TE WHARE WĀNANGA O TE ŪPOKO O TE IKA A MĀUI
VICTORIA
UNIVERSITY OF WELLINGTON

Diving Safety Manual

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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 standard and it is the responsibility of every member of the American Academy for Underwater Sciences (AAUS) to see that it always reflects state of the art, safe diving practice. This document is also under constant review and the guidelines for diving technologies sanctioned by AAUS but not included in this manual, e.g. Staged Decompression Diving, Saturation Diving, and Mixed Gas Diving, maybe added to future revisions of this manual as they become 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 Victoria University of Wellington (VUW) and it applies to all divers operating under VUW auspices, including staff, students, and visiting divers.

Regardless of VUW diving policy, all scientific diving at VUW shall be conducted in accordance with AS / NZS 2299.1:2015-Occupational diving operations: standard operational practice and AS / NZS 2299.2:2002-Occupational diving operations: scientific diving. These standards take precedence over this manual and should be referred to in the first instance.

ACKNOWLEDGEMENTS

Victoria University and the Academy thank the numerous dedicated individual and organizational members for their contributions and editorial comments in the production of these standards.

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SECTION 1.00 GENERAL POLICY

1.10 Scientific Diving Standards

Purpose

The purpose of these Scientific Diving Standards is to ensure that all scientific diving under the jurisdiction of Victoria University of Wellington (VUW), an Organizational Member of the American Academy of Underwater Sciences (AAUS), is conducted in a manner that will maximize protection of scientific divers from accidental injury and/or illness, and to set forth standards for diver training, evaluation, and certification that will allow a working reciprocity with other AAUS member 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 VUW scientific diving program, the organization for this program, and the basic regulations and procedures for safety in scientific diving operations. All scientific diving conducted under the auspices of VUW shall comply with the standards set forth in this manual.

This manual has been modified from the procedures 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.

Additional standards that extend this document are adopted by VUW, according to recognized procedures and legislation.

Scientific Diving Definition

Scientific diving is defined (according to AS/NZS 2299.1:2015) as diving performed for the purpose of professional scientific research, natural resource management or scientific research as an educational activity.

Scientific Diving Compliance

The following conditions are required as part of the VUW diving program:

a) All diving at VUW must comply with AS/NZS 2299.1:2015 and AS/NZS 2299.2:2002.

b) The scientific diving program shall include at least:

   a. Diving Safety Manual which includes: Procedures covering all diving operations specific to the program, including procedures for emergency care, recompression and evacuation, and criteria for diver training and authorization.

   b. Diving Control Board (DCB) with a majority of its members being active divers, which shall 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 for SCUBA diving.

c) All diving is voluntary; that is, any Scientific Diver may refuse to dive at anytime without concern or penalty if the diver feels the conditions or procedures are unsafe, or the diver is not fit or does not possess adequate training or experience

d) 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.

e) 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.

f) The purpose of the project using scientific diving is the advancement of science; therefore, information and data resulting from the project are non-proprietary.

AAUS Compliance

a) A copy of these standards shall be approved by and filed with AAUS

b) For each diving mode the following shall be described in writing, adhering to the standards of this manual, and be approved by the VUW DCB:
   a. Criteria for diver training and authorization
   b. Safety procedures for the diving operation
   c. Responsibilities of the dive team members
   d. Equipment use and maintenance procedures
   e. Emergency procedures for diving at each location, including procedures for appropriate emergency medical treatment and recompression

c) An annual report and review of the diving activities shall be prepared and submitted to the AAUS. At this time recommendations for modifications to the standards may be submitted for consideration.

Review of Standards

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

1.20 Operational Control

Victoria University Auspices Defined

All diving performed by individuals necessary to and part of a scientific, research, or educational activity in conjunction with a project or study under the jurisdiction of VUW shall be considered scientific diving. This shall include operations which involve:

a) VUW personnel:

   a. VUW employees or volunteers, where such persons are acting within their official capacity as a VUW affiliate, or are engaged otherwise in VUW scientific diving operations;

   b. Individuals whose diving activities are in support of a research or educational project which has been approved by a VUW academic advisor or advisory committee, the results of which are intended to be credited towards completion of a VUW project, course, or degree;

   c. Individuals from auxiliary organizations who are engaged in scientific diving operations under VUW auspices

b) Visiting persons engaged in diving under VUW auspices

c) VUW-owned, purchased, rented, chartered, or otherwise provided facilities, equipment, or supplies. This shall include diving equipment, vessels, or motor vehicles used for diving operational support, compressors, compressed air, or other scientific supplies, or equipment used to meet the diving objectives

d) VUW owned or leased locations

e) Scientific diving activities supported in whole or part by VUW administered funds

f) All research and training proposals which include scientific diving operations must have dive modes approved by the Diving Safety Officer (DSO) and / or Diving Control Board (DCB) prior to operations commencing

Diving Safety Officer

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

a) Qualifications

a. Shall be appointed by the responsible administrative officer or 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 AAUS
d. Shall be an active underwater instructor from an internationally recognised certifying agency

b) Duties and Responsibilities

a. Shall be responsible, through the DCB, to the responsible administrative officer or designee, for the conduct of the scientific diving program of the membership organization. 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 standard and all relevant regulations of the membership organization, 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 considered to be unsafe or unwise.

Diving Control Board

a) 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 designee, and should include other representatives of the diving program such as qualified divers and members selected by procedures established by each organizational member. A chairperson and a secretary may be chosen from the membership of the board according to local procedure.

b) Has autonomous and absolute authority over the scientific diving program's operation.

c) Shall approve and monitor diving projects.

d) Shall review and revise the diving safety manual.

e) Shall assure compliance with the diving safety manual.

f) Shall certify the depths to which a diver has been trained.

g) Shall take disciplinary action for unsafe practices.

h) Shall assure adherence to the buddy system for scuba diving.

i) Shall act as the official representative of the membership organization in matters concerning the scientific diving program.

j) Shall act as a board of appeal to consider diver-related problems.

k) Shall recommend the issue, reissue, or the revocation of diving certifications.

l) Shall recommend changes in policy and amendments to AAUS and the membership organization's diving safety manual as the need arises.

m) Shall establish and/or approve training programs through which the applicants for certification can satisfy the requirements of the organizational member's diving safety manual.

n) Shall suspend diving programs that are considered to be unsafe or unwise.

o) Shall establish criteria for equipment selection and use.

p) Shall recommend new equipment or techniques.

q) Shall establish and/or approve facilities for the inspection and maintenance of diving and associated equipment.

r) Shall ensure that the organizational member's air station(s) meet air quality standards as described in Section 3.60.

s) Shall periodically review the Diving Safety Officer's performance and program.

t) Shall sit as a board of investigation to inquire into the nature and cause of diving accidents or violations of the organizational member's diving safety manual.

Instructional Personnel

a) Qualifications - All personnel involved in diving instruction under the auspices of the VUW shall be qualified for the type of instruction being given.

b) Selection - Instructional personnel will be selected by the responsible administrative officer, or designee, who will solicit the advice of the DCB in conducting preliminary screening of applicants for instructional positions.

Reciprocity and Visiting Scientific Diver

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

b) 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, signed by the Diving Safety Officer or Chairperson of the home Diving Control Board.

c) A visiting Scientific Diver may be asked to demonstrate their knowledge and skills for the planned dive.

d) 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 their Diving Control Board with an explanation of all reasons for the denial.

Waiver of Requirements

The organizational 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 the VUW diving safety manual may be cause for the revocation or restriction of the diver's scientific diving certificate by action of the VUW 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 VUW's recognition by AAUS.

1.50 Record Maintenance

The Diving Safety Officer or designee shall maintain permanent records for each Scientific Diver certified. The file shall include evidence of certification level, log sheets, results of current physical examination, reports of disciplinary actions by the VUW Diving Control Board, and other pertinent information deemed necessary.

Availability of Records:

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

b) Records and documents required by this standard shall be retained by VUW for the following period:

   a. Occupational medical clearance for dive team members - 5 years.

   b. Diving safety manual - 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 - 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 VUW's scientific diving program unless they hold a current certification issued pursuant to the provisions of this standard.

2.20 Pre-Dive Procedures

Dive Plans

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

a) Divers qualifications and the type of certificate or certification held by each diver.

b) Emergency plan (Appendix 7) with the following information:

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

   b. Nearest operational decompression chamber.

   c. Nearest accessible hospital.

   d. Available means of transport.

c) Approximate number of proposed dives.

d) Location(s) of proposed dives.

e) Estimated depth(s) and bottom time(s) anticipated. The maximum diving depth at VUW is 39m and all dives must be within specified NDL's.

f) The anticipated profiles and dive plans for all dives using industry accepted occupational dive tables.

g) Proposed work, equipment, and boats to be employed.

h) Any hazardous conditions anticipated.

i) Anticipated weather conditions at the dive site. These should be updated with the latest available forecasts prior to dive operations commencing.

Additional care and planning should also be taken when conducting diving operations in remote locations. This may include depth restrictions, reduced NDL's for repetitive dives, reducing the number of dives per day, and scheduled days with no diving operations. It is also recommended that industry-best-practice be followed to further reduce the risk of DCI and related injuries.

Dive plans for remote locations should be discussed with the DSO and the DCB during the planning stage.

Pre-dive Safety Checks

a) Diver's Responsibility:

   a. Scientific divers shall conduct a functional check of their diving equipment in the presence of the diving buddy or tender.

   b. It is the diver's responsibility and duty to refuse to dive if, in their judgment, they are not medically / mentally fit to dive (or in their assessment of their buddy, their buddy is not), conditions are unfavorable, or if they would be violating the precepts of their training, of this standard, or the VUW diving safety manual.

   c. No dive team member shall be required to be exposed to hyperbaric conditions against their will, except when necessary to prevent or treat a pressure-related injury.

   d. 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.

b) Equipment Evaluations

   a. Divers shall ensure that their equipment is in proper working order and that the equipment is suitable for the type of diving operation.

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

c) Site Evaluation - 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 for scuba diving. This buddy system is based upon mutual assistance, especially in the case of an emergency.

Dive teams

All SCUBA diving operations require sufficient personnel to ensure the diving can be conducted safely, and careful consideration must be given during the planning stage to the surface support personnel (especially numbers and expertise required) and equipment.

The minimum dive team for all VUW diving operations comprises three members, one diver, their buddy, and someone who shall remain on the surface in the dive coordinating position. This person must be competent and able to respond to any situation that may arise and must have some way of calling for additional emergency assistance. They may only enter the water in the event of an emergency or if there is another person who can take over the coordinating duties (i.e., someone who is competent to communicate with emergency first-responders, but need not be a diver).

If diving operations are conducted from a vessel, then additionally, the surface support person must be competent to operate the vessel and any communications systems on board (or be in direct communication with someone trained to do so).

Lead Diver

For each dive, one individual shall be designated as the Lead Diver who shall be at the dive location during the diving operation.

The leader diver shall have:

a) A current medical clearance issued in accordance with AS NZS 2299.2:2004

b) A current first aid certificate

c) A current oxygen provider certificate

d) Suitable experience and knowledge appropriate for the task and location.

The Lead Diver shall be responsible for:

a) Coordination with other known activities in the vicinity that are likely to interfere with diving operations.

b) Ensuring all dive team members possess current certification and are qualified for the type of diving operation.

c) Planning dives in accordance with Section 2.20

d) Ensuring safety and emergency equipment is in working order and at the dive site.

e) Briefing dive team members on:

   a. Dive objectives.

   b. Unusual hazards or environmental conditions likely to affect the safety of the diving operation.

   c. Modifications to diving or emergency procedures necessitated by the specific diving operation.

   d. Procedures for suspending diving operations and diver recall signals.

f) Reporting to the DSO and DCB any physical problems or adverse physiological effects including symptoms of pressure-related injuries

Refusal to Dive

a) The decision to dive is that of the diver. A diver may refuse to dive, without fear of penalty, whenever they feel it is unsafe for them to make the dive.

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

Termination of the Dive

a) It is the responsibility of the diver to terminate the dive, without fear of penalty, whenever they feel it is unsafe to continue the dive, unless it compromises the safety of another diver already in the water.

b) 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 standard to the extent necessary to prevent or minimize a situation that is likely to cause death, serious physical harm, or major environmental damage. A written report of such actions must be submitted to the Diving Control Board explaining the circumstances and justifications.

2.40 Post-Dive Procedures

Post-Dive Safety Checks

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

b) Decompression diving is not permitted at VUW, however if the NDL's are breached divers and decompression stops are required, the divers should remain awake for at least 1 hour after diving, and in the company of a dive team member who is prepared to transport them to a decompression chamber if necessary.

2.50 Emergency Procedures

See Appendix 7 for procedures pertaining to emergency care, recompression, and evacuation from a dive location.

2.60 Flying After Diving or Ascending to Altitude (Over 1000 feet)

Following a Single No-Decompression Dive: Divers should have a minimum preflight surface interval of 12 hours.

Following Multiple Dives per Day or Multiple Days of Diving: Divers should have a minimum preflight surface interval of 18 hours.

Following Dives Requiring Decompression Stops: Divers should have a minimum preflight surface interval of 24 hours.

Before ascending to Altitude above (1000 feet) by Land Transport: Divers should follow the appropriate guideline for preflight surface intervals unless the decompression procedure used has accounted for the increase in elevation.

2.70 Record Keeping Requirements

Personal Diving Log

Each certified scientific diver shall log every dive made under the auspices of the VUW diving program, and is encouraged to log all other dives. Standard forms will be provided by VUW for this purpose and logs shall be placed in the diver's permanent file. They will also be used to form the annual diving report submitted to the AAUS. The diving log shall be in a form specified by VUW and shall include at least the following:

a) Name of diver.

b) Date, time, and location.

c) Maximum depth, bottom time, resulting pressure groups, and surface interval time.

d) Diving modes used.

e) Dive leader and other participants.

f) General nature of diving activities.

g) Approximate surface and underwater conditions.

h) Detailed report of any near or actual incidents.

Required Incident Reporting

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

Additional information must meet the following reporting requirements:

a) VUW shall record and report occupational injuries and illnesses in accordance with requirements of WorkSafe NZ.

b) If pressure-related injuries are suspected, or if symptoms are evident, the following additional information shall be recorded and retained by VUW, with the record of the dive, for a period of 5 years:

   a. Complete AAUS Incident Report at http://www.aaus.org.

   b. 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.

c) VUW shall investigate and document any incident of pressure-related injury and prepare a report that is to be forwarded to AAUS during the annual reporting cycle. This report must first be reviewed and released by the VUW 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.

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3.20 Equipment

Regulators

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

b) Scuba regulators shall be inspected and tested prior to first use and fully serviced every 12 months thereafter.

c) 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) A non-return valve at the attachment point between helmet or mask and hose, which shall close readily and positively.

b) An exhaust valve.

c) A minimum ventilation rate capable of maintaining the diver at the depth to which they are diving.

Scuba Cylinders

a) Scuba cylinders shall be designed, constructed, and maintained in accordance with AS / NZS 2299.2:20004.

b) Scuba cylinders must be hydrostatically tested in accordance with the current NZ testing standards.

c) Scuba cylinders must have an internal and external inspection at intervals not to exceed 12 months.

d) Scuba cylinder valves shall be functionally tested at intervals not to exceed 12 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 12 months thereafter.

Flotation Devices

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

b) Personal flotation systems, buoyancy compensators, dry suits, or other variable volume buoyancy compensation devices shall be equipped with an exhaust valve.

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

Timing Devices, Depth, and Pressure Gauges

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

Determination of Decompression Status: Dive Tables, Dive Computers

a) A set of industry accepted occupational diving tables must be available at the dive location.

b) All dives must be planned and performed in accordance with the NDL limits specified in the appropiate diving tables. Dive computers may be utilized to assist in remaining within the NDL limits however they do not remove the requirement to plan dives using dive tables. Dive computers must also be approved by the DCB and the AAUS recommendations on dive computers are located in Appendix 8.

3.30 Auxiliary Equipment

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.

Pneumatic tools must be supplied from an air source completely separate to a divers breathing supply.

3.40 Support Equipment

First aid supplies

A first aid kit and emergency oxygen shall be available at the dive site.

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

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

a) 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.

b) Compressed air systems over 500 psig shall have slow-opening shut-off valves.

c) All air compressor intakes shall be located away from areas containing exhaust or other contaminants.

3.50 Equipment Maintenance

Record Keeping

Each equipment modification, repair, test, calibration, or maintenance service 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:

a) Regulators
b) Submersible pressure gauges
c) Depth gauges
d) Scuba cylinders
e) Cylinder valves
f) Diving helmets
g) Submersible breathing masks
h) Compressors
i) Gas control panels
j) Air storage cylinders
k) Air filtration systems
l) Analytical instruments
m) Buoyancy control devices
n) Dry suits

Compressor Operation and Air Test Records

a) Gas analyses and air tests shall be performed on VUW's breathing air compressor at 3 monthly intervals. The results of these tests shall be entered in a formal log and be maintained.

b) 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 AS / NZS 2299.1:2015.

CGA Grade E	
Component	**Maximum**
Oxygen	20 - 22%/v
Carbon Monoxide	10 PPM/v
Carbon Dioxide	480 PPM/v
Condensed Hydrocarbons	0.5 mg/m3
Water Vapor	50mg/m3
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 Evaluation

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.

"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.

SECTION 5.00 SCIENTIFIC DIVER CERTIFICATION

5.10 Certification Types

Scientific Diver Certification

This is a permit to dive, usable only while it is current and for the purpose intended.

Temporary Diver Permit

This permit constitutes a waiver of the requirements of Section 5.00 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.

a) Requirements of this section 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.

5.20 General Policy

No person shall engage in scientific diving under the auspices of VUW unless that person is authorized by the VUW DSO pursuant to the provisions of this manual. Any scientific diver certification issued for such diving is valid only as long as the diver is affiliated with VUW.

5.30 Requirements for VUW Scientific Diver Certification

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 VUW scientific diving privileges. Minimum documentation and examinations required are as follows:

Prerequisites

a) Application - Application for certification shall be made to the Diving Safety Officer on the form prescribed by the organizational member.

b) Medical approval. Each applicant for diver certification shall submit a diving medical clearance from the NZ Diving Hyperbaric Medical Service or a statement of medical fitness for diving from the designated VUW diving doctor.

c) Scientific Diver-In-Training Permit - This permit signifies that a diver has shown documented proof of entry-level diver certification from an internationally recognized training agency or scientific diving program, and has the knowledge skills and experience equivalent to that gained by successful completion of training as specified in Section 4.00.

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

a. Swim 400 meters in less than 12 minutes.

b. Fin kick with mask, snorkel and fins a distance of 800 meters in less than 14 minutes.

c. Tread water for 12 minutes with the last 2 minutes without the use of hands.

d. Transport a passive person of equal size a distance of 25 meters in the water.

e. Swim underwater for a distance of 15 meters without surfacing.

Theoretical and Practical Training

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

Recognition of prior learning may be given for some components of the program however this will be assessed on a case by case basis by the VUW DCB.

a) Required Topics (include, but not limited to):

a. Diving Emergency Care Training
    - Cardiopulmonary Resuscitation (CPR)
    - Standard or Basic First Aid
    - Recognition of DCS and AGE
    - Accident Management
    - Field Neurological Exam
    - Oxygen Administration
b. Dive Rescue
c. Dive Physics
d. Dive Physiology
e. Dive Environments
f. Decompression Theory and its Application
g. AAUS Scientific Diving Regulations and History
    - Scientific Dive Planning
    - Coordination with other Agencies
    - Appropriate Governmental Regulations
h. Scientific Method
i. Data Gathering Techniques (Possible topics include)-
    - 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)

b) Suggested Topics (include, but not limited to):

a. Specific Dive Modes (methods of gas delivery)
    - Open Circuit
    - Hooka
    - Surface Supplied diving

b. Small Boat Operation

c. Rebreathers
    - Closed
    - Semi-closed

d. Specialized Breathing Gas
    - Nitrox
    - Mixed Gas

e. 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

f. Specialized Diving Equipment

- Full face mask
- Dry Suit
- Communications

c) Examinations

a. Written examination

- General exam required for scientific diver certification.
- Examination covering the suggested topics at the DSO's discretion.

b. Examination of equipment.

- Personal diving equipment
- Task specific equipment

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 3 m 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 meters 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.

5.40 Depth Certifications

Depth Certifications and Progression to Next Depth Level

A certified diver diving under the auspices of VUW 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.

a) Certification to 10m Depth - Initial permit level, approved upon the successful completion of training listed in Section 4.00 and 5.30. The diver shall also demonstrate proficiency in the use of the appropriate dive tables.

b) Certification to 20m Depth - A diver holding a 10m certificate may be certified to a depth of 20m after successfully completing, under supervision, 12 logged training dives to depths between 10 and 20m, for a minimum total time of 4 hours. The diver shall also demonstrate proficiency in the use of the appropriate dive tables.

c) Certification to 30m Depth - A diver holding a 20m certificate may be certified to a depth of 30m after successfully completing, 4 dives to depths between 20and 30m. The diver shall also demonstrate proficiency in the use of the appropriate Dive Tables. The diver shall also demonstrate proficiency in the use of the appropriate dive tables.

d) Certification to 40m Depth - A diver holding a 30m certificate may be certified to a depth of 40m after successfully completing, 4 dives to depths between 30 and 40m. The diver shall also demonstrate proficiency in the use of the appropriate dive tables.

In accordance with AS / NZS 2299.2.2004 the maximum diving depth permitted at VUW is 39m.

5.50 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
6-month period. 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 Section 5.30 are met, divers whose depth certification has lapsed due to lack of activity may be re-qualified by procedures adopted by the VUW DCB.

Medical Examination

All certified scientific divers shall pass a medical examination at the intervals specified in Section 6.10. After each major illness or injury, as described in Section 6.10, a certified scientific diver shall receive clearance to return to diving from the diving 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)

5.60 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 standard, or other governmental subdivisions not in conflict with this standard, may be considered cause. Diving Safety Officer shall inform the diver in writing of the reason(s) for revocation. The diver will be given the opportunity to present their case in writing 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.

5.70 Recertification

If a diver's certificate expires or is revoked, they may be re-certified after complying with such conditions as the Diving Safety Officer or the DCB may impose. The diver shall be given an opportunity to present their case to the DCB before conditions for re-certification are stipulated.

SECTION 6.00 MEDICAL STANDARDS

6.10 Medical Requirements

General

All divers working under the auspices of VUW are subject to the diving medical requirements listed in this manual.

a) The VUW DSO shall determine that divers have passed a current diving physical examination and have been declared by the examining physician to be fit to engage in diving activities as may be limited or restricted in the medical evaluation report.

b) All medical evaluations required by this standard shall be performed by the VUW DCB designated diving physician or a WorkSafe NZ approved diving physician.

c) 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)

Frequency of Medical Evaluations

Medical evaluation shall be completed:

a) Before a diver may begin diving

b) Annually thereafter, as stipulated by AS/NZS 2299.2:2004. This evaluation may be undertaken in accordance with AS / NZS 2299.2:2004 or by visiting the designated diving physician.

c) 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 the designated VUW Diving Physician.

Information Provided Examining Physician

The VUW DSO shall provide a copy of the medical evaluation requirements of AS / NZS 2299.2:2004 to the examining physician if requested.

Content of Medical Evaluations

Medical examinations shall contain all of the information specified by AS / NZS 2299.2:2004. Refer to Appendix 1 or contact the designated diving doctor for addition information about diving medical content.

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

a) Abnormalities of the tympanic membrane, such as perforation, presence of a monomeric membrane, or inability to auto inflate the middle ears.
b) Hearing loss; Vertigo including Meniere's Disease.
c) Stapedectomy or middle ear reconstructive surgery.
d) Recent ocular surgery.
e) Psychiatric disorders including claustrophobia, suicidal ideation, psychosis, anxiety states, depression.
f) Substance abuse, including alcohol.
g) Episodic loss of consciousness.
h) History of seizure.
i) History of stroke or a fixed neurological deficit.
j) Recurring neurologic disorders, including transient ischemic attacks.
k) History of intracranial aneurysm, other vascular malformation or intracranial

hemorrhage.

l) History of neurological decompression illness with residual deficit.
m) Head injury.
n) Hematologic disorders including coagulopathies.
o) Risk factors or evidence of coronary artery disease.
p) Atrial septal defects.
q) Significant valvular heart disease - isolated mitral valve prolapse is not disqualifying.
r) Significant cardiac rhythm or conduction abnormalities.
s) Implanted cardiac pacemakers and cardiac defibrillators (ICD).
t) Inadequate exercise tolerance.
u) Hypertension.
v) History of pneumothorax.
w) Asthma.
x) Chronic pulmonary disease, including radiographic evidence of pulmonary blebs, bullae or cysts.
y) Diabetes mellitus.
z) Pregnancy.

Visiting Divers

Divers visiting VUW from AAUS Organizational Members may provide a medical clearance in accordance with their home institution but this is at the discretion of the VUW DCB and will be treated on a case by case basis. Divers must complete Appendices 2 and 3 before applying to the VUW DCB for diving clearance.

The maximum period such a clearance will be granted is 12 months after which the diver must meet the medical requirements listed in AS / NZS 2299.2:2004.

SECTION 7.00 NITROX DIVING GUIDELINES

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

7.10 Prerequisites

Eligibility

Only a certified Scientific Diver or Scientific Diver In Training (Sections 4.00 and 5.00) diving under the auspices of VUW is eligible for authorization to use nitrox. After completion, review and acceptance of application materials, training and qualification, an applicant will be authorized to use nitrox within their depth authorization, as specified in Section 5.40.

Application and Documentation

Application and documentation for authorization to use nitrox should be made on forms specified by the Diving Control Board.

7.20 Requirements for Authorization to Use Nitrox

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

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

Training

The diver must complete additional theoretical and practical training beyond the Scientific Diver In Training air certification level, to the satisfaction of the VUW DSO and DCB (Section 7.30).

Examinations

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

a) Written examinations covering the information presented in the classroom training session(s) (i.e., gas theory, oxygen toxicity, partial pressure determination, etc.);

b) Practical examinations covering the information presented in the practical training session(s) (i.e., gas analysis, documentation procedures, etc.);

c) Openwater checkout dives, to appropriate depths, to demonstrate the application of theoretical and practical skills learned.

Minimum Activity to Maintain Authorization

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

7.30 Nitrox Training Guidelines

Training in these guidelines should be in addition to training for Diver-In-Training authorization (Section 4.00). It may be included as part of training to satisfy the Scientific Diver training requirements (Section 5.30).

Classroom Instruction

a) Topics should include, but are not limited to: review of previous training; physical gas laws pertaining to nitrox; partial pressure calculations and limits; equivalent air depth (EAD) concept and calculations; oxygen physiology and oxygen toxicity; calculation of oxygen exposure and maximum safe operating depth (MOD); determination of decompression schedules (both by EAD method using approved air dive tables, and using approved nitrox dive tables); dive planning and emergency procedures; mixing procedures and calculations; gas analysis; personnel requirements; equipment marking and maintenance requirements; dive station requirements.

b) DCB may choose to limit standard nitrox diver training to procedures applicable to diving, and subsequently reserve training such as nitrox production methods, oxygen cleaning, and dive station topics to divers requiring specialized authorization in these areas.

Practical Training

The practical training portion will consist of a review of skills as stated for scuba (Section 4.00), with additional training as follows:

a) Oxygen analysis of nitrox mixtures.

b) Determination of MOD, oxygen partial pressure exposure, and oxygen toxicity time limits, for various nitrox mixtures at various depths.

c) Determination of nitrogen-based dive limits status by EAD method using air dive tables, and/or using nitrox dive tables, as approved by the DCB.

d) Nitrox dive computer use may be included, as approved by the DCB.

Written Examination (based on classroom instruction and practical training)

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

a) Function, care, use, and maintenance of equipment cleaned for nitrox use.

b) Physical and physiological considerations of nitrox diving (ex.: O_2 and CO_2 toxicity).

c) Diving regulations and procedures as related to nitrox diving, either scuba or surface-supplied (depending on intended mode).

d) Given the proper information, calculation of:

   a. Equivalent air depth (EAD) for a given fO_2 and actual depth;
   b. pO_2 exposure for a given $_{fO2}$ and depth;
   c. Optimal nitrox mixture for a given pO_2 exposure limit and planned depth;
   d. Maximum operational depth (MOD) for a given mix and pO_2 exposure limit;
   e. For nitrox production purposes, percentages/psi of oxygen present in a given mixture, and psi of each gas required to produce a fO_2 by partial pressure mixing.

e) Dive table and dive computer selection and usage;

f) Nitrox production methods and considerations.

g) Oxygen analysis.

h) Nitrox operational guidelines (Section 7.40), dive planning, and dive station components.

Openwater Dives

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

Surface-Supplied Training

All training as applied to surface-supplied diving (practical, classroom, and openwater) will follow the member organization's surface-supplied diving standards, including additions listed in Section 11.60.

7.40 Scientific Nitrox Diving Regulations

Dive Personnel Requirements

a) Nitrox Diver In Training - A Diver In Training, who has completed the requirements of Section 4.00 and the training and authorization sections of these guidelines, may be authorized by the DSO to use nitrox under the direct supervision a Scientific Diver who also holds nitrox authorization. Dive depths should be restricted to those specified in the diver's authorization.

b) Scientific Diver - A Scientific Diver who has completed the requirements of Section 5.00 and the training and authorization sections of these guidelines, may be authorized by the DSO to use nitrox. Depth authorization to use nitrox should be the same as those specified in the diver's authorization, as described in Section. 5.40.

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

In addition to responsibilities listed in Section 1.20, the Lead Diver should:

a. As part of the dive planning process, verify that all divers using nitrox on a dive are properly qualified and authorized;

b. As part of the pre-dive procedures, confirm with each diver the nitrox mixture the diver is using, and establish dive team maximum depth and time limits, according to the shortest time limit or shallowest depth limit among the team members.

c. The Lead Diver should also reduce the maximum allowable pO_2 exposure limit for the dive team if on-site conditions so indicate.

Dive Parameters

a) Oxygen Exposure Limits

   a. The inspired oxygen partial pressure experienced at depth should not exceed 1.6 ATA. All dives performed using nitrox breathing mixtures should comply with the current *NOAA Diving Manual* "Oxygen Partial Pressure Limits for 'Normal' Exposures"

   b. The maximum allowable exposure limit should be reduced in cases where cold or strenuous dive conditions, or extended exposure times are expected. The DCB should consider this in the review of any dive plan application, which proposes to use nitrox. The Lead Diver should also review on-site conditions and reduce the allowable pO_2 exposure limits if conditions indicate.

   c. If using the equivalent air depth (EAD) method the maximum depth of a dive should be based on the oxygen partial pressure for the specific nitrox breathing mix to be used.

b) Bottom Time Limits

   a. Maximum bottom time should be based on the depth of the dive and the nitrox mixture being used.

   b. Bottom time for a single dive should not exceed the NOAA maximum allowable "Single Exposure Limit" for a given oxygen partial pressure, as listed in the current NOAA Diving Manual.

c) Dive Tables and Gases

   a. A set of DCB approved nitrox dive tables should be available at the dive site.

   b. When using the equivalent air depth (EAD) method, dives should be conducted using air dive tables approved by the DCB.

   c. If nitrox is used to increase the safety margin of air-based dive tables, the MOD and oxygen exposure and time limits for the nitrox mixture being dived should not be exceeded.

   d. Breathing mixtures used while performing in-water decompression, or for bail-out purposes, should contain the same or greater oxygen content as that being used during the dive, within the confines of depth limitations and oxygen partial pressure limits set forth in Section 7.40 Dive Parameters.

d) Nitrox Dive Computers

   a. Dive computers may be used to compute decompression status during nitrox dives. Manufacturers' guidelines and operations instructions should be followed.

   b. Use of Nitrox dive computers should comply with dive computer guidelines included in the AAUS Standards.

   c. Nitrox dive computer users should demonstrate a clear understanding of the display, operations, and manipulation of the unit being used for nitrox diving prior to using the computer, to the satisfaction of the DSO or designee.

   d. If nitrox is used to increase the safety margin of an air-based dive computer, the MOD and oxygen exposure and time limits for the nitrox mixture being dived shall not be exceeded.

e. Dive computers capable of pO_2 limit and fO_2 adjustment should be checked by the diver prior to the start each dive to assure compatibility with the mix being used.

e) Repetitive Diving

a. Repetitive dives using nitrox mixtures should be performed in compliance with procedures required of the specific dive tables used.

b. Residual nitrogen time should be based on the EAD for the specific nitrox mixture to be used on the repetitive dive, and not that of the previous dive.

c. The total cumulative exposure (bottom time) to a partial pressure of oxygen in a given 24 hour period should not exceed the current *NOAA Diving Manual* 24-hour Oxygen Partial Pressure Limits for "Normal" Exposures.

d. When repetitive dives expose divers to different oxygen partial pressures from dive to dive, divers should account for accumulated oxygen exposure from previous dives when determining acceptable exposures for repetitive dives. Both acute (CNS) and chronic (pulmonary) oxygen toxicity concerns should be addressed.

f) Oxygen Parameters

a. Authorized Mixtures - Mixtures meeting the criteria outlined in Section 7.40 may be used for nitrox diving operations, upon approval of the DCB

b. Purity - Oxygen used for mixing nitrox-breathing gas should meet the purity levels for "Medical Grade" (U.S.P.) or "Aviator Grade" standards

In addition to the AAUS Air Purity Guidelines (Section 3.60), the following standard should be met for breathing air that is either:

a. Placed in contact with oxygen concentrations greater than 40%.

b. Used in nitrox production by the partial pressure mixing method with gas mixtures containing greater than 40% oxygen as the enriching agent

Air Purity: CGA Grade E (Section 3.60)	
Condensed Hydrocarbons	0.5mg/m^3
Hydrocarbon Contaminants	No greater than 0.1 mg/m^3

g) Gas Mixing and Analysis for Organizational Members

a. Personnel Requirements

- Individuals responsible for producing and/or analyzing nitrox mixtures should be knowledgeable and experienced in all aspects of the technique.
- Only those individuals approved by the DSO and/or DCB should be responsible for mixing and/or analyzing nitrox mixtures.

b. Production Methods - It is the responsibility of the DCB to approve the specific nitrox production method used.

c. Analysis Verification by User

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

7.50 Nitrox Diving Equipment

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

- Labeled SCUBA Cylinders
- Oxygen Analyzers

Oxygen Cleaning and Maintenance Requirements

a) Requirement for Oxygen Service

a. All equipment, which during the dive or cylinder filling process is exposed to concentrations greater than 40% oxygen at pressures above 10 bar (150 psi), should be cleaned and maintained for oxygen service.

b. Equipment used with oxygen or mixtures containing over 40% by volume oxygen shall be designed and maintained for oxygen service. Oxygen systems over 8 bar (125 psi) shall have slow-opening shut-off valves. This should include the following equipment: scuba cylinders, cylinder valves, scuba and other regulators, cylinder pressure gauges, hoses, diver support equipment, compressors, and fill station components and plumbing.

b) Scuba Cylinder Identification Marking

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

a. Cylinders should be marked “NITROX”, or “EANx”, or “Enriched Air”.

b. Nitrox identification color-coding should include a 4-inch wide green band around the cylinder, starting immediately below the shoulder curvature. If the cylinder is not yellow, the green band should be bordered above and below by a 1-inch yellow band.

c. The alternate marking of a yellow cylinder by painting the cylinder crown green and printing the word “NITROX” parallel to the length of the cylinder in green print is acceptable.

d. Other markings, which identify the cylinder as containing gas mixes other than Air, may be used as the approval of the DCB.

e. A contents label should be affixed, to include the current fO_2, date of analysis, and MOD.

f. The cylinder should be labeled to indicate whether the cylinder is prepared for oxygen or nitrox mixtures containing greater than 40% oxygen.

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

d) Other Support Equipment

a. An oxygen analyzer is required which is capable of determining the oxygen content in the scuba cylinder. Two analyzers are recommended to reduce the likelihood of errors due to a faulty analyzer. The analyzer should be capable of reading a scale of 0 to 100% oxygen, within 1% accuracy.

b. All diver and support equipment should be suitable for the fO_2 being used.

e) Compressor system

a. Compressor/filtration system must produce oil-free air.

b. An oil-lubricated compressor placed in service for a nitrox system should be checked for oil and hydrocarbon contamination at least quarterly.

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

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. A depth indicator is not required, except that a repetitive diver shall use the same computer used on any prior dive.

b. Only one buddy must be equipped with a timing device.

c. 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:

a. There are no overhead obstructions or entanglements.

b. The diver is proficient in performing a Controlled Emergency Swimming Ascent from at least as deep as the maximum depth of the aquarium.

c. The diver is proficient in performing out of air emergency drills, including ascent and mask/helmet removal.

d. 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.

c) 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."

d) 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.

e) 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 9.00 STAGED DECOMPRESSION DIVING

Currently staged decompression diving is not permitted at VUW. This policy will be reviewed in 2018.

SECTION 10.00 MIXED GAS DIVING

Mixed gas diving is defined as dives done while breathing gas mixes containing proportions greater than 1% by volume of an inert gas other than nitrogen.
Currently mixed gas diving is not permitted at VUW. This policy will be reviewed in 2018.

SECTION 11.00 OTHER DIVING TECHNOLOGY

Certain types of diving require equipment or procedures that require additional training. Any modes of diving not specifically identified in this manual require the approval of the VUW DCB and DSO before diving operations can begin. See the VUW DSO or DCB members for further information.

SECTION 12.0 REBREATHERS

Currently the use of rebreather technology is not permitted at VUW. This policy will be reviewed in 2018.

SECTION 13.0 SCIENTIFIC CAVE AND CAVERN DIVING STANDARD

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

Cave, cavern, and diving in overhead environments are currently not permitted at VUW. This policy will be reviewed in 2018.

APPENDIX 1 DIVING MEDICAL ASSESSMENTS

The following pages outline the requirements for the AAUS Medical Assessment. For information regarding the AS/ NZS 2299 occupational diving medical assessment please see the Diving Safety Officer.

AAUS DIVING MEDICAL EXAM OVERVIEW FOR THE EXAMINING PHYSICIAN

TO THE EXAMINING PHYSICIAN:

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

Organizational Member

_____ _____

Diving Safety Officer Date

_____ _____

Printed Name Phone Number

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

CONDITIONS WHICH MAY DISQUALIFY CANDIDATES FROM DIVING

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

SELECTED REFERENCES IN DIVING MEDICINE

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

- Elliott, D.H. ed. 1996. *Are Asthmatics Fit to Dive?* Kensington, MD: Undersea and Hyperbaric Medical Society.

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

APPENDIX 2
AAUS MEDICAL EVALUATION OF FITNESS FOR SCUBA DIVING REPORT

_____ _____
Name of Applicant (Print or Type) Date (Month/Day/Year)

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

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

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

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

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

- Chest x-ray (Required only during first exam over age 40)
- Resting EKG
- Assessment of coronary artery disease using Multiple-Risk-Factor Assessment[1]
  (age, lipid profile, blood pressure, diabetic screening, smoking)
  Note: Exercise stress testing may be indicated based on Multiple-Risk-Factor Assessment[2]

PHYSICIAN'S STATEMENT:

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

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

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

_____
Name (Print or Type)

_____
Address

_____ _____
Telephone Number E-Mail Address

My familiarity with applicant is: _____This exam only _____Regular physician for _____ years

My familiarity with diving medicine is: _____

APPENDIX 2b
AAUS MEDICAL EVALUATION OF FITNESS FOR SCUBA DIVING REPORT

APPLICANT'S RELEASE OF MEDICAL INFORMATION FORM

_____

Name of Applicant (Print or Type)

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

Signature of Applicant _____ Date_____

REFERENCES

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

APPENDIX 3
DIVING MEDICAL HISTORY FORM

(To Be Completed By Applicant-Diver)

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

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

TO THE APPLICANT:

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

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

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

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

	Yes	**No**	**Please indicate whether or not the following apply to you**	**Comments**
18			Wear glasses or contact lenses	

19			Bleeding disorders	
20			Alcoholism	
21			Any problems related to diving	
22			Nervous tension or emotional problems	
23			Take tranquilizers	
24			Perforated ear drums	
25			Hay fever	
26			Frequent sinus trouble, frequent drainage from the nose, post-nasal drip, or stuffy nose	
27			Frequent earaches	
28			Drainage from the ears	
29			Difficulty with your ears in airplanes or on mountains	
30			Ear surgery	
31			Ringing in your ears	
32			Frequent dizzy spells	
33			Hearing problems	
34			Trouble equalizing pressure in your ears	
35			Asthma	
36			Wheezing attacks	
37			Cough (chronic or recurrent)	
38			Frequently raise sputum	
39			Pleurisy	
40			Collapsed lung (pneumothorax)	
41			Lung cysts	
42			Pneumonia	
43			Tuberculosis	

	Yes	**No**	**Please indicate whether or not the following apply to you**	**Comments**
44			Shortness of breath	
45			Lung problem or abnormality	
46			Spit blood	

47			Breathing difficulty after eating particular foods, after exposure to particular pollens or animals	
48			Are you subject to bronchitis	
49			Subcutaneous emphysema (air under the skin)	
50			Air embolism after diving	
51			Decompression sickness	
52			Rheumatic fever	
53			Scarlet fever	
54			Heart murmur	
55			Large heart	
56			High blood pressure	
57			Angina (heart pains or pressure in the chest)	
58			Heart attack	
59			Low blood pressure	
60			Recurrent or persistent swelling of the legs	
61			Pounding, rapid heartbeat or palpitations	
62			Easily fatigued or short of breath	
63			Abnormal EKG	
64			Joint problems, dislocations or arthritis	
65			Back trouble or back injuries	
66			Ruptured or slipped disk	
67			Limiting physical handicaps	
68			Muscle cramps	
69			Varicose veins	

	Yes	**No**	**Please indicate whether or not the following apply to you**	**Comments**
70			Amputations	
71			Head injury causing unconsciousness	
72			Paralysis	
73			Have you ever had an adverse reaction to medication?	
74			Do you smoke?	

75			Have you ever had any other medical problems not listed? If so, please list or describe below;	
76			Is there a family history of high cholesterol?	
77			Is there a family history of heart disease or stroke?	
78			Is there a family history of diabetes?	
79			Is there a family history of asthma?	
80			Date of last tetanus shot? Vaccination dates?	

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

_____
_____
_____
_____
_____
_____
_____
_____

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

Signature Date

APPENDIX 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 Helen Fieldes
   Contact: Helen.f@xtra.co.nz
   Telephone:+64 27 221 5335 / +64 43857017

APPENDIX 5
DEFINITION OF TERMS

Air sharing - Sharing of an air supply between divers.

AGE – Arterial Gas Embolism

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.

DCIEM – Defence and Civil Institute of Environmental Medicine

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

Decompression Illness (DCI) – Term used to describe injuries or illness related to breathing compressed gases. This includes AGE and DCS.

Decompression Sickness (DCS) - 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 or freshwater, or equivalent static head.

FSW - Feet of seawater, or equivalent static head.

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

Hyperbaric Chamber - See decompression chamber.

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

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

Maximum Working Pressure - Maximum pressure to which a pressure vessel may be exposed under standard operating conditions.

Organizational Member - An organization which is a current member of the AAUS, and which has a program, which adheres to the standards of the AAUS as, set forth in the AAUS Standards for Scientific Diving Certification and Operation of Scientific Diving Programs.

Mixed Gas - MG

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

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

MoBIE – Ministry of Business, Innovation, and Employment

MSW - Meters of seawater or equivalent static head.

Nitrox - Any gas mixture comprised predominately of nitrogen and oxygen, most frequently containing between 21% and 40% oxygen. Also be referred to as Enriched Air Nitrox, abbreviated EAN.

NOAA Diving Manual: Refers to the *NOAA Diving Manual, Diving for Science and Technology*, 2001 edition. National Oceanic and Atmospheric Administration, Office of Undersea Research, US Department of Commerce.

No-Decompression limits - Depth-time limits of the "no-decompression limits and repetitive dive group designations table for no-decompression air dives" of the U.S. Navy Diving Manual or equivalent limits.

Normal Ascent - An ascent made with an adequate air supply at a rate of 60 feet per minute or less.

Oxygen Clean - All combustible contaminants have been removed.

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

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

Oxygen Toxicity Unit - OTU

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

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

Pressure Vessel - See cylinder.

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.

Rebreather – When the breathing gas is recycled through the breathing loop. The breathing loop maybe fully or partially closed.

Recompression Chamber - see decompression chamber.

Reverse Profile Diving – When a repeat dive is deeper than the earlier dive. Reverse profiles with a depth differential greater than 12m are not permitted at VUW.

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.

VUCEL - Victoria University Coastal Ecology Laboratory

VUW - Victoria University of Wellington

Working Pressure - Normal pressure at which the system is designed to operate.

WorkSafe NZ – The regulator for workplace health and safety in New Zealand.

APPENDIX 6

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

Diver:_____ Date:_____

This letter serves to verify that the above listed person has met the training and pre-requisites as indicated below, and has completed all requirements necessary to be certified as a *(Scientific Diver / Diver in Training)* as established by the *(Organizational Member)* Diving Safety Manual, and has demonstrated competency in the indicated areas. (Organizational Member) 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
_____
(Date)

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

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

Please indicate any pertinent specialty certifications or training:

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

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

Diving Safety Officer:
_____ _____
(Signature) (Date)
_____ _____
(Print)

APPENDIX 7
DIVING EMERGENCY MANAGEMENT PROCEDURES

Introduction

A diving accident victim could be any person who has been breathing compressed gas underwater regardless of depth. It is essential that emergency procedures are pre-planned and that medical treatment is initiated as soon as possible. It is the responsibility of the dive leader to ensure there are suitable means of communication at the dive site to initiate any emergency medical treatment or evacuation plan.

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 Services 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. Start written record of events and timelines. Preserve any equipment or items of interest used during the dive.
6. Call Diver Emergency Services (0800 4 DES 111) and be prepared to provide dive profiles and associated information to DES staff.
7. Notify DSO or designee according to the Hazard Assessment for the diving operation.
8. Complete and submit Incident Report Form (www.aaus.org) to the DCB of the organization and the AAUS (Section 2.70 Required Incident Reporting).

List of Emergency Contact Numbers Appropriate For Dive Location

Police / Fire / Ambulance	111
Diver Emergency Services	0800 4 DES 111 / 0800 4 337 111
WorkSafe NZ	0800 030 040 / +64 9 969 2950
Daniel McNaughtan	+64 21 684704
John van der Sman	+64 27 5348377
Jeff Shima	+64 27 5635475

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. Any make or model of dive computer may be used at VUW however the Diving Control Board reserves the right to request evidence confirming the accuracy and reliability for any computer in use at VUW. The Diving Control Board also reserves the right to prohibit the use of any make or model within the VUW diving program.

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.

10. Whenever practical, divers using a dive computer should make a stop between 3 and 5m for 5 minutes, especially for dives below 20m.

11. 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 VUW. Dives logged by divers from another AAUS Organization will be reported with the diver's home organization. Only a diver who has actually logged a dive during the reporting period is counted under this category.

Incident(s) 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 definition in AS/NZS 2299.1:2015. 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.

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.

Decompression Planning and Calculation Method:

- Dive Tables
- Dive Computer
- PC Based Decompression Software

Depth Ranges:

Depth ranges for sorting logged dives are 0-10, 11-20, 21-30, and 31-40. Depths are in meters 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 VUW 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 VUW 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 VUW considers being serious in nature. Examples of this classification would include, but not be limited to:
    - Arterial Gas Embolism.
    - DCS symptoms requiring multiple hyperbaric treatments.
    - Near drowning.
    - Oxygen Toxicity.
    - Hypercapnea.
    - Spinal injuries.
    - Heart attack.

- Fatality.