print or Type)

---

Date of Medical Evaluation ( M/D/Y)

### 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 Assessment<sup>1</sup> (age, lipid profile, blood pressure, diabetic screening, smoking)  
Note: Exercise stress testing may be indicated based on Multiple-Risk-Factor Assessment<sup>1</sup>

### REFERENCES:

---

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

**PHYSICIAN'S STATEMENT:**

\_\_\_\_\_ 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 medical standards and required tests for scientific diving (Sec. 6.00 and Appendix 1) and, in my opinion, find no medical conditions that may be disqualifying for participation in scuba diving. I have discussed with the patient any medical condition(s) that would not disqualify him/her from diving but which may seriously compromise subsequent health. The patient understands the nature of the hazards and the risks involved in diving with these conditions.

\_\_\_\_\_, MD or DO \_\_\_\_\_  
Signature Date (M/D/Y)

\_\_\_\_\_  
Physician's Name (Print or Type)

\_\_\_\_\_  
Address

\_\_\_\_\_ Telephone Number \_\_\_\_\_ E-mail Address

My familiarity with applicant is:

\_\_\_\_\_ With 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, Eloise Brown and Diving Control Board or their designee at  
Name (Print or Type)

Alaska Pacific University on \_\_\_\_\_  
(Place) Date (M/D/Y)

\_\_\_\_\_  
(Signature of Applicant) Date (M/D/Y)

## APPENDIX 3: Diving Medical History Form

(To Be Completed By Applicant-Diver)

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

Sponsor \_\_\_\_\_ Date \_\_\_\_\_  
 (Dept./Project/Program/School, etc.) (M/D/Y)

### 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
1			Convulsions, seizures, or epilepsy
2			Fainting spells or dizziness
3			Been addicted to drugs
4			Diabetes
5			Motion sickness or sea/air sickness
6			Claustrophobia
7			Mental disorder or nervous breakdown
8			Are you pregnant?
9			Do you suffer from menstrual problems?
10			Anxiety spells or hyperventilation
11			Frequent sour stomachs, nervous stomachs or vomiting spells
12			Had a major operation
13			Presently being treated by a physician
14			Taking any medication regularly (even non-prescription)

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

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

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

---



---



---



---



---



---

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

\_\_\_\_\_  
(Signature)

\_\_\_\_\_  
(Date)

## APPENDIX 4: Recommended Physicians With Expertise in Diving Medicine

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

1. Name: Dr. Nancy Greenwell, Board Certified in Hyperbarics and Dive Medicine  
Address: **American Hyperbaric Center**, 2710 Wesleyan Dr, Suite 201, Anchorage, AK 99508  
Telephone: Phone: (907) 565-4600 Email: nancyg@02Alaska.com
  
2. Name: Dr. Donald Hudson, background in Dive Medicine  
Address: **American Hyperbaric Center**, 2710 Wesleyan Dr, Suite 201, Anchorage, AK 99508  
Telephone: Phone: (907) 565-4600 Email: donaldh@02Alaska.com
  
4. Name: Dr. Mario Lanza, MD Certified Diving Medical Examiner  
Address: **Alyeska Family Medicine**, 3841 Piper Street, Suite T3-162, Anchorage, Alaska 99508  
Telephone: (907) 258-1258
  
5. Name: Dr. James Lord  
Address: **Medical Park Family Care**, 2211 E Northern Lights Blvd, Anchorage AK 99508  
Telephone: (907) 279-8486
  
6. Name: Dr. Thomas Wiggins  
Address: **Medical Park Family Care**, 2211 E Northern Lights Blvd, Anchorage AK 99508  
Telephone: (907) 279-8486
  
7. Name: Dr. Ray Johnson  
Address: **Medical Park Family Care**, 2211 E Northern Lights Blvd, Anchorage AK 99508  
Telephone: (907) 279-8486

## APPENDIX 5: 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 1.24).

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

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

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

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

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

$fN_2$  - Fraction of nitrogen in a gas mixture, expressed as either a decimal or percentage, by volume.

$fO_2$  - Fraction of oxygen in a gas mixture, expressed as either a decimal or percentage, by volume.

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

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

*Hookah* - 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  $pO_2$  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 safety manual* - Refers to the *NOAA Diving safety 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 safety 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.

$pN_2$  - Inspired partial pressure of nitrogen, usually expressed in units of atmospheres absolute.

$pO_2$  - 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.

## APPENDIX 6: Letter of Reciprocity/Verification of Training

AAUS REQUEST FOR DIVING RECIPROCITY FORM (LOR)

VERIFICATION OF DIVER TRAINING AND EXPERIENCE (VOT)

**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 Alaska Pacific University's Diving Safety Manual, and has demonstrated competency in the indicated areas. Alaska Pacific 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 Alaska Pacific 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 (Expires) \_\_\_\_\_
- \_\_\_\_\_ Oxygen administration (Agency) \_\_\_\_\_ (Expires) \_\_\_\_\_
- \_\_\_\_\_ First aid for diving (Agency) \_\_\_\_\_ (Expires) \_\_\_\_\_
- \_\_\_\_\_ 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:



## APPENDIX 7: Diving Emergency Management Procedures

### Introduction

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

### General Procedures

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

1. Make appropriate contact with victim or rescue as required.
2. Establish (A)irway, (B)reathing, (C)irculation as required.
3. Stabilize the victim
3. Administer 100% oxygen, if appropriate (in cases of Decompression Illness, or Near Drowning).
4. Call local Emergency Medical System (EMS) for transport to nearest medical treatment facility. Explain the circumstances of the dive incident to the evacuation teams, medics and physicians. Do not assume that they understand why 100% oxygen may be required for the diving accident victim or that recompression treatment may be necessary.
5. Call appropriate Diving Accident Coordinator for contact with diving physician and decompression chamber. etc.
6. Notify DSO or designee according to the APU Emergency Action Plan
7. Complete and submit Incident Report Form ([www.aaus.org](http://www.aaus.org)) to the APU DCB and the AAUS (Section 2.70 Required Incident Reporting).

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

DAN – Divers Alert Network Emergency Hotline

**Telephone** (919) 684-9111

Nearest operational recompression chamber:

#### **American Hyperbaric Center**

2710 Wesleyan Dr, Suite 201, Anchorage, AK 99508

**Telephone** (907) 565-4600

**Website** <http://o2alaska.com/>

Nearest accessible hospital(s):

#### **Providence Alaska Medical Center**

3200 Providence Dr, Anchorage, AK 99508  
99508

**Telephone** (907) 562-2211

#### **Alaska Regional Hospital**

2801 DeBarr Rd, Anchorage AK

**(907) 276-1131**

**Website** <http://alaska.providence.org/>

Available means of transport:

1. **Ambulance** - call **911** for Emergency Medical Services.
2. **Coastguard** – call **\*CG** from an AK registered cell phone, radio **VHF Channel 16**
3. **Alaska Rescue Coordination Center** (Air Force) - call 24 hrs **(800) 420-7230**

Local emergency services (Kachemak Bay):

Homer

**Fire (907) 235-3155**  
**Police (907) 235-3150**

**South Peninsula Hospital**  
4300 Bartlett St, Homer, AK 99603  
Telephone (907) 235-8101

Seldovia

**Fire/Ambulance/Clinic (907) 234-7812**  
**Police (907) 234-7640**

#### **Available Procedures**

- Emergency care
- Recompression
- Evacuation

#### **Emergency Plan Content**

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

## APPENDIX 8: Dive Computer Guidelines

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

## APPENDIX 9: 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.