UNIVERSITY *of* TASMANIA

AUSTRALIA

DIVE MANUAL

Version 9.0
February 2021

https://www.utas.edu.au/safety-and-wellbeing
Division of the Chief Operating Officer/People and Wellbeing/Safety and Wellbeing
Dive.Safety@utas.edu.au
Feb 2021

FOREWORD

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

This document reflects these industry minimum standards for scientific diving. It also meets Australian WHS (2012) legislative requirements, incorporates appropriate Australian Standards, and is informed by world-best practices.

As diving science progresses so must this Dive Manual, and it is the responsibility of all divers at the University of Tasmania to see that it always reflects state of the art, safe diving practice.

ACKNOWLEDGEMENTS

The University thanks the numerous dedicated individuals who have made contributions and editorial comments in the production of this Dive Manual, and those who have contributed both directly and indirectly in the development of WHS legislation, Australian Standards, and scientific diving industry standards, such as the American Academy of Underwater Sciences' Standards for Scientific Diving.

Revision History		Date
Version 8.0	Submission of Minimum Standard to AAUS	May 2020
Version 9.0	UTAS Dive Manual Update	Feb 2021
Addition	Added Appendix 13	Jun 2022
Edit	Fixed errors in page numbers in Contents, Manual Approved	Jun 2022

Prior document revision history

Note that this Dive Manual is also based on a series of prior control documents (UTAS Diving Policy and Procedures Manual) with a revision history from 1998-2011 including:

v 1.0	1998	December
v 2.0	2001	January
v 3.1	2001	June
v 3.3	2001	November
v 4.1	2003	September
v 5.0	2004	June
v 5.1	2005	January
v 6.0	2005	September
v 7.0	2007	June
v 7.1	2008	May
v 7.2	2008	November
v 7.3	2008	December
v 7.4	2009	March
v 7.5	2011	August

Contents

APPENDICES

Volume 1

Sections 1.00 through 5.00

PRINCIPLES AND CORE PRACTICES

Section 1.00 GENERAL POLICY PRINCIPLES

1.10 Scientific Diving Policy Principles

Purpose

The purpose of this UTAS Dive Manual is to ensure scientific diving at the University of Tasmania is conducted in a manner that will maximise the protection of scientific divers from accidental injury and/or illness, and to set forth requirements for training and certification for conducting diving operations. Fulfillment of these purposes shall be consistent with the furtherance of research and safety, and facilitation of collaborative opportunities between UTAS and our research partners.

This Dive Manual establishes requirements for the University's scientific diving programs, the organisation for the conduct of these programs, and the basic procedures for safety in scientific diving operations. It also establishes a framework for reciprocity between UTAS and our research partners.

Historical Perspective and Source Material

The content and foundational authority of this Dive Manual includes several sources.

This document is based on and compliant with Australian Legislation, including the Work Health and Safety Act 2012, the Work Health and Safety Regulations 2012, and reflects Australian/New Zealand Standards for Occupational Diving (AS/NZS 2299.1) Scientific Diving (AS/NZS 2299.2) and Training and certification of occupational divers (2815 series).

This document is also based on and compliant with the Standards for Scientific Diving promulgated by AAUS, which was developed and written by compiling the policies set forth in the diving manuals of several university, private, and governmental scientific diving programs. These programs shared 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.[1]

Scientific Diving Definition

Scientific Diving in Australia is defined as diving performed for the purpose of professional scientific research, natural resource management or scientific research as an educational activity.[2]

Recommendations for Changes to AAUS Minimum Standards

As part of the annual report to AAUS, the University will submit recommendations for modifications of the AAUS Minimum Standards for consideration.

1.20 Operational Control

UTAS Auspices and Responsibilities

UTAS auspices include any scientific diving operation in which UTAS is connected because of ownership of life support equipment used, locations selected, products, data, or outcomes of diving operations, or relationship with the individual(s) concerned. This includes all cases

---

[1] In 1982, OSHA (USA) exempted scientific diving from commercial diving regulations (29CFR1910, Subpart T) under certain conditions. The final guidelines for the exemption became effective in 1985 (Federal Register, Vol. 50, No.6, p.1046). AAUS is recognised by OSHA as the scientific diving standard setting organisation.

[2] Source: AS/NZS 2299.2

involving the operations of authorised individuals of UTAS or auxiliary organisations, where such individuals are acting within the scope of their authorisation.

The requirements of this Dive Manual must be observed at all locations where scientific diving is conducted.

UTAS Diving Manual alignment with AAUS standards

Meeting AAUS minimum standards is a requirement for organisational membership in the AAUS. The University must maintain this Dive Manual to include wording on how the University defines specific policies and procedures required for the proper function of a scientific diving program. This Dive Manual addresses environmental and working conditions unique to the program's operations and meets or exceeds the AAUS standards.

AAUS standards are a key component of this Dive Manual, which includes the information contained in all required sections of the AAUS standards. Any deviations or significant changes to AAUS minimum standards contained in this Dive Manual are related to Australian legislation or Australian Standards.

Supplementary Guidelines and High-Risk Diving

Most diving conducted at UTAS meets the definition of General Diving, provided by the Work Health and Safety Regulations 2012 (Part 1.1 – Interpretation), however High Risk Diving may occasionally be conducted. All dives that meet the definition of High Risk diving must be conducted in accordance with AS/NZS 2299.1 Standards for Occupational Diving Operations.

For any other dive operation not specifically addressed in this Dive Manual, final interpretation of conflicting or unclear operations shall fall to Australian WHS Legislation, Australian Standards, and/or AAUS's Standards for Scientific Diving. If the operation parameters are not addressed in these, the operations shall fall under AS/NZS 2299.1 Standards for Occupational Diving Operations.

An immediate judgment may be provided by the UDO until the DSC can meet, review, and provide advice on the operation.

Diving Safety Committee

- The Dive Safety Committee (DSC) is a governance committee providing oversight of the scientific diving program at UTAS. The committee must consist of a majority of active scientific divers. Voting members include the University Diving Officer (UDO), and other representatives of the diving program such as qualified divers and members selected by procedures established by UTAS. A chairperson and a secretary may be chosen according to UTAS procedure.
- The DSC is responsible to:
    - Establish additional standards, protocols, and operational procedures beyond required minimums to address University-specific needs and concerns.
    - Recommending policy and procedure changes in operating procedures that will ensure a safe and efficient diving program.
    - Approve and monitor diving projects, including reviewing contracts and cooperative agreements that involve scientific diving as necessary.
    - Review and revise the UTAS Dive Manual.
    - Ensure compliance with the UTAS Dive Manual.
    - Approve the depth to which a diver has been authorized to dive.
    - Recommend disciplinary action for unsafe practices.
    - Ensure adherence to the buddy system for scientific diving.
    - Represent UTAS (in concert with the UDO) in matters concerning the scientific diving

program.
    - Serves as a board of appeal to consider diver-related problems.
    - Recommend the issue, reissue, or the revocation of diving authorisations.
    - Recommend changes in policy and amendments to AAUS and the UTAS Dive Manual as the need arises.
    - Provide advice regarding training protocols or standards through which the applicants for authorisation can satisfy the requirements of the UTAS Dive Manual.
    - Suspend diving operations considered to be unsafe or unwise.
    - Provide advice regarding criteria for equipment selection and use.
    - Recommend new equipment or techniques.
    - Approve facilities for the inspection and maintenance of diving and associated equipment.
    - Ensure that air station(s) meet air quality standards as described in Section 3.60.
    - Periodically review dive officer performance and the dive program.
    - Review and provide advice regarding Learning Reviews of scientific diving incidents or violations/deviations of the UTAS Dive Manual.
- The DSC may delegate operational oversight for portions of the program to the UDO (and other dive officers); however, the DSC may not abdicate responsibility for the safe conduct of the diving program.

University Diving Officer

A University-wide suitably qualified and experienced dive officer, The University Dive Officer (UDO) has overall management responsibility for diving activities associated with the University; has oversight of dive training requirements; and is the subject matter expert and representative of the University for diving related matters.

The UDO serves as a voting member of the DSC and shall serve as an Organisational Member Representative to AAUS. This person shall have broad technical expertise and experience in research related diving.

Qualifications:

1. Must be an active scuba instructor from an internationally recognized certifying agency.
2. Must be appointed by the responsible administrative officer or designee, with the advice and counsel of the DSC.
3. Must qualify as a Full Voting Member of AAUS as defined by AAUS Bylaws:

   "(a) Holds a diving certification from a recognized national certifying agency or equivalent, and
   (b) Has engaged in sustained or successive scientific diving activities during the past two years, or
   (c) Has completed a course in scientific diving that meets the requirements as specified by the most current edition of the AAUS Standards for Scientific Diving."
4. Must attend an AAUS DSO Orientation within one year of accepting a position at an AAUS approved OM, unless he/she has served as a DSO for another current AAUS

OM within the last year.

Duties and Responsibilities

1. Answers to the Director of Safety and Wellbeing and provides reports to the DSC relating to the conduct of the UTAS scientific diving program.
2. Responsible for ensuring that University diving operations conform to the University's WHS management framework, policies, relevant legislation and Australian Standards
3. Authority for this program rests with the UDO. This oversight includes, but is not limited to training, diver authorisations, approval of dive project plans and dive plans, maintenance of diving records, and ensuring compliance with this Dive Manual.
4. Promotes a safe diving culture;
5. Engages with key stakeholders to ensure consistent management of safe diving across all organisational units of the University;
6. May permit some duties and responsibilities to be carried out by a qualified delegate, with the approval of the DSC.
7. Is guided in the performance of the required duties by the advice of the DSC, but responsibility for the conduct of the scientific diving program will be retained by the UDO.
8. Suspend diving operations determined to be unsafe or unwise.

Instructional Personnel Qualifications

All personnel involved in diving instruction, training and assessment under the auspices of the University must be reviewed and authorised by the DSC.

Instructional personnel shall meet current ASQA trainer and assessor requirements, which include:

- holding required credentials (including current TAE qualifications for Training and Assessment),
- holding vocational competencies,
- meeting current industry skills requirements,
- meeting current knowledge and skills in vocational training and learning requirements,
- undertaking relevant professional development.

Dive Coordinator/Dive Supervisor

For each dive, one individual shall be designated as the Dive Coordinator/Dive Supervisor who shall be at the dive location during the diving operation. The Dive Coordinator shall be responsible for:

- Ensuring dives are conducted in accordance with Section 2.0.
- Ensuring all dive team members possess current authorisation and are qualified for the type of diving operation.
- Coordination with other known activities in the vicinity that are likely to interfere with diving operations.
- Ensuring safety and emergency equipment is in working order and at the dive site.
- Suspending diving operations if in their opinion conditions are not safe.

- Reporting any physical problems or adverse physiological effects including symptoms of pressure-related injuries - following current UTAS reporting procedures.

Reciprocity and Visiting Scientific Diver

- Two or more organisations (AAUS OMs or AAUS-compliant programs) engaged jointly in diving activities, or engaged jointly in the use of diving resources, must designate one of the participating DSCs to govern the joint dive project. However, responsibility for individual divers ultimately resides with the home organisation.
- A Scientific Diver from one organisation must apply for permission to dive under the auspices of another organisation by submitting to the UDO/DSO of the host organisation a document containing all the information listed in Appendix 6, signed by the UDO/DSO or designee of the home DSC.
- A visiting Scientific Diver may be asked to demonstrate their knowledge and skills for the planned dive.
- If a host organisation denies a visiting Scientific Diver permission to dive, the host DSC must notify the visiting Scientific Diver and their DSC with an explanation of all reasons for the denial.

Waiver of Requirements

The UTAS DSC may grant a waiver for specific requirements of training, examinations, depth authorisations, and minimum activity to maintain authorisations. Medical standards may not be waived.

1.30 Consequence of Violation of UTAS Dive Manual by Scientific Divers

Failure to comply with the requirements of this UTAS Dive Manual may be cause for the restriction or revocation of the diver's scientific diving authorisation by action of the UTAS DSC

1.40 Consequences of Violation of Regulations by AAUS Organisational Members

Failure to comply with the AAUS standards may be cause for the restriction or revocation of UTAS as a recognised Organisational Member of AAUS.

1.50 Record Maintenance

Each Site Diving Office at UTAS must maintain consistent records for the UTAS diving program and for each participant under their auspices. These records include but are not limited to: this UTAS Dive Manual; equipment inspection, testing, and maintenance records; dive plans (project and/or individual); records of dive (project and/or individual); medical approval to dive; diver training records; diver authorisation(s); individual dive log; documentation related to dive incident reports; reports of disciplinary actions by the DSC; and other pertinent information deemed necessary by UTAS.

Availability of Records:

- Medical records must be available to an attending physician of a diver or former diver when released in writing by the diver.
- Records and documents required by this UTAS Dive Manual must be retained by UTAS (e.g. each Site Diving Office) for a period of time consistent with current UTAS Information Management procedures in the Staff Recordkeeping Manual (SRM), or the below, whichever is longer.

    1. Dive Manual – Current document only.
    2. Equipment inspection, testing, and maintenance records – Minimum current entry or

tag.

3. Records of Dive – minimum of 5 years, except 7 years where there has been an incident of pressure-related injury.
4. Medical approval to dive – Minimum of 1 year past the expiration of the current document except 7 years where there has been an incident of pressure-related injury.
5. Diver training records – Minimum of 1 year beyond the life of the diver's program participation.
6. Diver authorisation(s) – Minimum of 1 year beyond the life of the diver's program participation.
7. Pressure-related injury assessment - 5 years.
8. Reports of disciplinary actions by the DSC – Minimum of 1 year beyond the life of the diver's program participation.

SECTION 2.00 DIVING CORE PROCEDURES

2.10 Introduction

No person shall engage in scientific diving operations under the auspices of the UTAS scientific diving program unless they are authorized pursuant to the provisions of this Dive Manual.

2.20 Pre-Dive Procedures

Dive Project Plan – is a written submission of a diving project for approval by the UDO. Usually prepared by the project leader, it includes a risk assessment and/or a ***Safe Work Practice*** ***(SWP)*** completed in consultation with the UDO and dive team members that will be undertaking the work.

The project plan is a high-level view and should include the following:

- Purpose and scope of the project
- References, Legislation, Standards and other guidance material
- Potential hazards, risks and controls specific to the project
- Proposed work, equipment and vessel type to be used
- Diving Mode(s) and gasses
- Approximate number of proposed dives, estimated depth ranges and bottom times anticipated (and expected decompression status/profile)
- Training, qualification/diving authorisation requirements specific to the project
- Permits and other records
- Locations of proposed dives
- Emergency procedures and action plan specific to the project

Dive Activity/Trip Plan – is a documented operational plan for a dive or a series of dives, which identifies a specific date(s), location(s), personnel, their roles/assignments, dive project(s) and logistics for the trip/activity. Activity plans are prepared by the Dive Coordinator or Dive Supervisor and agreed upon by all parties involved in the diving operation prior to commencement of the activity. Activity plans are submitted via the current approval process (e.g. online platform) and approved by the relevant Diving Officer.

The dive activity should be planned around the competency of the least experienced diver and should include the following:

- Diving Mode(s) and Gas(es)
- Divers' authorisations
- Number of planned dives, depths, bottom times and decompression status/dive profiles
- Location(s), date(s), time(s)
- Personnel and their assignments/roles for the activity (e.g. coxswain, diver, attendant, etc.)
- Proposed work, equipment, and vessels to be employed
- Any hazardous conditions or risks anticipated, and any additional controls/mitigations
- Emergency Action Plan (Appendix 7)

On-Site Risk Assessment

On arrival at the dive location, an onsite risk assessment must be conducted, including environmental conditions, operating hazards and mitigations. See Appendix 11 for a checklist that may be used for this purpose (Checklist 1: On-Site Risk Assessment).

Pre-Dive Briefing

Before conducting any diving operations, the dive team members must participate in a pre-dive briefing. See Appendix 11 for a checklist that may be used for this purpose (Checklist 2: Pre-Dive Briefing).

There must be a competent person (Dive Coordinator or Dive Supervisor) supervising the diving work and diving functions at all times. That person must prepare a dive plan before the work takes place and give workers instructions about it. The dive plan must be followed, and the briefing must contain[3]:

- Goals and dive objectives[4]
- The task(s) of each person who is diving[3]**Error! Bookmark not defined.**
- Dive Buddy assignments and tasks[4]
- The Diving equipment and support equipment needed[3]
- The breathing gas/gasses required[3]
- The dive procedures[3]
- Maximum depth(s)[4]
- The dive times, bottom times, and decompression profiles[3]
- Gas management plan[4]
- Turn-around pressure and required surfacing pressure[4]
- Entry, exit, descent and ascent procedures[4]
- Any hazards relating to the dive and steps to be taken to control the risks[3]
- Emergency procedures[3] and recall procedures[4]

Diver Responsibility and Refusal to Dive

The decision to dive is that of the diver. The ultimate responsibility for safety rests with the individual diver. It is the diver's responsibility and duty to refuse to dive, without fear of penalty, if in their judgment, conditions are unsafe or unfavourable, or if they would be violating the principles or requirements of this Dive Manual.

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

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

Pre-dive Safety Checks and Diver Deployment

Before conducting any diving operation, dive team members must conduct Pre-Dive Safety Checks and Diver Deployment Checks. See Appendix 11 for a checklist that may be used for this purpose (Checklist 3: Deploy Diver Checks).

- Prior to commencing the dive, the team must assure that every team member is healthy, fit, and trained for the type of dive that is being attempted.
- Scientific divers must conduct a check of their diving equipment in the presence of the dive buddy and/or tender/attendant to ensure the equipment is functioning properly, and

[3] Source: WorkSafe Tasmania guidance.

[4] AAUS Standards Manual Nov2018

configured and suitable for the type of diving operation being conducted.

- Each diver must have the capability of achieving and maintaining positive buoyancy at the surface.
- Environmental conditions at the site will be evaluated prior to entering the water.

Post-dive Debriefing

Upon completion of diving activities, dive team members must conduct a post-dive debriefing. See Appendix 11 for a checklist that may be used for this purpose (Checklist 4: Post-Dive Debriefing).

2.30 Diving Procedures

Solo Diving Prohibition

Solo diving is prohibited. All diving activities must assure adherence to the buddy system and/or team diving. This buddy system is based upon mutual assistance, especially in the case of an emergency.

Buddy System – is a system of diving based on mutual assistance and responsibility through monitoring and communication. Buddy divers must at all times have visual contact with and direct access to each other, in order to immediately recognize a problem and render assistance.

Team Diving – is a team approach to diving that adheres to the principles of the Buddy System, and tacitly acknowledges the cooperative nature of all members of a dive team, (i.e. divers, attendants and other personnel) working together to actively support dive operations. Team diving may also describe three-diver combinations, activities where buddy teams change during a dive, or more complicated operations such as Bluewater diving procedures (with the safety diver stationed at the centre of an array). It may also describe SSBA, Tethered Scuba, or Hookah operations.

Decompression Management

- On any given dive, both divers in the buddy pair must follow the most conservative dive profile
- An ascent rate of slower than 9m per minute is strongly recommended.
- Safety Stops:
    - are recommended for most diving activities, provided it is safe to do so.
    - should be performed for any dive of greater than 9m depth,
    - should be performed for any dive between 7m-9m depth that exceeds 180 minutes
    - should be performed at a depth of 3m-5m for 3 to 5 minutes.

Termination of the Dive

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

It is the responsibility of the diver to terminate any dive they consider unsafe, without fear of reprisal, in a way that does not compromise the safety of another diver already in the water.

Emergencies and Deviations from Regulations

Any diver may deviate from the requirements of this Dive Manual to the extent necessary to prevent or minimize a situation likely to cause death, serious physical harm, or major environmental damage. A written report (including an incident report via MySafety) must be

submitted to the DSC through the UDO, explaining the circumstances and justifications.

2.40 Post-Dive Procedures

Post-Dive Safety Checks

After the completion of a dive, each diver must report any physical problems, symptoms of decompression illness, or equipment malfunctions to the Dive Coordinator and record it on the dive log record sheet. The Dive Coordinator shall notify the UDO (and relevant Dive Officer) of any hazard, near miss or incident and assure it is reported in MySafety.

2.50 Emergency Procedures

All diving project plans must include emergency procedures which follow the standards of care of the community and must include procedures and implementation criteria for emergency care, recompression, evacuation, and incident reporting. See Appendix 7 for additional guidance.

2.60 Flying After Diving or Ascending to Altitude (Over 150 meters)

Due to increased risk of DCI through exposure to altitude after diving, restrictions on ascending/traveling to altitude (i.e. road or air travel) apply where UTAS divers are subject to pressures of greater than one atmosphere while breathing compressed gas. These shall apply to all UTAS divers and must be followed, except in the event of an extreme emergency where no other option is available. In such a case, these rules should only be breached on the advice of medical personnel trained in hyperbaric medicine, and with the consent of all diving personnel involved.

- After incurring any form of decompression illness, a diver should not be exposed to greater than 300m effective altitude for seven days.
- After any compressed gas dive under the auspices of UTAS, the minimum surface interval before the diver may travel by air is 24 hours.
- It is the Dive Coordinator's responsibility to determine whether travel after diving will exceed an altitude threshold, and to ensure the correct delay is observed before the team's trip home after a dive.
- The table below, taken from Appendix G of AS2299.1:2015, lists the appropriate delay periods required after diving before travel above certain altitudes is permitted. These recommendations have been developed with advice from Hyperbaric Medicine Specialists and should be applied where air or road travel after a dive will exceed any of the altitude thresholds listed.
- Dive Coordinators should also consider Appendix 9 – Maximum Altitudes of Roads in Tasmania during dive planning.

When calculating applicable delays after diving, the Dive Coordinator must also consider:

- These recommendations are for divers who are in normal health following diving. If any signs/symptoms of illness/injury are present, advice should be sought regarding the need for emergency evacuation.
- Exertion by divers after any dive(s)
- Effects on divers of in-water exertion and water temperature during the dive.

Table from AS2299.1:2015 - Recommended Delay Before Exposure to Altitude After Diving

Altitude (m)	Minimum delay before travel to altitude (Hrs) Category of Dive (see Legend)		
	Category 1	**Category 2**	**Category 3**
0 - 150	Nil	Nil	2
150 - 600	Nil	2	12
600 - 2400	12	24	48
>2400	24	48	72

LEGEND:

Category 1: A single dive to ≤ 50% of the DCIEM no-decompression limit, or two short dives within 18h with a total, combined bottom time of ≤ 50% of the no-decompression limit for the depth of the deeper dive. No decompression dives or repetitive dives to have been performed in the preceding few days.

Category 2: Dives exceeding category 1 but not included in Category 3, e.g. one or more dives to ≤ 50% of the no-decompression limits, or a single decompression dive in a day.

Category 3: Repetitive deep diving over multiple days; multiple decompression dives on one day; extreme exposures; omitted decompression, or other adverse events.

2.70 Record Keeping Requirements

Diver's Logs

Each authorized scientific diver must log every dive made under the auspices of the UTAS dive program and is encouraged to log all other dives. Logs (UTAS dive record forms) must be submitted to the appropriate Site Dive Officer and must remain in the divers' file. The dive log must include at least the following:

- Name of diver and buddy
- Date, time, and location
- Diving modes used
- General nature of diving activities
- Maximum depth and dive time
- Diving tables or computers used
- Detailed report of any near or actual incidents

Required Incident Reporting

UTAS procedures require all incidents (regardless of severity), near misses and hazards to be reported at UTAS on the MySafety platform.

All diving incidents requiring recompression treatment or resulting in moderate or serious injury or death must be reported to the UTAS DSC via the UDO, and to AAUS in a timely manner. Any "notifiable" incident will be reported to WorkSafe Tasmania (or the relevant state authority) by the Safety and Wellbeing Manager. The UDO 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.

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

- Written descriptive report shall 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.
    - The circumstances of the incident and the extent of any injuries or illnesses.
    - Description of symptoms, including depth and time of onset.
    - Description and results of treatment.
    - Disposition of case.
    - Recommendations to avoid repetition of incident.

In addition to UTAS reporting requirement, all diving incidents will be reported to the AAUS. This report must first be reviewed and released by the UTAS DSC and at a minimum contain:

- Complete AAUS Incident Report.
- Summary of experience of divers involved.
- Description of dive site, and description of conditions that led up to incident.
- The circumstances of the incident and the extent of any injuries or illnesses.
- Description of symptoms, including depth and time of onset.
- Description and results of treatment.
- Disposition of case.
- Recommendations to avoid repetition of incident.

SECTION 3.00 DIVING EQUIPMENT

3.10 General Policy

All equipment must meet standards as determined by the UDO and the DSC. All equipment must be regularly examined by the person using it and serviced according to manufacturer recommendations by a qualified, DSC approved facility/technician. See Appendix 12 for Equipment Service Intervals. Equipment that is subjected to extreme usage under adverse conditions should require more frequent testing and maintenance. It is the responsibility of the Dive Coordinator to ensure that all required equipment is used or carried by each diver on every dive.

3.20 Equipment

The UDO and the DSC must establish the minimum equipment and configuration for all dives.

Regulators and Gauges

- Scuba regulators and gauges must be checked by the user for functionality prior to each use and function tested/serviced, at a minimum, according to manufacturer's recommendations.
- Standard open circuit (OC) regulator configuration is:
  - A first stage
  - Primary 2nd stage
  - Back up 2nd stage
  - Submersible Pressure Gauge (SPG)
  - Inflator hose for a Buoyancy Compensator Device
- A Full-Face Mask may be used in place of the primary 2nd stage according to manufacturer's recommendations

Equipment for Determination of Decompression Status

- Each member of the buddy team must have an underwater timing device and depth indicator, or approved dive computer
- If dive tables are being used a set must be available at the dive location
- If a dive computer is used the diver must use the same computer used on repetitive dives.

Scuba Cylinders

- Scuba cylinders must be designed, constructed, and maintained in accordance with Australian Standards.
- Scuba cylinders must be hydrostatically tested in accordance with Australian standards.
- Scuba cylinders must have an internal and external inspection at intervals not to exceed 12 months.
- Scuba cylinder valves must be functionally tested at intervals not to exceed 12 months.

Buoyancy Compensation Devices (BCD)

- Each diver must have the capability of achieving and maintaining neutral buoyancy underwater and positive buoyancy at the surface.
- BCDs, dry suits, or other variable volume buoyancy compensation devices must be equipped with an exhaust valve that is capable of exhausting gas faster than the device can be inflated.
- These devices must be functionally inspected and tested at intervals not to exceed 12 months.
- BCDs, dry suits, or other variable volume buoyancy compensation devices must not be used as a lifting device in lieu of lift bags.

3.30 Auxiliary Equipment

Handheld Underwater Power Tools

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

3.40 Support Equipment

First Aid Supplies

- A first aid kit and emergency oxygen appropriate for the diving being conducted must be available at the dive site.

Diver's Flag

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

Compressor Systems - UTAS Controlled

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

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

3.50 Equipment Maintenance

Record Keeping

Each equipment modification, repair, test, calibration, or maintenance service must be logged/recorded in the current asset management platform and accessible by the UDO. Log records must include the date and nature of work performed, serial number of the item (if applicable), and the name of the person performing the work for the following equipment:

- Regulators
- Gauges (SPG, Depth Gauges, Timers, and Dive Computers)
- BCDs
- Dry suits
- Scuba cylinders and valves
- Full Face Masks
- Compressors, air filtration systems, gas control panels, and storage banks
- Surface supplied equipment
- Rebreather systems
- Additional equipment categories as determined by the DSC

Compressor Operation and Air Test Records

Gas analyses and tests must be performed on each UTAS-controlled breathing gas compressor at regular intervals of no more than 100 hours of operation or 3 months, whichever occurs first. The results of these tests must be entered in the current asset management platform and in the daily operation log.

3.60 Air Quality Standards

Breathing Gas

Any compressor system used to provide compressed breathing air for UTAS diving operations must produce air to the standard specified in AS/NZ 2299.1:2015.

In addition to the above, any compressor/filtration system used for production of EAN must produce oil-free air as per applicable standards. Extra filtration and/or and oil-free or oil-less compressor is highly recommended when blending or mixing EAN using Oxygen concentrations greater than 40%, to reduce the presence of oil mist and reduce the possibility for oxygen igniting hydrocarbons.

Remote Operations

For remote site operations using gas sources not controlled by UTAS, every effort should be made to verify breathing gas meets the requirements of this standard. If the gas quality is not verifiable, the DSC must develop a protocol to mitigate risk to the diver.

SECTION 4.00 SCIENTIFIC DIVER CERTIFICATION AND AUTHORISATIONS

This section describes the training and performance standards for AAUS Scientific Divers and represents the minimum required level of knowledge and skills presented in a generalised format.

4.10 Prerequisites

Administrative

The candidate must complete all administrative and legal documentation required by UTAS.

Entry Level Diver Certification

The candidate must, at minimum, show documented proof of Diver Certification or equivalent from an internationally recognised training agency. Entry level diver training is a prerequisite to scientific diver training and therefore no part of entry level training may be counted in any way toward scientific diver training.

Medical Examination

The candidate must hold a current occupational diving medical as required by AS/NZ 2299.1 Supplement 1:2015. Medical standards may not be waived.

Physical Function Testing and Watermanship

The candidate must complete the UTAS Physical Function Testing Protocol[5]. This includes the fitness components in the following table, which may be assessed by an approved tester. The Swim Competency tests must be demonstrated in the presence of the UDO or designee.

Fitness Component	Type	Specifics	Minimum Requirement
Strength	Manual Muscle Testing	Full flexion, extension, adduction, and abduction of shoulder and hip	Score of 4/5
Strength	Core	Five step Sahrmann test (Sahrmann 2001)	Under development
Strength	Endurance	a) Dive Pack lift - Squat to upright row + 5 second iso with ≥ 15kg b) Walking lunges 15kg	≥5 repetitions ≥5 repetitions for each leg
Power	Explosive	Standing broad jump	Normative data
Flexibility	Range of Motion	Static range of motion shoulders and hips	Normative data
Aerobic and Anaerobic Capacity	Swim Competency	800m snorkel swim 25m breath-hold swim	<17 minutes 1 breath/25m

[5] Source: Designed with the cooperation of the UTAS Exercise Physiology Clinic and the Faculty of Health's Sports Performance Optimisation Research Team. See Diving for Science 2016 Proceedings of the AAUS Symposium, pg. 127-131

4.20 Training

The candidate must successfully complete prerequisites, theoretical aspects, practical training, and examinations for a minimum cumulative time of 100 hours and a minimum of 12 open water dives. Theoretical aspects must include principles and activities appropriate to the intended area of scientific study. Formats for meeting the 100-hour training requirement include completing the UTAS Scientific Diving Course (or equivalent) or a combination of formalized and on the job training.

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

Any candidate who does not convince the DSC, through the UDO, that they possess the necessary judgment, under diving conditions, for the safety of the diver and their buddy, may be denied AAUS scientific diving privileges at UTAS.

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

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

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

	• Demonstrate ability to achieve and maintain neutral buoyancy while submerged* • Demonstrate techniques of self-rescue and buddy rescue* • Navigate underwater ^ • Plan and execute a dive^ • Demonstrate judgment adequate for safe scientific diving* ^^
	Rescue Skills: • Rescue from depth and transport 23 meters, as a diver, a passive simulated victim of an accident: surface diver, establish buoyancy, stabilize victim • Demonstrate simulated in-water mouth-to-mouth resuscitation • Removal of victim from water to shore or boat • Stressed and panicked diver scenarios • Recommendations for Rescue of a Submerged Unresponsive Compressed-Gas Diver – Appendix 8
	Successfully complete a minimum of one checkout dive and at least eleven additional open water dives in a variety of dive sites, for a cumulative surface to surface time of 6 hours. Dives following the checkout dive(s) may be supervised by an active Scientific Diver holding the necessary depth authorisation experienced in the type of diving planned, and with the knowledge and permission of the UDO/designee.
	The eleven dives (minimum) following the initial checkout dive may be conducted over a variety of depth ranges as specified by the OM DSC. Depth progression must proceed shallower to deeper after acceptable skills and judgement have been demonstrated, and are not to exceed 30 m during the initial 12 dive cycle
	* Checkout dive element ^^ Evaluated on all dives ^ Evaluated at some point during the training cycle

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

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

4.30 Diver Certification and Authorisations

Only a person diving under the auspices of an OM that subscribes to the practices of the AAUS is eligible for an AAUS scientific diver certification.

Diver-In-Training (DIT) Authorisation

This is an authorisation to dive, usable only while it is current and for the purpose intended. This authorisation signifies that a diver has completed and been certified as at least an entry level diver through an internationally recognised certifying agency and has the knowledge skills and experience necessary to commence and continue training as a scientific diver under supervision, as approved by the DSC. DIT status must only be used when the diver is on their way to becoming certified as a scientific diver. While it is recommended for DIT's to have hands-on scientific diver experience during their training, the DIT status is intended to be a temporary authorisation, not a substitute for Scientific Diver Certification.

Scientific Diver Certification

Signifies a diver has completed all requirements in Section 4.20 and is certified by the AAUS OM to engage in scientific diving without supervision. Submission of documents and participation in aptitude examinations does not automatically result in certification. To be certified, the applicant must demonstrate to the satisfaction of the assessing Dive Officer that they are sufficiently skilled and proficient and possess the necessary judgement for their safety and/or that of the dive team. Scientific Diver Certification is only active when required authorisations are in place and current.

Scientific Aquarium Diver Certification

Scientific Aquarium Diver is a certification authorising the diver to participate in scientific diving solely in the aquarium environment.

All requirements set forth for Scientific Diver certification must apply, except follows:

- Practical training must include at least 12 supervised aquarium dives for a cumulative bottom time of 6 hours.
- Training requirements for navigation and 366-meter surface swim in scuba gear may be waived at the discretion of the DSC.

Temporary Diver Authorisation

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

4.40 Depth Authorisations

Depth Ratings and Progression to Next Depth Level

Indicates the maximum depth in which a diver can conduct science and may supervise other divers holding a lesser depth authorisation. A scientific diver requires a valid depth authorisation to be considered active.

A diver may be authorized to the next depth level after successfully completing the requirements for that level. A diver may exceed their depth authorisation when accompanied and supervised by a dive buddy holding a depth authorisation greater or equal to the intended depth. Dives must be planned and executed with the permission of the DSC or designee.

In the event a diver within the OM does not hold an authorisation at the desired next level, the DSC may authorize a required progression or procedure for a diver to attain a deeper authorisation. If local conditions do not conform to traditional AAUS depth progressions, the DSC may devise a reasonable accommodation. However, the total number of dives to obtain a given depth authorisation must follow the cumulative number of dives listed below.

a) Authorisation to 10m Depth - Initial science diver depth authorisation, approved upon the successful completion of training listed in Section 4.00. Cumulative minimum supervised dives: 12.
b) Authorisation to 18m Depth - A diver holding a 10m authorisation may be authorized to a depth of 18m after successfully completing and logging 12 supervised dives to depths between 10.1m and 18m under supervision of a diver authorized by the DSC, for a minimum total time of 4 hours. Cumulative minimum supervised dives: 24.
c) Authorisation to 30m Depth - A diver holding an 18m authorisation may be authorized to a depth of 30m after successfully completing and logging 6 supervised dives to depths between 18.1m and 30m under supervision of a dive buddy authorized by the DSC. The diver must also demonstrate proficiency in the use of the appropriate decompression profiling method. Cumulative minimum supervised dives: 30.
d) Authorisation to 40m Depth - A diver holding a 30m authorisation may be authorized to a depth of 40m after successfully completing and logging 6 supervised dives to depths between 30.1m and 40m under supervision of a dive buddy authorized by the DSC. The diver must also demonstrate proficiency in the use of the appropriate decompression profiling method. Cumulative minimum supervised dives: 36.
e) Authorisation to 45m Depth - A diver holding a 40m authorisation may be authorized to a depth of 45m after successfully completing and logging 6 supervised dives to depths between 40.1m and 45m under supervision of a dive buddy authorized by the DSC. The diver must also demonstrate knowledge of the special problems of deep diving and of special safety requirements. Cumulative minimum supervised dives: 42.
f) Authorisation to 58m Depth - A diver holding a 45m authorisation may be authorized to a depth of 58m after successfully completing and logging 6 dives to depths between 45.1m and 58m under supervision of a dive buddy authorized by the DSC. The diver must also demonstrate knowledge of the special problems of deep diving and of special safety requirements. Cumulative minimum supervised dives: 48.
g) Authorisation to beyond 58m is not currently supported by UTAS unless on mixed gas (see Section 9).

Diving on air is not permitted beyond a depth of 18m.

4.50 Maintaining Active Status

Minimum Activity to Maintain Authorisations

During any 12-month period, each scientific diver must log a minimum of 12 scientific, scientific training, or proficiency dives. At least one dive must be logged near the maximum depth, as defined by the DSC, of the diver's authorisation during each 6-month period. Divers authorized to 45m or deeper may satisfy these requirements with dives to 40m or deeper. Failure to meet these requirements will result in revocation or restriction of authorisation by the UDO or their designee under procedures established by the DSC.

Requalification of Authorisation

Once the initial requirements of Section 4.00 are met, divers whose depth authorisation has lapsed due to lack of activity may be requalified by procedures adopted by the DSC.

Medical Examination

All scientific divers must pass a medical examination, and this cannot be waived for any diver. See Section 5 for Medical Requirements.

- A medically cleared diver experiencing any Conditions Which May Disqualify Candidates from Diving (Appendix 2) must receive clearance to return to diving from a physician before resuming diving activities.
- Divers must report to their Site Diving Officer any accident, injury or illness that may have commenced/occurred since their last dive medical, that could increase their risk if they undertake a dive. Note that a diving officer may require the diver be re-examined before they are considered fit to dive.
- Divers must ensure they are fit to dive prior to participating in UTAS diving operations and must report any variation in their normal health and fitness to the Dive Coordinator immediately (prior to, during or after diving operations), and to a medical practitioner if the variation persists.

Emergency Care Training

The scientific diver must hold current training in the following:

- Provide CPR and AED
- Provide Resuscitation (Oxygen)
- Provide First aid

4.60 Revocation of Authorisation

An individual's scientific diver certification can be restricted or revoked for cause by the DSC. Authorisations associated with an individual's scientific diver certification may be restricted or suspended for cause by the UDO or their designee. Restrictions or suspensions issued by the UDO/designee may be rescinded by the UDO/designee; these issues will be reported to and reviewed by the DSC, and the outcomes or actions resulting from this review will be documented in the diver's UTAS diving record. Violations of regulations set forth in this Dive Manual or other legislation not in conflict with this Dive Manual, or demonstration of poor judgement, may be considered cause. The DSC or designee must inform the diver in writing of the reason(s) for revocation. The diver will be given the opportunity to present their case in writing to the DSC for reconsideration. Following revocation, the diver may be reauthorized after complying with conditions the DSC may impose. All such written statements and requests, as identified in this section, are formal documents, and therefore part of the diver's file.

SECTION 5.00 MEDICAL STANDARDS

5.10 Medical Requirements

General

- All medical evaluations required by this Dive Manual must be performed in accordance with AS/NZ 2299.1:2015 by, or under the direction of, a licensed physician, trained in underwater medicine (i.e. SPUMS list). See Appendix 4.
- The diver should be free of any chronic disabling disease and any conditions contained in the list of conditions for which restrictions from diving are generally recommended. (Appendix 2)
- The UDO or a Site Diving Officer must verify that divers have been declared by the examining medical authority to be fit to engage in diving activities.

5.20 Frequency of Medical Evaluations

- Occupational Diving Medical examinations must be conducted annually.
- Clearance to return to diving must be obtained from a healthcare provider following a medically cleared diver experiencing any Conditions Which May Disqualify Candidates From Diving (Appendix 2), or following any major injury or illness, or any condition requiring chronic medication. If the condition is pressure related, the clearance to return to diving must come from a physician trained in diving medicine.

5.30 Information Provided Examining Physician

The University may need to provide a copy of the medical evaluation requirements of the AS/NZ 2299.1 Supplement 1:2015 Occupational diving medical examination to the examining physician.

5.40 Content of Medical Evaluations

Medical examinations must include all content listed in AS/NZ 2299.1 Supplement 1:2015 Occupational diving medical examination forms

5.50 Physician's Written Report

- An original report, signed by the examining physician stating the individual's fitness to dive, including any recommended restrictions or limitations will be submitted to the Site Diving Officer for the diver's record after the examination is completed.
- The report will be reviewed by the Site Diving Officer and the diver's record and authorisations will be updated accordingly.
- A copy of any physician's written reports will be made available to the individual.
- It is the diver's responsibility to provide to the Site Diving Officer a written statement from any examining medical authority listing any restrictions, limitations, or clearances to dive resulting from medical examinations obtained by the individual outside of their normal diving medical examination cycle. These statements will be reviewed by the DSC or designee and the diver's record and authorisations will be updated accordingly.

Volume 2

Sections 6.00 through 12.00
Specific Modes and Gasses for Diving Activities

SECTION 6.00 NITROX DIVING

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

6.10 Requirements for EAN (Nitrox) Authorisation

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

Prerequisites

Only a certified Scientific Diver or DIT diving under the auspices of UTAS is eligible for authorisation to use nitrox.

Application for authorisation to use nitrox must be made to the DSC or delegate. Submission of documents and participation in aptitude examinations does not automatically result in authorisation to use nitrox. The applicant must convince the DSC through the UDO/designee that they are sufficiently knowledgeable, skilled and proficient in the theory and use of nitrox for diving.

Training

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

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

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

References:

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

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

Practical Evaluation

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

Written Evaluation

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

6.20 Minimum Activity to Maintain Authorisation

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

6.30 Operational Requirements

Oxygen Exposure Limits

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

Calculation of Decompression Status

- A set of DSC approved nitrox dive tables should be available at the dive site.
- Dive computers may be used to compute decompression status during nitrox dives. Manufacturers' guidelines and operation instructions should be followed.
- Dive computers capable of pO_2 limit and fO_2 adjustment should be checked by the diver prior to the start each dive to ensure conformity with the mix being used.

Gas Mixture Requirements

- Only nitrox mixtures and mixing methods approved by the DSC may be used.
- UTAS personnel mixing nitrox must be qualified and approved by the DSC for the method(s) used.
- Oxygen used for mixing nitrox should meet the purity levels for "Medical Grade" standards.
- In addition to the Air Purity Guidelines outlined in Section 3.60, any air that may come in contact with oxygen concentrations greater than 40% (i.e. during mixing), must also have a hydrocarbon contaminant no greater than .01 mg/m^3.
    - For remote site operations using compressors not controlled by UTAS where this is not verifiable, the DSC must develop a protocol to mitigate risk to the diver.

Analysis Verification by User

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

6.40 Nitrox Diving Equipment

Required Equipment

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

- Labelled SCUBA Cylinders in Accordance with Industry and Australian Standards
- Oxygen Analysers
- Oxygen compatible equipment as applicable

Requirement for Oxygen Service

- All equipment, which during the dive or cylinder filling process is exposed to concentrations greater than 40% oxygen, should be cleaned and maintained for oxygen service.
- Any equipment used with oxygen or mixtures containing over 40% by volume oxygen must be designed and maintained for oxygen service. Oxygen systems over 125 psig must have slow-opening shut-off valves.

Compressor system

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

SECTION 7.00 SURFACE SUPPLIED DIVING TECHNOLOGIES

Surface supplied diving technologies include any diving mode in which a diver at depth is supplied with breathing gas from the surface. This includes both SSBA and Hookah Modes.

7.10 Prerequisites

All surface supplied and hookah divers must be certified scientific divers or divers in training and have completed system specific training as authorized by UTAS.

7.20 Surface Supplied Diving Mode

Surface Supply Mode Definition

A mode of diving using open circuit, surface supplied, compressed gas delivered by means of a pressurized umbilical hose. The umbilical generally consists of a gas supply hose, strength member, pneumofathometer hose, and communication line. The umbilical supplies a helmet or full-face mask, often with voice communications.

Procedures

- Each diver must be continuously tended while in the water.
- A diver must be stationed at the underwater point of entry when diving is conducted in enclosed or physically confined spaces.
- Each diving operation must have a primary breathing gas supply sufficient to support divers for the duration of the planned dive including decompression.
- For dives deeper than 30 m or outside the no-decompression limits:
    - A separate dive team member must tend each diver in the water;
    - A standby diver must be available while a diver is in the water;
- A diver using Surface Supply may rely on surface personnel to keep the diver's depth, time and diving profile
- Surface supplied air diving must not be conducted at depths deeper than 40m.
- The UDO/DSC is responsible for developing additional operational protocols

Manning Requirements

The minimum number of personnel comprising a surface supplied dive team is three. They consist of a Diver's Attendant/Tender, a Diver, and a Standby Diver. Additional dive team members are required when a diving operation or dive site is considered complex, or when the task loading of a dive team member is deemed excessive. It is the DSC's responsibility to define when the surface supplied dive team must be expanded beyond the minimum manning requirements.

Equipment

- The diver will wear a positive buckling device on the safety harness to which the umbilical hose will be secured. The attachment must be of sufficient strength to prevent any strain on the helmet/full face mask hose connections and equipment must be configured to allow retrieval of the diver by the surface tender without risk of interrupting air supply to the diver.
- Each diver must be equipped with a diver-carried independent reserve breathing gas supply containing sufficient volume to complete the ascent to the surface, including all required decompression and safety stops.
- Masks and Helmets

    - Surface supplied and mixed gas masks and helmets must have:
        - A non-return valve at the attachment point between the mask/helmet and hose which must close readily and positively; and
        - An exhaust valve
    - Surface-supplied masks and helmets must have a minimum ventilation rate capability of 4.5 actual cubic feet per minute (acfm) at any depth at which they are operated or the capability of maintaining the diver's inspired carbon dioxide partial pressure below 0.02 atmospheres absolute (ATA) when the diver is producing carbon dioxide at the rate of 1.6 standard litres per minute
    - Helmets or masks connected directly to the dry suit or other buoyancy-changing equipment must be equipped with an exhaust valve
- Air supplied to the diver must meet the air quality standards outlined in section 3.60

7.40 Hookah Mode

Hookah (*in Australia)* - a colloquial, but widely used, term for a limited feature form of surface supply diving apparatus usually involving the supply of breathing air from a small compressor unit via an air supply hose to a mouth-held demand breathing gas supply device.
Hookah *(in AAUS)* - 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

Hookah is an open circuit diving mode comprised of a remote gas supply, a long hose, and a standard scuba second stage or full-face mask. Hookah is generally used in shallow water (10m or less), though the configuration has been used to supply breathing gas from a diving bell, habitat, or submersible.

Equipment Requirements

- The air supply hose must be rated for a minimum operating pressure of 8.96 bar (130psi).
- Air supplied to the hookah diver must meet the air quality standards outlined in section 3.60
- Hookah supply systems must be capable of supplying all divers breathing from the system with sufficient gas for comfortable breathing for the planned depth and workload.
- Hookah system second stage should be capable of being attached to the diver in a way to avoid pulling stress on the second stage mouthpiece and affords easy release if the diver must jettison the regulator and hose.
- An independent reserve breathing gas supplied will be carried by each hookah diver:
    - When the diver does not have direct access to the surface or
    - At depths or distance from alternate breathing gas source determined by the DSC.

Operational Requirements

- Hookah diving must not be conducted beyond depths or distance from alternate breathing gas source as determined by the DSC.
- A diver's independent reserve breathing gas supply, if worn, must contain sufficient volume to allow the diver(s) to exit to the surface or alternate breathing gas source
- Hookah divers not supported by diving bell, or underwater habitat must not be exposed to dives that require staged decompression.
- The OM DSC is responsible for developing additional operational protocols.

SECTION 8.00 STAGED DECOMPRESSION DIVING

Decompression diving is defined as any diving during which the diver cannot perform a direct return to the surface without performing a mandatory decompression stop to allow the release of inert gas from the diver's body.

The following procedures must be observed when conducting dives requiring planned decompression stops.

8.10 Minimum Experience and Training Requirements

Prerequisites

1) Scientific Diver qualification according to Section 4.00.
2) Minimum of 100 logged dives with experience in the depth range where decompression dives will be conducted.
3) Demonstration of the ability to safely plan and conduct dives deeper than 30m/100 feet.
4) Nitrox certification/authorisation according to AAUS Section 6.00 recommended.

Training

Training must be appropriate for the conditions in which dive operations are to be conducted. Minimum Training must include the following:

1. A minimum of 6 hours of classroom training to ensure theoretical knowledge to include: physics and physiology of decompression; decompression planning and procedures; gas management; equipment configurations; decompression method, emergency procedures, and omitted decompression.
2. It is recommended that at least one training session be conducted in a pool or sheltered water setting, to cover equipment handling and familiarization, swimming and buoyancy control, to estimate gas consumption rates, and to practice emergency procedures.
3. At least 6 open-water training dives simulating/requiring decompression must be conducted, emphasizing planning and execution of required decompression dives, and including practice of emergency procedures.
4. Progression to greater depths must be by 4-dive increments at depth intervals as specified in Section 5.50.
5. No training dives requiring decompression shall be conducted until the diver has demonstrated acceptable skills under simulated conditions.
6. The following are the minimum skills the diver must demonstrate proficiently during dives simulating and requiring decompression:
    - Buoyancy control
    - Proper ascent rate
    - Proper depth control
    - Equipment manipulation
    - Stage/decompression bottle use as pertinent to planned diving operation
    - Buddy skills
    - Gas management
    - Time management
    - Task loading
    - Emergency skills

7. Divers must demonstrate to the satisfaction of the UDO or the UDO's qualified designee proficiency in planning and executing required decompression dives appropriate to the conditions in which diving operations are to be conducted.
8. Upon completion of training, the diver must be authorized to conduct required decompression dives with UDO/designee approval.

8.20 Minimum Equipment Requirements

1. Valve and regulator systems for primary (bottom) gas supplies must be configured in a redundant manner that allows continuous breathing gas delivery in the event of failure of any one component of the regulator/valve system.
2. Cylinders with volume and configuration adequate for planned diving operations
3. One of the second stages on the primary gas supply must be configured with a hose of adequate length to facilitate effective emergency gas sharing in the intended environment.
4. Minimum dive equipment should include:
   a) Diver location devices adequate for the planned diving operations and environment.
   b) Compass
5. Redundancy in the following components may be required at the discretion of the DSC:
   a) Decompression Schedules
   b) Dive Timing Devices
   c) Depth gauges
   d) Buoyancy Control Devices
   e) Cutting devices
   f) Lift bags and line reels

8.30 Minimum Operational Requirements

1. The maximum pO_2 to be used for planning required decompression dives is 1.6 for open circuit. It is recommended that a pO_2 of less than 1.6 be used during bottom exposure.
2. Decompression dives may be planned using dive tables, dive computers, and/or PC software approved by the DSC.
3. Breathing gases used while performing in-water decompression must contain the same or greater oxygen content as that used during the bottom phase of the dive.
4. The dive team prior to each dive must review emergency decompression procedures appropriate for the planned dive.
5. If breathing gas mixtures other than air are used for required decompression, their use must be in accordance with those regulations set forth in the appropriate sections of this Dive Manual.
6. Use of additional nitrox and/or high-oxygen fraction decompression mixtures as travel and decompression gases to decrease decompression obligations is recommended.
7. Use of alternate inert gas mixtures to limit narcosis is recommended for depths greater than

45.7m/150 feet.

8. The maximum depth for required decompression using air as the bottom gas is 50m/164 feet.
9. If a period of more than 6 months has elapsed since the last decompression dive, a series of progressive workup dives defined by the DSC to return the diver(s) to proficiency status prior to the start of project diving operations are required.
10. Mission specific workup dives are recommended.

SECTION 9.00 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.

9.10 Minimum Experience and Training Requirements

Prerequisites

1. Nitrox authorisation (Section 6.00).
2. If the intended use entails required decompression stops, divers will be previously authorized in decompression diving (Section 8.00).
3. Divers must demonstrate the skills, knowledge, and attitude appropriate for training in the safe use of mixed gases to the satisfaction of the UDO/DSC.

Classroom training including

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

Practical Training

1. Confined water session(s) in which divers demonstrate proficiency in required skills and techniques for proposed diving operations.
2. A minimum of 6 open water training dives.
3. At least one initial dive must be in 40m/130 feet or less to practice equipment handling and emergency procedures.
4. Subsequent dives will gradually increase in depth, with a majority of the training dives being conducted between 40m/130 feet and the planned operational depth.
5. Planned operational depth for initial training dives must not exceed 80m/260 feet.

6. Diving operations beyond 80m/260 feet requires additional training dives.

9.20 Equipment and Gas Quality Requirements

1. Equipment requirements must be developed and approved by the DSC. Equipment must meet other pertinent requirements set forth elsewhere in this Dive Manual.
2. The quality of inert gases used to produce breathing mixtures must be of an acceptable grade for human consumption.

9.30 Minimum Operational Requirements

1. All applicable operational requirements for nitrox and decompression diving must be met.
2. The maximum pO_2 to be used for planning required open circuit decompression dives is 1.6. It is recommended that a pO_2 of less than 1.6 be used during bottom exposure.
3. Divers decompressing on high-oxygen concentration mixtures must closely monitor each other for signs of acute oxygen toxicity.
4. If a period of more than 6 months has elapsed since the last decompression dive, a series of progressive workup dives defined by the DSC to return the diver(s) to proficiency status prior to the start of project diving operations are required.
5. Mission specific workup dives are recommended.

SECTION 10.00 SPECIALISED DIVING ENVIRONMENTS

Certain types of diving, some of which are listed below, require equipment or procedures that require training. Supplementary guidelines for these technologies are in development by the AAUS. OM's using these, must have guidelines established by their DSC. Divers must comply with all scuba diving procedures in this Dive Manual unless specified.

10.10 Blue Water Diving

Blue water diving is defined as diving in open water where the bottom is generally greater than 60 meters deep. It requires special training and the use of multiple-tethered diving techniques. Specific guidelines that should be followed are outlined in "Blue Water Diving Guidelines" (California Sea Grant Publ. No. T-CSGCP-014).

Blue Water diving is not currently conducted at UTAS. Any diver wishing to undertake Blue Water diving shall make application to the DSC via the UDO. Procedures will be developed at that time.

10.20 Ice and Polar Diving

Divers planning to dive under ice or in polar conditions should use the following: "PESH-POL_2000.08 Standards for the Conduct of Scientific Diving", National Science Foundation, Division of Polar Programs, 2015. Any diver wishing to undertake Ice and Polar Diving shall make application to the DSC via the UDO. Procedures will be developed at that time.

10.30 Overhead Environments

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

For the purposes of this Dive Manual, Ice diving is a specialized overhead environment addressed in Section 10.20 and supplemented by requirements and protocols established by the DSC.

Cavern, Cave, or Flooded Mine Diving see Section 12

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

Overhead Environment is not currently conducted at UTAS. Any diver wishing to undertake Overhead Environment diving shall make application to the DSC via the UDO. Procedures will be developed at that time.

10.40 Saturation Diving

UTAS does not currently conduct Saturation Diving.

10.50 Aquarium Diving

An aquarium is an artificial, confined body of water, which is operated by or under the control of an institution and is used for the purposes of specimen exhibit, education, husbandry, or research.

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

UTAS does not currently conduct Aquarium Diving. Any diver wishing to undertake Aquarium diving shall make application to the DSC via the UDO. Procedures will be developed at that time.

SECTION 11.00 REBREATHERS

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

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

Application of this standard is in addition to pertinent requirements of all other sections of this Dive Manual.

For rebreather dives that also involve staged decompression and/or mixed gas diving, all requirements for each of the relevant diving modes must be met. The DSC reserves the authority to review each application of all specialized diving modes, and include any further requirements deemed necessary beyond those listed here on a case-by-case basis.

No diver shall conduct planned operations using rebreathers without prior review and approval of the DSC.

In all cases, trainers must be qualified for the type of instruction to be provided. Training must be conducted by agencies or instructors approved by UDO and DSC.

11.10 Definition

A. Rebreathers are defined as any device that recycles some or all of the exhaled gas in the breathing loop and returns it to the diver. Rebreathers maintain levels of oxygen and carbon dioxide that support life by metered injection of oxygen and chemical removal of carbon dioxide. These characteristics fundamentally distinguish rebreathers from open-circuit life support systems, in that the breathing gas composition is dynamic rather than fixed.

B. There are three classes of rebreathers:

1. Oxygen Rebreathers: Oxygen rebreathers recycle breathing gas, consisting of pure oxygen, replenishing the oxygen metabolized by the diver. Oxygen rebreathers are generally the least complicated design but are limited in depth of use due to the physiological limits associated with oxygen toxicity.

2. Semi-Closed Circuit Rebreathers: Semi-closed circuit rebreathers (SCR) recycle the majority of exhaled breathing gas, venting a portion into the water and replenishing it with a constant or variable amount of a single oxygen-enriched gas mixture. Gas addition and venting is balanced against diver metabolism to maintain safe oxygen levels.

3. Closed-Circuit Rebreathers: Closed-circuit mixed gas rebreathers (CCR) recycle all of the exhaled gas. Electronically controlled CCRs (eCCR) replace metabolized oxygen via an electronically controlled valve, governed by oxygen sensors. Manually controlled CCR (mCCR) rely on mechanical oxygen addition and diver monitoring to control oxygen partial pressure (ppO_2). Depending on the design, manual oxygen addition may be available on eCCR units as a diver override, in case of electronic system failure. Systems are equipped with two cylinders; one with oxygen, the other with a diluent gas source used to make up gas volume with depth increase and to dilute

oxygen levels. CCR systems operate to maintain a constant ppO_2 during the dive, regardless of depth.

11.20 Prerequisites for use of any rebreather

A. Active scientific diver status, with depth authorisation sufficient for the type, make, and model of rebreather, and planned application.

B. Completion of a minimum of 25 open-water dives on open circuit scuba The DSC may require increased dive experience depending upon the intended use of the rebreather system for scientific diving.

C. For SCR or CCR, a minimum 18m-depth authorisation is generally recommended, to ensure the diver is sufficiently conversant with the complications of deeper diving. If the sole expected application for use of rebreathers is shallower than this, a lesser depth authorisation may be allowed with the approval of the DSC.

D. Nitrox training. Training in use of nitrox mixtures containing 25% to 40% oxygen is required. Training in use of mixtures containing 40% to 100% oxygen may be required, as needed for the planned application and rebreather system.

11.30 Training

A. Specific training requirements for use of each rebreather model must be defined by DSC on a case-by-case basis. Training must include factory-recommended requirements but may exceed this to prepare for the type of mission intended (e.g., staged decompression or heliox/trimix CCR diving). (See training section for details.)

B. Successful completion of training does not in itself authorize the diver to use rebreathers. The diver must demonstrate to the DSC or its designee that the diver possesses the proper attitude, judgment, and discipline to safely conduct rebreather diving in the context of planned operations.

C. Post training supervised dives are required before the Scientific rebreather diver is authorized to use rebreather for research dives. (See training section for details).

Individual Equipment Requirements

Individual Equipment Requirements			
Key: X = include, IA = If Applicable			
	O_2	SCR	CCR
DSC approved rebreather make and model	X	X	X
Bottom timer, and depth gauge	X	X	X
Dive computer (separate from rebreather unit)		X	X
Approved dive tables		IA	IA
SMB (surface marker buoy) and line reel or spool with sufficient line to deploy an SMB from the bottom in the training environment	IA	IA	IA
Access to an oxygen analyser	X	X	X
Cutting implement	X	X	X
BCD capable of floating a diver with a flooded loop and/or dry suit at the surface	X	X	X
Bailout gas supply of sufficient volume for planned diving activities	X	X	X
Approved CO2 absorbent and other consumables	X	X	X

11.40 Equipment Requirements

A. General
   1. Only those models of rebreathers specifically approved by DSC shall be used.
   2. Rebreathers should meet the quality control/quality assurance protocols of the International Organization for Standardization (ISO) requirements: ISO 9004: 2009 or the most current version, AND successful completion of CE (Conformité Européenne) or DSC approved third party testing.
   3. Rebreather modifications (including consumables and operational limits) that deviate from or are not covered by manufacturer documentation should be discussed with the manufacturer and approved by the DSC prior to implementation.

B. Equipment Maintenance Requirements
   1. The DSC or their designee will establish policies for the maintenance of rebreathers and related equipment under their auspices. Rebreathers should be maintained in accordance with manufacturer servicing recommendations.
   2. Field repairs and replacement of components covered in rebreather diver training is not annual maintenance and may be performed by the rebreather diver in accordance with DSC policy.
   3. A maintenance log will be kept and will minimally include:
      a) Dates of service
      b) Service performed
      c) Individuals or company performing the service

11.50 Operational Requirements

A. Dive Plan
   In addition to standard dive plan components, at a minimum all dive plans that include the use of rebreathers must include:
   a) Information about the specific rebreather model(s) to be used
   b) Type of CO_2 absorbent material
   c) Composition and volume(s) of supply gasses d) Bailout procedures
   e) Other specific details as required by the DSC

B. Particular attention should be paid to using rebreathers under conditions where vibration or pulsating water movement could affect electronics or control switches and systems.

C. Particular attention should be paid to using rebreathers under conditions where heavy physical exertion is anticipated.

D. Respired gas densities should be less than 5 $g \cdot L^{-1}$, and should not exceed 6 $g \cdot L^{-1}$ under normal circumstances.

E. User replaceable consumable rebreather components should be replaced per manufacture recommendations or as defined by the DSC.

F. If performed, periodic field validation of oxygen cells should be conducted per DSC designated procedure.

G. Diver carried off-board bailout is not required under conditions where the onboard reserves are adequate to return the diver to the surface while meeting proper ascent rate and stop requirements, and the system is configured to allow access to onboard gas.

These calculations must take into consideration mixed mode operations where an open circuit diver could require assistance in an out of gas situation.

H. Use and reuse of CO_2 scrubber media should be per manufacture recommendations or as defined by the DSC.

I. Planned oxygen partial pressure in the breathing gas must not exceed 1.4 atmospheres at depths greater than 30 feet, or 1.6 at depths less than 30 feet.

J. Both CNS and Oxygen Tolerance Units (OTUs) should be tracked for each diver. Exposure limits should be established by the DSC.

K. The DSC or their designee will:

1. Establish policies for the use of checklists related to rebreather operations.
2. Establish policies for pre- and post- dive equipment checks to be conducted by their divers.
3. Establish policies for disinfection of rebreathers to be used by their divers.
4. Establish policies for pre-breathing of rebreathers used by their divers
5. Establish policies for the use of mixed mode and mixed rebreather platform dive teams under their auspices.
    a) Mixed mode and/or mixed platform dive teams are permitted.
    b) At minimum, divers must be cross briefed on basic system operations for establishing positive buoyancy, closing a rebreather diver's breathing loop, and procedures for gas sharing.
6. Establish policies for the maximum depth of dives conducted using a particular class of rebreather within the auspices of their diving operations.
7. Establish policies for depth authorisation and maintenance for divers using rebreathers.
8. Establish policies for implementing workup dives within program
    a) Pre-operation workup dives, including review and practice of emergency recognition and response skills, and management of task loading are required for operations defined by the DSC as beyond the scope of normal operating conditions.
9. Establish policies for the minimum use of rebreathers to maintain proficiency.
    a) The minimum Annual rebreather diving activity should be 12 rebreather dives, with a minimum of 12 h underwater time.
    b) To count, dives should be no less than 30 min in duration. A required element of maintaining proficiency is the periodic performance and re-evaluation of skills. related to in-water problem recognition and emergency procedures

L. Establish policies for reauthorisation for the use of rebreathers if minimum proficiency requirements are not met.

1. Reestablishment of authorisation to use rebreathers must require more than just performing a dive on a particular make or model of rebreather.
2. At minimum demonstrated skills included in the required training elements for the level of rebreather operation must be performed and re-evaluated.

11.60 REBREATHER TRAINING SECTION

A. Entry Level Training

1. The training area for O_2 Rebreather should not exceed 6m in depth.
2. Entry level CCR and SCR training is limited in depth of 40m and shallower.
3. Entry level CCR and SCR training is limited to nitrogen/oxygen breathing media.
4. Divers at the CCR and SCR entry level may not conduct dives that require a single decompression stop longer than 10 minutes.
5. Who may teach: Individuals authorized as a CCR, SCR, or O_2 Rebreather Instructor by the DSC; in all cases, the individual authorized must have operational experience on the rebreather platform being taught, and where applicable the individual being authorized should be authorized as an instructor by the respective rebreather manufacturer or their designee.
6. Maximum Student/Instructor Ratio: 4 to 1. This ratio is to be reduced as required by environmental conditions or operational constraints.
7. Upon completion of practical training, the diver must demonstrate proficiency in pre-dive, dive, and post-dive operational procedures for the particular model of rebreather to be used.
8. Supervised dives target activities associated with the planned science diving application. Supervisor for these dives is the UDO or designee, experienced with the make/model rebreather being used.

Rebreather Entry Level Training Requirements			
Key: X = include, IA = If Applicable, ISE = If So Equipped			
	O_2	SCR	CCR
Required Training Topic			
Academic			
History of technology	X	X	X
Medical & physiological aspects of:			
Oxygen toxicity	X	X	X
Chemical burns & caustic cocktail	X	X	X
Hypoxia – insufficient O_2	X	X	X
Hypercapnia – excessive CO_2	X	X	X
Arterial gas embolism	X	X	X
Middle Ear Oxygen Absorption Syndrome (oxygen ear)	X	X	X
Hygienic concerns	X	X	X
Nitrogen absorption & decompression sickness		X	X
CO_2 retention	X	X	X
Hyperoxia-induced myopia	X	X	X
System design, assembly, and operation, including:			
Layout and design	X	X	X
Oxygen control systems	X	X	X
Diluent control systems		ISE	ISE
Use of checklists	X	X	X

Complete assembly and disassembly of the unit	X	X	X
Canister design & proper packing and handling of chemical absorbent	X	X	X
Decompression management and applicable tracking methods		ISE	X
Oxygen and high-pressure gas handling and safety	X	X	X
Fire triangle	X	X	X
Filling of cylinders	X	X	X
Pre-dive testing & trouble shooting	X	X	X
Post-dive break-down and maintenance	X	X	X
Trouble shooting and manufacturer authorized field repairs	X	X	X
Required maintenance and intervals	X	X	X
Manufacturer supported additional items (ADV, temp stick, CO2 monitor, etc.)	ISE	ISE	ISE
Dive planning:			
Operational planning	X	X	X
Gas requirements	X	X	X
Oxygen exposure and management	X	X	X
Gas density calculations		X	X
Oxygen metabolizing calculations	X	X	X
Scrubber limitations	X	X	X
Mixed mode diving (buddies using different dive modes)	X	X	X
Mixed platform diving (buddies using different rebreather platforms)	X	X	X
Problem Recognition & Emergency Procedures:			
Applicable open circuit emergency procedures for common gear	X	X	X
Loss of electronics	ISE	ISE	X
Partially flooded loop	X	X	X
Fully flooded loop	X	X	X
Cell warnings		ISE	X
Battery warnings	ISE	ISE	X
High O_2 warning	ISE	ISE	X
Low O_2 warning	ISE	ISE	X
High CO_2 warning	ISE	ISE	ISE
Recognizing issues as indicated by onboard scrubber monitors	ISE	ISE	ISE
Recognizing hypercapnia signs and symptoms in self or buddy	X	X	X
Excluded O_2 cell(s)	ISE	ISE	ISE
Loss of Heads Up Display (HUD)	ISE	ISE	ISE
Loss of buoyancy	X	X	X
Diluent manual add button not functioning		ISE	ISE
O2 manual add button not functioning	ISE	ISE	ISE
Exhausted oxygen supply	X	X	X
Exhausted diluent supply		ISE	ISE
Lost or exhausted bailout	ISE	ISE	ISE
Handset not functioning	ISE	ISE	ISE
Solenoid stuck open	ISE	ISE	ISE
Solenoid stuck closed	ISE	ISE	ISE
ADV stuck open	ISE	ISE	ISE
ADV stuck closed	ISE	ISE	ISE
Isolator valve(s) not functioning	ISE	ISE	ISE
Oxygen sensor validation	ISE	ISE	X
CO_2 sensor validation	IA	IA	IA

Gas sharing	X	X	X
Diver assist and diver rescue	X	X	X
Other problem recognition and emergency procedures specific to the particular unit, environment, or diving conditions	X	X	X
Practical Training and Evaluations			
Demonstrated skills must include, at a minimum:			
Use of checklists	X	X	X
Carbon dioxide absorbent canister packing	X	X	X
Supply gas cylinder analysis and pressure check	X	X	X
Test of one-way valves	X	X	X
System assembly and breathing loop leak testing	X	X	X
Oxygen control system calibration	ISE	ISE	X
Proper pre-breathe procedure	X	X	X
In-water bubble check	X	X	X
Proper buoyancy control during descent, dive operations, and ascent	X	X	X
System monitoring & control during descent, dive operations, and	X	X	X
Proper interpretation and operation of system instrumentation	X	X	X
Proper buddy contact and communication	X	X	X
Use of a line reel or spool to deploy an SMB from planned dive depth and while controlling buoyancy in the water column	X	X	X
Proper management of line reel or spool, and SMB during ascents and safety or required stops	X	X	X
Unit removal and replacement on the surface	X	X	X
Bailout and emergency procedures for self and buddy, including:			
System malfunction recognition and solution	X	X	X
Manual system control	ISE	ISE	ISE
Flooded breathing loop recovery	IA	IA	IA
Absorbent canister failure	X	X	X
Alternate bailout options	X	X	X
Manipulation of onboard and off board cylinder valves	X	X	X
Manipulation of bailout cylinders (removal, replacement, passing and receiving while maintaining buoyancy control)	ISE	ISE	ISE
Manipulation of quick disconnects, isolator valves, and manual controls specific to the unit and gear configuration	ISE	ISE	ISE
Proper system maintenance, including:			
Breathing loop disassembly and disinfection	X	X	X
Oxygen sensor replacement	ISE	ISE	ISE
Battery removal and replacement or recharging	ISE	ISE	ISE
Other tasks as required by specific rebreather models	X	X	X
Written Evaluation	X	X	X
Supervised Rebreather Dives	X	X	X

Entry Level Training – Minimum Underwater Requirements

	Pool/Confined Water	Open water	Supervised Dives
O2	1 Dive, 90 – 120 minutes	4 dives, 120 minutes cumulative	2 Dives, 120 minutes cumulative
SCR	1 Dive, 90 – 120 minutes	4 dives, 120 minutes cumulative	4 dives, 120 minutes cumulative
CCR	1 Dive, 90 – 120 minutes	8 dives, 380 minutes cumulative	4 dives, 240 minutes cumulative

B. Rebreather Required Decompression, Normoxic, and Hypoxic Mix Training

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

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

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

Proper management of line reel or spool, and SMB during ascents and safety or required stops	X	X	X
Demonstrate the ability to maintain minimum loop volume	X	X	X
Demonstrate comfort swimming on surface and at depth carrying a single bailout/decompression cylinder/bailout rebreather	X		
Demonstrate ability to pass and retrieve a single bailout/decompression cylinder or bailout rebreather while maintaining position in the water column	X		
Demonstrate ability to pass and receive multiple bailout/decompression cylinders or bailout rebreather while maintaining position in the water column	IA	X	X
Demonstration of the ability to perform simulated decompression stops at pre-determined depths for scheduled times	X	X	X
Demonstration of the ability to perform decompression stops at pre-determined depths for scheduled times	X	X	X
Demonstrate competence managing multiple bailout cylinders, including drop and recovery while maintaining position in the water column	IA	X	X
Demonstrate appropriate reaction to simulated free-flowing deco regulator	X	X	X
Gas share of deco gas for at least 1 minute	X	X	X
Demonstrate oxygen rebreather mode at appropriate stop depth		X	X
Complete bailout scenarios from depth to include decompression obligation on open circuit	X	X	X
Written Evaluation	X	X	X
Supervised Rebreather Dives	X	X	X

Minimum Underwater Requirements

	Pool/Confined	Openwater	Supervised Dives**
Deco	1 Dive / 60 min	7 Dives / 420 min	4 Dives / 240 min.
Normoxic	1 Dive / 60 min	7 Dives / 420 min	4 Dives / 240 min.
Deco/Normoxic Combined	1 Dive / 60 min	7 Dives / 420 min 3 Normoxic Dives / 180 min	4 Dives / 240 min.
Hypoxic Mixes		7 Dives / 420 min	4 Dives / 240 min.

**A minimum of three supervised dives should comply with authorisation parameters

B. Rebreather Crossover Training

1. Crossover training to a new rebreather platform requires a minimum of 4 training dives for a minimum cumulative dive time of 240 min.
2. Advanced level certification on a new rebreather platform may be awarded upon successful demonstration of required skills using the new platform.

SECTION 12.00 SCIENTIFIC CAVE AND CAVERN DIVING

This section is omitted – UTAS does not currently support Cave or Cavern Diving.

APPENDICES

APPENDICES 1 – 12

APPENDIX 1
DIVING MEDICAL EXAMINATION

This Appendix is supplied as a placeholder to acknowledge that the University of Tasmania requires a diving medical compliant with AS/NZS 2299.1:2015, which is protected under copyright © Standards Australia Limited/Standards New Zealand. The UTAS community may access a licensed copy of this standard through the UTAS Library online resources and databases pages. (*Note: scroll down to **Australian Standards Online**, and click on the link to online SAI Global portal, which requires a registered user sign in.)*

AS/NZS 2299.1 Supplement 1:2015

Occupational diving operations
Part 1: Standard operational practice
Supplement 1: AS/NZS 2299 diving medical examination forms
(Supplement to AS/NZS 2299.1:2015)

APPENDIX 2
CONDITIONS WHICH MAY DISQUALIFY CANDIDATES FROM DIVING

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 auto inflate 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]

APPENDIX 3
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 4
RECOMMENDED PHYSICIANS WITH EXPERTISE IN DIVING MEDICINE

A complete list of Medical Doctors that have training and expertise in diving and hyperbaric medicine can be found through the South Pacific Underwater Medicine Society.
www.spums.org.au/dive-doctors-list

In Tasmania, this includes:

1. Name: Elizabeth Elliott
   Address: South Hobart, Tasmania

2. Jane Gorman – no longer conducting diving medicals

3. Name: Erica Jones
   Address: Stoke Family Medical Centre, Hobart, Tasmania
   Telephone: +61 03 6228 7841

4. Name: Sarah Lockley
   Address: General Practice Plus 18 Gregory St, Sandy Bay, Tasmania
   Telephone: +61 03 6270 8444

5. Name: David Smart
   Address: iN2 Deep Medical Consulting Howrah, Tasmania
   Telephone: +61 407 138 332

6. Name: Graham Stevens
   Address: yourhealthhub Bellerive, Tasmania
   Telephone: +61 03 6122 0150

7. Name: Michael Tooth
   Address: City Doctors 188 Collins St, Tasmania
   Telephone: +61 03 6231 3003

8. Royal Hobart Hospital Hyperbaric Medicine Unit
   Telephone: +61 03 6166 8193

APPENDIX 5

ABBREVIATIONS, ACRONYMS, AND INITIALISMS DEFINITIONS

ABBREVIATIONS, ACRONYMS, AND INITIALISMS

AAUS	American Academy of Underwater Sciences www.aaus.org
AESD	Advanced European Scientific Diver
AGE	Arterial Gas Embolism (AKA CAGE)
AMC	Australian Maritime College https://amc.edu.au
AQTF	Australian Quality Training Framework
ASQA	Australian Skills Quality Authority www.asqa.gov.au/
BCD	Buoyancy Control Device
CAGE	Cerebral Arterial Gas Embolism (AKA AGE)
CCR	Closed Circuit Rebreather
CPR	Cardio-Pulmonary Resuscitation
DAN AP	Divers Alert Network (Asia Pacific) www.danap.org
DC	Dive Coordinator
DCI	Decompression Illness (includes both DCS and AGE)
DCS	Decompression Sickness
DES	Divers Emergency Service
DS	Dive Supervisor
DSC	Diving Safety Committee
DSO	Diving Safety Officer
EAN	Enriched Air Nitrox
IMAS	Institute for Marine and Antarctic Studies www.imas.utas.edu.au
ISO	International Standards Organization
MSW	Meters Seawater
OM	Organisational Member (of AAUS)
RTO	Registered Training Organisation
SCBA	Self-Contained Breathing Apparatus
SCR	Semi-Closed Circuit Rebreather
SCUBA	Self-Contained Underwater Breathing Apparatus
SDO	Site Diving Officer
SPUMS	South Pacific Undersea Medicine Society www.spums.org.au
SSBA	Surface Supplied Breathing Apparatus
SWP	Safe Work Procedure
TEQSA	Tertiary Education Quality and Standards Agency www.teqsa.gov.au
UDO	University Diving Officer
UTAS	University of Tasmania www.utas.edu.au
VET	Vocational Education and Training

DEFINITIONS

Accident - see *Incident*.

Active Diver - a diver that meets all currency and proficiency requirements for diving at UTAS.

Air/Gas Sharing - sharing of an air/gas supply between divers[7] using any equipment configuration or technique.

ATA (Atmospheres Absolute) - the total pressure exerted on an object by a gas or mixture of gases, at a specific depth or elevation, including normal atmospheric pressure.[7]

Alternate Air/Gas Supply – a generic term for a system or configuration capable of providing a breathing gas source to the diver as an alternative to a diver's primary air/gas supply. Includes redundant and non-redundant sources. See also *Emergency Air/Gas Supply (AKA Bailout)*.

American Academy of Underwater Sciences (AAUS) - a non-profit, self-regulating body dedicated to the establishment and maintenance of standards of practice for scientific diving with a mission of advancing and facilitating safe and productive scientific diving.

Australian Qualifications Framework (AQF) – is the national policy for regulated qualifications in Australian education and training. It incorporates the qualifications from each education and training sector into a single comprehensive national qualifications framework. The AQF is the agreed policy of Commonwealth, State and Territory ministers.

Australian Skills Qualifications Authority (ASQA) – the national regulator for vocational education and training.

Authorisation - the DSC authorises divers to dive using specialised modes of diving, and the maximum depth they may dive to.[7]

Bailout System - see *Emergency Air/Gas Supply*.

Belt Block - see *Manifold Block*.

Bottle Bank - see *Cylinder Bank*.

Bottom Time - the total elapsed time from when a diver leaves the surface to the time (next whole minute) at which ascent is commenced, measured in minutes.[6]

Breath-hold Diving - a generic term used to describe a diving mode in which the diver uses no compressed gas supply to conduct a dive. Includes freediving, skin diving and snorkelling. (See also *Freediving* and *Snorkelling*).

Bubble Check – a visual examination by the dive team of their diving systems, looking for O-ring leaks or other air leaks, conducted in the water[7].

Buddy Breathing - sharing of a single air source/demand valve between divers.[7]

Buddy Line - a line that secures two divers to each other. Sometimes used in low visibility.

Buddy System – a system of diving *based upon mutual assistance*[7] and responsibility through monitoring and *maintaining effective two-way communication*[8]. Buddy divers must *at all times have visual contact with and direct access to each other*[8], in order to immediately recognize a problem, and render assistance. See also *Team Diving*.

---

[6] Sources: AS/NZS 2299.1:2015 and AS/NZS 2299.2:2002

[7] AAUS Standards Manual Nov 2018

[8] Source: AS/NZS 2299.2:2002

Buoyant (or Partially Buoyant) Ascent - an ascent made using some form of positive buoyancy.[7] Typically used to describe an emergency ascent.

Cave Dive - a dive which takes place partially or wholly underground, in which one or more of the environmental parameters defining a cavern dive are exceeded.[7] Note: cave diving activities are currently excluded at UTAS.

Cavern Dive - a dive which takes place partially or wholly underground, in which natural sunlight is continuously visible from the entrance.[7] Note: cave diving activities are currently excluded at UTAS.

Certified Diver – a diver who holds a recognised valid certification for diving from a *Registered Training Organisation (RTO)* an internationally recognised certification agency, or an AAUS Organisational Member.

Competent Person – a person who has acquired through training and qualifications or experience, or a combination of these, the knowledge and skills to enable that person to perform a specified task.[9]

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.[7] Rate of ascent may vary but should be close to normal rates. See also *Normal Ascent*.

Current Line - a line deployed at a dive site (typically off a vessel) to facilitate recovery of divers from the water, particularly in conditions of strong current. Sometimes referred to as a mermaid line.

Cylinder - a pressure vessel for the storage of gases.

Cylinder Bank - high pressure breathing air/gas cylinders yoked together and used in conjunction with a regulator to deliver breathing gas to a diver. Also referred to as a Bottle Bank.

DCIEM Tables – Dive tables developed by the Defence and Civil Institute of Environmental Medicine of Canada (now Defence Research and Development Canada).

Decompression Illness (DCI) – a generic term for acute illness resulting when pathological consequences arise from a reduction in the ambient pressure surrounding the body (e.g. decompression). The term includes the conditions known as decompression sickness (DCS), and arterial gas embolism (AGE), but does not include barotrauma of ascent.[6]

Decompression Schedule – a specific decompression procedure for a given combination of depth and bottom time as listed in a decompression table or on a dive computer; normally includes a series of stops at specified depths (in MSW or FSW) and specified time (in minutes).[6]

Decompression Sickness - a condition with a variety of symptoms, which may result from gas, and bubbles in the tissues of divers after pressure reduction.[7]

Decompression Stop - The specified length of time which a diver must spend at a specified depth to allow for the elimination of enough inert gas from the body to theoretically allow safe ascent to the next decompression stop or the surface.[6]

Delegate – an individual appointed (usually in writing) by the University Diving Officer and/or the Diving Safety Committee to perform nominated duties.

Dive – any hyperbaric condition exceeding 1ATA of pressure, and/or any event that includes a descent, an ascent, and return to the surface. Variations include compressed gas dives (e.g. Scuba, SSBA, rebreather), breath-hold dives (including snorkelling and freediving) and chamber (hyperbaric/recompression chamber) dives. Note that only compressed gas dives are reported to AAUS.

[9] Sources: AS/NZS 2299.1:2015; AS/NZS 2299.2:2002 and ASQA

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.[7]

Dive Coordinator (DC) - a competent person responsible for dive team safety who is appointed to supervise and coordinate scientific diving work. Nominated by the UDO or their designee on an annual basis.[8]

Dive Coordinating Position – a single designated location on the surface, adjacent to where a diver enters the water, from which the diver's safety is monitored.[8]

Dive Leader (AKA Lead Diver)- a person in charge of a specific part of a dive operation[8] (usually the in-water leader of a dive team).

Dive Plan/Dive Project Plan - a written submission of a dive plan for approval by the UDO and the DSC. Includes general project information on the intended diving mode, gas, dive profile /decompression management, environment, required qualifications/roles, and a description of the underwater work, tools, and techniques the project will include. Usually prepared by the project leader and includes consultation with the UDO and dive team members that will be undertaking the work. May be completed as a ***Safe Work Procedure (SWP)***

Diver – a person who holds relevant competencies for the type of diving work to be performed. See also *Scientific Diver*.

Diver-In-Training – see *Scientific Diver-in-Training*.

Diver's Attendant (AKA Surface Attendant) – the person at the surface, responsible for attending a diver or dive team.

Dive Site/Location – the geographic/physical location of a dive, diver, or dive team.

Dive Supervisor- a competent person who supervises [occupational] diving operations.[10] Also describes a specific qualification issued by an RTO under AS/NZS 2815.5.

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.[7]

Dive Team – a group of people, including the dive coordinator, divers, attendant(s) and other personnel as required who are present at the dive site, directly involved in the dive operation, responsible for the safe conduct of the diving operation and responsible for the availability and conduct of emergency procedures.[10]

Diving Mode – See *Mode*.

Diving Program (AKA Diving Project) – One or more dives that are related by purpose, place or time to form a series.[8] See also *Project Plan*.

Diving Safety Committee (DSC) – a governance committee providing oversight of the scientific diving program at UTAS. For the purposes of AAUS Organisational Membership, this committee fulfils the same role as a Diving Control Board (DSC).

Diving Safety Officer (DSO) (AKA Dive Officer) – an industry-recognised professional title of an individual with responsibilities for the safe conduct of a scientific diving program. See also *University Diving Officer* and *Site Diving Officer*.

Effective Bottom Time (EBT) – For a diver carrying out repetitive diving, the bottom time calculated

[10] Source: AS/NZS 2299.1:2015

after taking into consideration the residual nitrogen from previous dives. Calculation method depends on tables used.

Effective Depth (ED) - for a dive at altitude, the depth of an equivalent dive at sea level.

Element of Competency - within a unit of competency, describes the skill outcomes that contribute to a unit or what skills are required to perform the work activity. *A discretely identifiable action or knowledge that can be demonstrated or assessed.*[11]

Emergency Air/Gas Supply (AKA Bailout) – a diver-carried redundant (fully independent of the diver's primary breathing air/gas supply) source of breathing air/gas supply 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. May be used to respond to an out of air/gas, low on air/gas, or possible contaminated air/gas event. Sometimes called an Independent Reserve Breathing Gas.

Emergency Swimming Ascent (AKA Controlled Emergency Swimming Ascent) - an ascent made under emergency conditions where the diver may exceed the normal ascent rate.[7] See also ***Normal Ascent***.

Enriched Air Nitrox (AKA EAN, EANx or Nitrox) – Any gas mixture comprised predominantly of Nitrogen and Oxygen, where the percentage of oxygen exceeds 21% (most frequently containing between 22% and 40% Oxygen. (See Volume 2 Section 6.00).

Equivalent Air Depth (EAD) - depth at which air will have the same nitrogen partial pressure as the nitrox mixture being used. This number, expressed in units of feet or meters of seawater or saltwater, will always be less than the actual depth for any enriched air mixture.[7]

Exceptional Exposure Dive - a dive where the maximum recommended dive time for a particular depth (shown by the limiting line in decompression tables) is exceeded by a diver at that depth.[8]

Float line - a line connecting the diver to a highly visible float on the surface of the water enabling the approximate location of the diver to be known at all times.[6]

Freediving – a range of breath-hold diving activities, several of which have evolved into distinct activities/sports and competitive disciplines, during which the diver uses no compressed gas supply to conduct a dive. Freediving at UTAS includes breath hold activities to a maximum depth of 15m using mask, snorkel, and fins. It is distinguished from Snorkelling which is primarily an observational surface activity. See also *Breath-hold Diving* and *Snorkelling*.

Gas Management - gas planning rules, in which the diver reserves a portion of their available breathing gas for anticipated emergencies. See also *Rule of Thirds*, *Rule of Sixths*.[7]

Gas Matching –the technique of calculating breathing gas reserves and turn pressures for divers using different volume cylinders. Divers outfitted with the same volume cylinders may employ the *Rule of Thirds* for gas management purposes. Divers outfitted with different volume cylinders will not observe the same gauge readings when their cylinders contain the same gas volume, therefore the Rule of Thirds will not guarantee adequate reserve if both divers must breathe from a single gas volume at a Rule of Thirds turn pressure. Gas Matching is based on individual consumption rates in volume consumed per minute. It allows divers to calculate turn pressures based on combined consumption rates and to convert the required reserve to a gauge-based turn pressure specific to each diver's cylinder configuration.[7]

General Diving Work - is work carried out in or underwater while breathing compressed gas and includes *Incidental Diving Work* and *Limited Scientific Diving Work* but does not include *High Risk*

[11] Source: AS/NZS 2815 series

Diving Work.[12,13]

Guideline - continuous line used as a navigational reference during a dive leading from the team position to a point where a direct vertical ascent may be made to the surface.[7]

Hazard - anything that has the potential to cause injury or illness to people, or damage to plant or equipment.[14]

High Risk Diving Work - is work carried out in or underwater or any other liquid while breathing compressed gas, and involving one or more of the following:[12,13]

- Construction work,
- Work of the kind described in *regulation 289(3)(d)*,
- Inspection work carried out in order to determine whether or not work described in the above two points is necessary,
- The recovery or salvage of a large structure or large item of plant for commercial purposes,

but does not include minor work carried out in the sea or the waters of a bay or inlet or a marina that involves cleaning, inspecting, maintaining, or searching for a vessel or mooring. Note that High Risk Diving Work requires compliance with AS/NZS 2299.1:2015.

Hookah - a Mode of diving.[7]
(***in Australia)*** - a colloquial, but widely used, term for a limited feature form of surface supply diving apparatus usually involving the supply of breathing air from a small compressor unit via an air supply hose to a mouth-held demand breathing gas supply device.[10]
Note that outside Australia, the term varies. Example: 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 (sometimes referred to as SNUBA). The diver is responsible for the monitoring his/her own depth, time, and diving profile.[7]

Hyperbaric Chamber – see *Recompression Chamber*.

Hyperbaric Conditions - pressure conditions in excess of normal atmospheric pressure at the dive location.[7]

Incident - An incident is an occurrence that has, or could have had, an adverse impact on people, property or equipment. This can include, incidents resulting in:

- injury, illness, or "near misses" when there is potential for an injury or illness;
- includes both physical and mental injuries and illnesses
- damage to or failure of structure, motor vehicles or other plant and equipment.[14]

Incidental Diving Work - is *General Diving Work* that is incidental to the conduct of the business or undertaking in which the diving work is carried out and involves *Limited Diving*.[12, 13]

Instructor – An individual certified by a recognised certifying organisation to train and assess the appropriate course and authorise and recommend the issue of the same level of certification (note that the terms instructor and trainer are synonymous).[11]

---

[12] Source: WorkSafe Tasmania: Diving Work
[13] Tasmania WHS Regulations 2012 (Chapter 1, Part 1.1, Interpretation)
[14] Source: UTAS Incidents and Hazards Module MySafety

Lazy Shot - a line/rope running vertically from the surface (dive coordinating position) to an attached weight hanging free and positioned off the bottom or worksite. The line/rope is marked with depth graduations to facilitate decompression stops at the correct depth.[6]

Lifeline – a line attached to a diver which is capable of being used to haul the diver to the surface.[6]

Life Support Equipment – underwater equipment necessary to sustain life.[7]

Limited Diving - diving that does not involve:

- Diving to a depth below 30 meters,
- The need for a decompression stop,
- The use of mechanical lifting equipment or a buoyancy lifting device,
- Diving beneath anything that would require the diver to move sideways before being able to ascend,
- The use of plant that is powered from the surface,
- Diving for more than 28 days during a period of 6 months.[12,13]

Limited Scientific Diving Work - is *General Diving Work* that is carried out for the purpose of professional scientific research, natural resource management, or scientific research as an educational activity, and involves only *Limited Diving*.[12,13]

Live Boating (AKA Working Live) – a type of diving operation performed while the dive vessel is underway, under power, or not secured by anchorage, mooring or other means.

Manifold Block – block or assembly with gas switching controls for a redundant gas supply system, usually positioned at front of diver's body on belt/harness. May also be referred to as a Belt Block.

Manifold with Isolator Valve - a manifold joining two diving cylinders, that allows the use of two completely independent regulators. If either regulator fails, it may be shut off, allowing the remaining regulator access to the gas in both of the diving cylinders.[7]

Mixed Gas - breathing gas containing proportions of inert gas other than nitrogen greater than 1% by volume.[7]

Mixed Gas Diving - a diving mode in which the diver is supplied in the water with a breathing gas other than air.[7]

Maximum Operating Depth (MOD) - usually determined as the depth at which the pO_2 for a given gas mixture reaches a predetermined maximum.[7]

Mode – a method of gas delivery that requires specific equipment/configuration, procedures and techniques used for diving. This includes Scuba, SSBA, Hookah, and Rebreather Diving[7], snorkelling, and freediving. (Note for purposes of reporting statistics to AAUS, snorkelling and freediving are not included.)

Night Diving – any diving conducted in darkness, (for purposes of training, this is typically considered to be at least 30 minutes after sunset and 30 minutes before sunrise[11]).

Nitrox – see Enriched Air Nitrox.

Normal Ascent - an ascent made with an adequate air supply at a rate of 9 meters per minute or less.[7] See also ***Emergency Swimming Ascent***.

Notifiable Incident - an incident that is serious or had the potential to be serious, requiring notification of the WorkSafe Regulator by the UTAS Safety and Wellbeing Unit. Under the WHS Act, a notifiable incident is defined as: the death of a person, a serious injury or illness of a person, or a dangerous

incident.[14,15]

Occupational Diving – diving performed by a worker (irrespective of whether or not diving is the principal function of employment or merely an adjunct to it) and comprising all diving carried out as part of a business, a service, for research, or for profit.[10]

Organisational Member (OM) - an organisation which is a current member of the AAUS, and which has a program which adheres to the standards of the AAUS.[7]

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.[7]

Oxygen Service - a gas delivery system that is both oxygen clean and oxygen compatible.[7]

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.[7]

Performance Criteria – evaluative statements that specify the required level of performance required to demonstrate achievement of the element of competency.[11]

Pressure-Related Injury - An injury resulting from pressure disequilibrium within the body as the result of hyperbaric exposure (such as decompression sickness, pneumothorax, mediastinal emphysema, air embolism, subcutaneous emphysema, or ruptured eardrum.)[7]

Primary Air/Gas supply – the main supply of any diver's breathing gas.

Project Leader - UTAS staff member with overall responsibility for conduct of a project and the field team (noting that the Dive Coordinator retains authority over decision making during the conduct of any diving operation).

Qualification - defined by ASQA as a formal certification, issued by a relevant approved body, to recognise that a person has achieved learning outcomes or competencies relevant to identified individual, professional, industry or community needs. In Australia, this refers to a nationally recognised qualification within the Australian Qualifications Framework.

Quick release - a readily operated mechanism that enables the immediate release (e.g. of a diver's equipment) from the secured position by a single operation of one hand, but which is designed to minimise the risk of accidental release.[6]

Rebreather - Any device that recycles some or all of the exhaled gas in the breathing loop and returns it to the diver. (See Volume 2 Section 11.0 for full definition)

Recognition of Prior Learning (RPL) – defined by ASQA as an assessment-only pathway of determining the competence of a person; a process that involves assessment of an individual's relevant prior learning (including formal, informal, and non-formal learning).

Recompression Chamber - A pressure vessel designed and equipped for human occupancy[8] in which persons may be subjected to pressures equivalent to or greater than those experienced when under water, or under conditions which simulate those experienced on an actual dive.[10] Also called a hyperbaric chamber or decompression chamber.

Registered Training Organisation (RTO) - a training provider registered by ASQA (or a state regulator) to deliver VET services. RTOs provide quality training and qualifications that are nationally recognised. The national register of RTOs is maintained by *training.gov.au*.

Regulatory Authority – a Minister of the Crown, a government department, or other public authority

[15] Source: Safework Australia Incident Notification Fact Sheet download

having power to issue regulations, orders, or other instructions having the force of law.[11] The WHS Regulator in Tasmania is *WorkSafe Tasmania*, a part of the Department of Justice. Note that *Safe Work Australia* is an Australian government statutory body established in 2008 to develop national policy relating to WHS and worker's compensation and does not regulate WHS laws. The Commonwealth, states and territories retain responsibility for regulating and enforcing WHS laws in their jurisdictions. UTAS diving may involve operations in any of these jurisdictions.

Remote Dive Site - any area of dive operation greater than 30 minutes from medical assistance. For purposes of dive profile/decompression management, it may also be used to describe any dive operation conducted more than 2 hours transport from a recompression chamber. Safe Work Australia also defines remote and isolated as workers that may be isolated from help because of where or when they are working, or the nature of the work they are doing.

Repetitive Dive – any dive conducted [after a surface interval of more than 15 minutes or] within 18 hours of a previous dive or that has a repetitive factor greater than 1.0 when calculated using DCIEM tables.[8]

Repetitive Factor (RF) – when using DCIEM tables for repetitive diving, RF is a figure determined by the repetitive dive group (RG) and the length of the surface interval after a dive.[8]

Repetitive Group (RG) - a designation or category allocated to a diver that gives an indication of nitrogen loading, determined by the depth and time of any dives completed in the previous 18 hours. Used by many dive tables.

Reserve Gas Supply - that quantity of air/gas that will enable a diver to return safely to the surface from the planned depth of the dive, completing any planned decompression or safety stops.[8]

Residual Nitrogen - Nitrogen that is still dissolved in a diver's tissues after the diver has surfaced.[8]

Restriction - Any passage through which two divers cannot easily pass side by side while sharing air.[7]

Risk assessment - is a simple tool to look at an activity such as a task, project, or event to identify health and safety risks that are likely to pose a threat to a person's safety or impact on operations of the University and to establish appropriate risk controls to minimise harm.[16]

Rule of Thirds - Gas planning rule which is used in cave diving environments in which the diver reserves 2/3's of their breathing gas supply for exiting the cave or cavern.[7] Also described as 1/3 in, 1/3 out and 1/3 redundancy. This rule is also used in technical diving and the broader diving community.

Rule of Sixths - Air planning rule which is used in cave or other confined diving environments in which the diver reserves 5/6's of their breathing gas supply (for DPV use, siphon diving, etc.) for exiting the cave or cavern.[7]

Safety Drill - ("S" Drill) - Short gas sharing, equipment evaluation, dive plan, and communication exercise carried out prior to beginning a technical dive by the dive team.[7]

Safety Reel - Secondary reel used as a backup to the primary reel, usually containing 150 feet of guideline that is used in an emergency.[7]

Safety Stop - a precautionary decompression stop (i.e. not specified as mandatory by a decompression schedule) usually completed for 3 to 5 minutes duration at 3 to 5 meters depth.

Safe Work Practice (SWP) - a document that is developed for tasks, techniques processes and the operation and maintenance of plant and equipment where there is a risk of harm to any worker or other person. Before a SWP is developed, a risk assessment shall be completed to identify potential hazards

[16] Source: UTAS Safety and Wellbeing Risk Topics – Risk Management

and controls. As part of the monitoring and review process, the SWP must be tested by carrying out the procedure to assure that all the actions and steps are correct. If for any reason the SWP is deviated from, a risk assessment must again be carried out to ensure any new risks are controlled.[16] Sometimes used to create a ***Dive Plan/Dive Project Plan*** .

Saturation - that condition where the person's body tissues are totally saturated with the particular inert element of the breathing medium.[8]

Scientific Diver – a competent person performing diving for the purpose of professional scientific research, natural resource management or scientific research as an educational activity.[8,13][13] Also describes:

- a specific qualification issued by an RTO under AS/NZS 2815.6:2013;
- a certification issued by an AAUS Organisational Member; and/or
- a person authorised to dive through RPL (Recognition of Prior Learning).

This includes reciprocity for international scientific divers certified by AAUS, AESD or similar.

(Scientific) 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.[7]

Scientific Diver (Restricted) – an Australian designation for a person performing diving for the purpose of professional scientific research, natural resource management or scientific research as an educational activity, but who may not meet all requirements for unrestricted diving.

Scientific Diving – diving performed for the purpose of professional scientific research, natural resource management or scientific research as an educational activity.[8,13]

SCUBA (Self Contained Underwater Breathing Apparatus) - open circuit diving equipment which supplies the wearer with breathing gas from cylinders carried by the wearer.[6]

Scuba Diving - A diving mode independent of surface supply in which the diver uses open circuit self-contained underwater breathing apparatus.[7]

Serious Injury or Illness – *defined* by WorkSafe Tasmania as: an injury or illness requiring the person to have:

a. Immediate treatment as an in-patient in a hospital, or
b. Immediate treatment for: the amputation of any part of their body: a serious head or eye injury; a serious burn; separation of skin from underlying tissue (e.g. degloving or scalping); a spinal injury; loss of a bodily function; or serious lacerations, or
c. Medical treatment within 48 hours of exposure to a substance

Shot Line (AKA Shot Rope) - a line/rope running vertically from the surface (dive coordinating position) and fixed to the worksite or bottom with a weight or attachment. The line/rope is marked with depth graduations to facilitate decompression stops at the correct depth. See also *Lazy Shot*.[6]

Sidemount - a diving mode/configuration utilizing [at least] two independent scuba systems carried along the sides of the diver's body; either of which always has sufficient air to allow the diver to reach the surface unassisted.[7]

Siphon - cave or similar structure into which water flows with a generally continuous in-current.[7]

Site Diving Officer (SDO) –an individual nominated by the UDO (and approved by the DSC) to perform the role/assignment of a *Dive Officer* for a specific UTAS workplace/site, organisational unit, project or program (on or off campus). A Dive Officer may additionally be an appointed position by an organisational unit undertaking diving operations (noting that position descriptions, titles and job duties

may vary). All Dive Officers report to the UDO on all diving related matters, and to their respective line management for all other aspects of their substantive position.

Shall – indicates that a statement is mandatory.

Should – indicates a recommendation.

Snorkelling (AKA Snorkel Diving) a primarily observational surface activity using mask, snorkel and fins with dives limited to a maximum depth of 3m. A form of breath-hold diving during which the diver uses no compressed gas supply to conduct a dive. See also *Breath-hold Diving* and *Freediving*.

Standby Diver - a qualified diver who is currently fit to dive, and is located at the dive location, dressed and equipped to enable immediate entry into the water for the purpose of providing aid or assistance to a diver.[6]

Surface Attendant - see *Diver's Attendant*.

Surface Interval – the time between surfacing from one dive and commencing another. Note that if diving under DCEIM tables, two dives with less than 15 minutes surface interval is deemed a single dive.

Surface Supplied Breathing Apparatus (SSBA) - diving equipment that supplies breathing gas at the required pressure for the depth, through a diver's hose to a diver from plant at the surface.[6]

Surface Supplied Diving – a mode of diving 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 a full-face mask, or the combination of a half-mask and regulator. The diver may rely on the tender at the surface to keep up with the divers' depth, time and diving profile.[7] See also *Hookah*.

Swimming Ascent - An ascent, which can be done under normal or emergency conditions accomplished by simply swimming to the surface.[7]

Team Diving – a team approach to diving that adheres to the principles of the Buddy System, and tacitly acknowledges the cooperative nature of all members of a dive team, (i.e. divers, attendants and other personnel) working together to actively support dive operations. Team diving may also describe three-diver combinations, activities where buddy teams change during a dive, or more complicated operations such as Bluewater diving procedures (with the safety diver stationed at the centre of an array). It may also describe SSBA, Tethered Scuba, or Hookah operations.

Tender - used in Surface Supplied, Hookah and Tethered diving with duties similar to a diver's attendant. The tender comprises the topside buddy for the in-water diver on the other end of the tether. The tender must have the experience or training to perform the assigned tasks in a safe and healthful manner.[7]

Tethered Scuba (AKA Tethered Mode) – scuba diving in which a diver is secured by a lifeline and tended by a diver's attendant or secured to a tended float line.[8]

Trip/Activity Plan– a documented operational plan for a dive excursion, including date, location, personnel, roles/assignments. Prepared by the Dive Coordinator/Dive Supervisor and submitted to the relevant Dive Officer for approval. Subordinate to the Dive Project Plan

Turn Pressure – The gauge reading of a diver's open circuit scuba system designating the gas limit for terminating the dive and beginning the exit from the water.[7]

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.[7]

Unit of Competency – a broad aspect of the knowledge or ability the trainee needs to acquire before being considered competent.[11] Defined by ASQA as the specification of the standards of performance required in the workplace.
University Diving Officer – a University-wide suitably qualified and experienced *Dive Officer* responsible for ensuring that all University diving operations conform to the University's WHS management framework, policies, relevant legislation, and Australian Standards. The UDO has overall management responsibility for diving activities associated with the University; has oversight of dive training requirements; promotes a safe diving culture; engages with key stakeholders to ensure consistent management of safe diving across all organisational units of the University; and is the subject matter expert and representative of the University for diving related matters.

UTAS Diver - a diver authorised to undertake diving on behalf of the University.

Visibility – generally considered to be the distance at which an object underwater can be readily identified. Though typically used to refer to horizontal measurements (i.e. between divers), visibility may also be measured vertically (looking up at the surface or down from the surface).
Low Visibility - is usually considered as horizontal visibility less than 2m.[8]
Zero Visibility - is described as conditions in which an un-gloved hand is not visible at the glass/water interface of the face mask.[8]
Visiting Scientific Diver - is a trained, certified visiting diver from another country who performs tasks relevant to scientific diving in his or her own country, who has a current diving medical certification and who is allowed to dive under AS/NZS 2299.2:2002 during his or her visit.[8]
Working Live – see *Live Boating*.

APPENDIX 6

☐ **REQUEST FOR DIVING RECIPROCITY (and/or)**

☐ **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 University of Tasmania Diving Manual and has demonstrated competency in the indicated areas. The University of Tasmania 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)

_____ 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 Authorisation_____ msw
Total number of career dives? _____

Any restrictions or Waivers of Requirements? (Y/N)_____ if yes, explain:

Please indicate any pertinent authorisations or training (e.g. drysuit, Nitrox, etc):

Emergency Contact Information for Diver (to notify in an emergency):

Name: _____ Relationship:_____

Telephone:_____(work) _____(home)

Address:_____

This is to verify that the above information is complete and correct

Diving Safety Officer:

_____ _____

(Signature) (Date)

_____ _____

(Print)

APPENDIX 7
EMERGENCY RESPONSE PLANNING

Introduction

A diving accident victim may include:

- Any person who becomes ill/injured, *and*
  - Has been breathing compressed gas underwater (regardless of depth), *or*
  - Has been conducting breath-hold diving activities.
- An ill/injured diver irrespective of whether the injury is sustained by or during the dive itself.

This inclusion assures that:

- Diving physiology is considered during treatment of what may appear to be a non-diving malady.
- Hyperbaric medicine expertise is consulted as appropriate.

It is therefore essential that emergency procedures are pre-planned, and that medical treatment is initiated as soon as possible. These procedures and guidelines are intended to assist in the planning and management of diving related emergencies, and include this Appendix and supporting documents:

- Appendices 7a *(Step-By-Step Response to a Diving Emergency)*
- Appendix 7b *(Diving Emergency First Aid Flowchart)*
- Appendix 7c *(Missing Diver Protocol)*

Planning

As part of the risk assessment and planning process, the Dive Coordinator must prepare an emergency response plan for the activity, including site-specific considerations for evacuation and medical treatment. This must be included by the Dive Coordinator in the fieldwork activity plan submission process, (e.g. within FieldFriendly for IMAS).

General Procedures

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

1. Remember DRSABCD – make appropriate contact with victim or rescue as required.
2. Stabilize the victim – administer 100% oxygen, if appropriate.
3. Call local Emergency Medical System (EMS) for transport. Explain circumstances of the incident to evacuation teams, medics, and physicians. Do not assume that they understand why 100% oxygen may be required or that recompression treatment may be necessary.
4. Call as appropriate Hyperbaric medical facility, and/or DAN, DES.
5. Notify: – activate notification/escalation protocol (see Appendix 7a)
6. Submit a MySafety Incident Report when time allows – noting mandatory reporting times.
7. Diving Officer to complete and submit Incident Report Form (www.aaus.org) to the DSC via the UDO, and the AAUS (Section 2.70 Required Incident Reporting).

Fieldwork Activity Plan Inclusions:

- List of emergency contact numbers appropriate for dive locations.
- Name and emergency contact information for each diver in the event of an emergency.
- Nearest operational recompression chamber and accessible hospital/medical facility.
- Available means of transport.
- Availability of appropriate emergency response equipment (e.g. quantity Oxygen, AED, etc.)

APPENDIX 7a

Response to a Diving Emergency

Recognise the emergency – tell all crew. Think **DRSABCD**. Note time	
Danger: safety of vessel, people, scene	
Spotter assigned/marker deployed	
Reach/Throw/Relocate (vessel)/Go (rescuer)	
Prep AED, Oxygen, First Aid	
Send for Help (Marine Radio Ch 16 or 000) *"this is a diving emergency"*	
Remove injured from water. Assess **Responsiveness**. Provide **ABC**s	
AED/**Defibrilator**	
100% Oxygen – Diver and Buddy	
Recall all other personnel/divers	
Record details of incident when you can	
Proceed with Evacuation	
Field Neurological Assessment	
Contact Hyperbaric facility if appropriate	
Contact DAN AP/Divers Emergency Service if needed	
Inform/Notify/Report (see IMAS or AMC Escalation list below)	
Secure dive gear. Preserve evidence. Take photos	

Emergency Contact Numbers: ***"this is a diving emergency"***

Tasmanian Ambulance Service **000**
Royal Hobart Hospital Switchboard **6166 8308**
Hyperbaric Medicine Unit (Hobart) **6166 8193** (after hrs call RHH)
DAN AP/Divers Emergency Service **1800 088 200**

IMAS

Inform/Report/Notify – Escalation List (IMAS)

Call- in this order (and leave message), until you speak with someone

1. University Dive Officer **0400 479 140**
2. IMAS Operations Mgr **0424 673 960**
3. IMAS Dive Officer **0418 120 705**
4. IMAS Boating Officer **0400 870 858**
5. IMAS Ops Safety Ofc **0409 174 590**

AMC

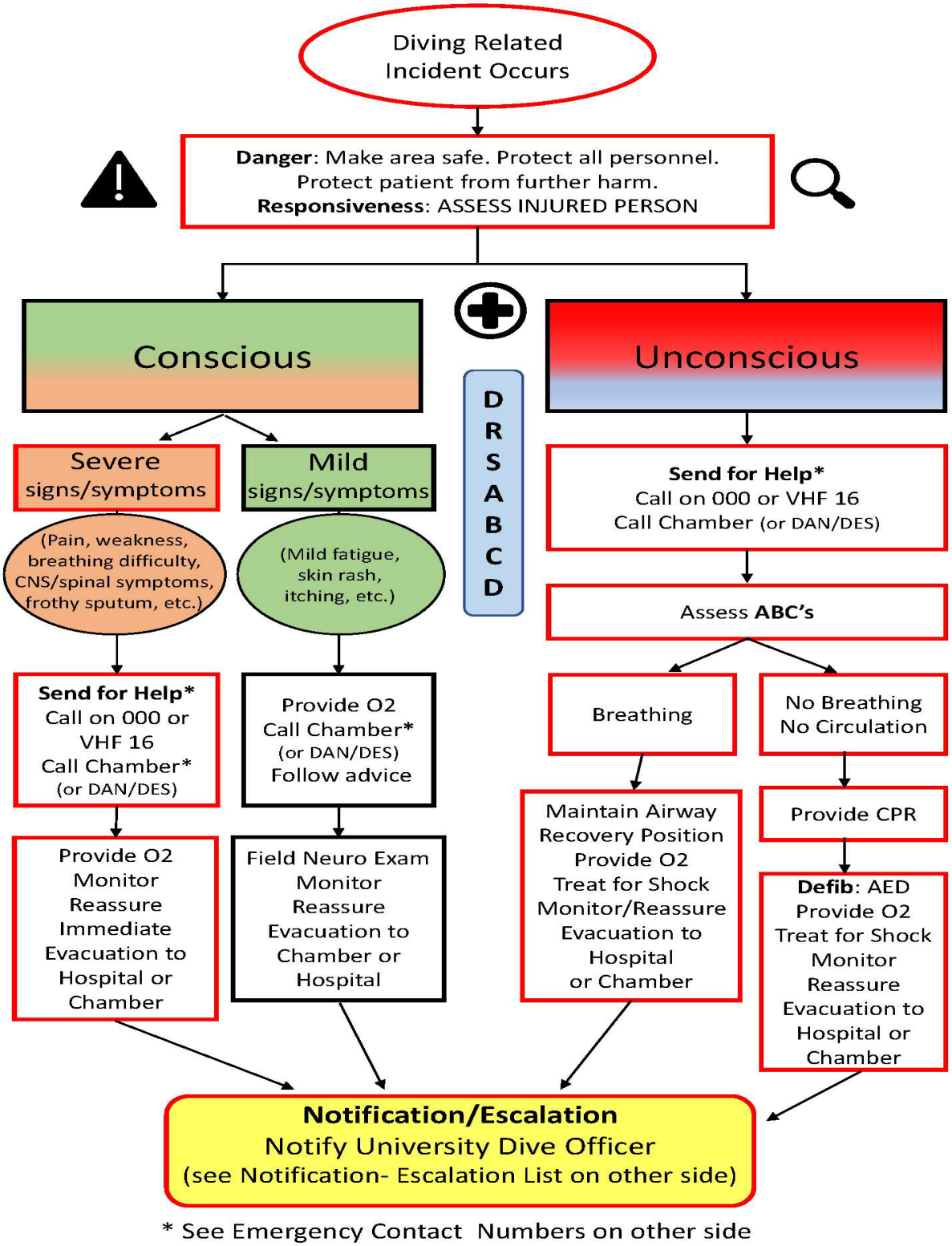
Inform/Report/Notify – Escalation List (AMC)

(Call- leave message, <u>and</u> text in this order until you speak with someone)

1. University Dive Officer **0400 479 140**
2. AMC Ops Mgr / DP **0422 323 883**
3. AMC Deputy DP **0417 549 884**
4. UTAS Safety & Security **6226 7600** (state- diving incident)

APPENDIX 7b

Diving Emergency First Aid FlowChart



* See Emergency Contact Numbers on other side

Version 2.0 20 April 2020

APPENDIX 7c

MISSING DIVER PROTOCOL

1.
- Mark LSP (Last Seen Point)
- Use GPS, shot line/buoy, other marking methods

2.
- Consider wind and water current (direction/speed)
- Consider time of entry, depth, and gas supply at entry- to estimate current gas supply/status

3.
- Scan/look down current, shoreline, surrounding area for diver, bubbles, SMB, other gear/debris
- Assign lookout to continue scanning

4.
- Question dive buddy(s) - details of the dive
- Question crew - details of the dive
- Plan and execute search as resources and safety allows

5.
- Send/call for help
  - At Sea: Marine Radio VHF Channel 16 (or call 000) - Advise missing diver
  - On Land: Call 000 - Advise missing diver

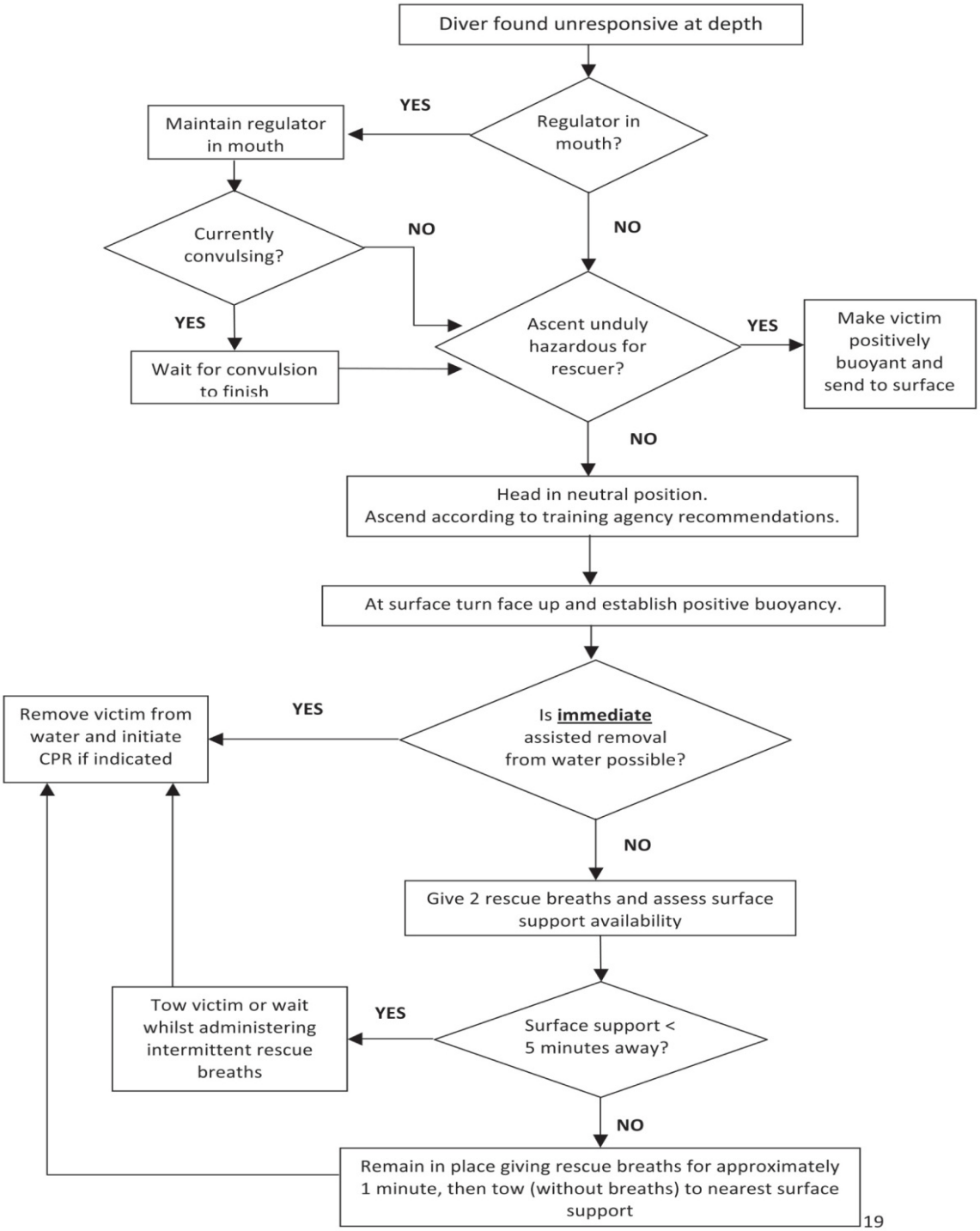
6
- Notification/Escalation - Notify University Dive Officer
- See Notification/Escalation List (Step by Step Response to a Diving Emergency)
- Record/Log all data

Version 2.0 20 April 2020

APPENDIX 8

Recommendations for Rescue of a Submerged Unresponsive Compressed-Gas Diver

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



19

APPENDIX 9
MAXIMUM ROAD ALTITUDES IN TASMANIA

The below table is provided to allow a Dive Coordinator to plan and manage traveling to altitude (via road travel) after a dive. This list is not comprehensive as it covers only major routes in the state. Refer to 2.60 for additional requirements regarding ascending/traveling to altitude after diving.

Road	Max. Altitude
EAST COAST	**EAST COAST**
Eaglehawk Neck Hill (above Pirates Bay) - Arthur Highway at Hillcrest	190 m
Orford to Sorell – Bust-me-gall Hill	***336 m***
Orford to Sorell – Black Charlies Opening	***366 m***
Lake Leake Road	***640 m***
NORTHEAST COAST	**NORTHEAST COAST**
Elephant Pass/St. Mary's Pass	***400 m***
Weldborough Pass (to Scottsdale from St. Helens/Northeast coast	***600 m***
NORTH COAST	**NORTH COAST**
Cethana Pass	***440 m***
Lake Cethana water level	221 m
SOUTH COAST	**SOUTH COAST**
Southern Outlet – Kingston to Hobart (Proctor's Road)	240 m
Dover to Huonville	< 300 m
Huon Highway – Huonville to Hobart (Vince's Saddle)	***380 m***
Huonville to Hobart – via Channel Highway (along coast all the way)	< 100 m
Huonville to Hobart – via Channel Highway (across Gardeners Bay Road)	200 – 300m
MIDLANDS	**MIDLANDS**
Midlands Highway – Spring Hill	***488 m***
Midlands Highway – St. Peter's Pass	***462 m***
Lake Leake Road	***640 m***
Lyell Highway (Queenstown to Hobart) - Mt King William	***830 m***

APPENDIX 10
AAUS STATISTICS COLLECTION CRITERIA AND DEFINITIONS

COLLECTION CRITERIA:

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

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

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

A Dive is defined as a descent underwater utilizing compressed gas and subsequent ascent/return to the surface with a minimum surface interval of 10 minutes.

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

A "Diver Logging a Dive" is defined as a person who is diving under the auspices of the University of Tasmania's Scientific Diving Program. Dives logged by divers from another AAUS Organisation will be reported with the diver's home organisation. Only a diver who has actually logged a dive during the reporting period is counted under this category.

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

DEFINITIONS:

Dive Classification:

- Scientific Dives: Dives that meet the scientific diving definition. 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/authorisation.

Breathing Gas:

- Air: Dives where the bottom gas used for the dive is air.
- Nitrox: Dives where the bottom gas used for the dive is a combination of nitrogen and oxygen percentages different from those of air.
- Mixed Gas: Dives where the bottom gas used for the dive is a combination of oxygen, nitrogen, and helium (or other inert gas), or any other breathing gas combination not classified as air or nitrox.

Diving Mode:

- Open Circuit Scuba: Dives where the breathing gas is inhaled from a self-contained underwater breathing apparatus and all of the exhaled gas leaves the breathing loop.
- Surface Supplied: Dives where the breathing gas is supplied from the surface by means of a pressurized umbilical hose. The umbilical generally consists of a gas supply hose, strength member, pneumofathometer hose, and communication line. The umbilical supplies a helmet or full-face mask. The diver may rely on the tender at the surface to monitor the divers' depth, time and diving profile.
- Hookah: While similar to Surface Supplied in that the breathing gas is supplied from the surface by means of a pressurized hose, the supply hose does not require a strength member, pneumofathometer hose, or communication line. Hookah equipment may be as simple as a long hose attached to a standard scuba cylinder supplying a standard scuba second stage. The diver is responsible for monitoring his/her own depth, time, and diving profile.
- Rebreathers: Dives where the breathing gas is repeatedly recycled in a breathing loop. The breathing loop may be fully closed or semi-closed. Note: A rebreather dive ending in an open circuit bailout is still logged as a rebreather dive.

Decompression Planning and Calculation Method:

- Dive Tables
- Dive Computer
- PC Based Decompression Software

Depth Ranges:

Depth ranges (expressed in MSW) for sorting logged dives are: 0-10, >10-30, >30-40, >40-45, >45-58, >58-76, >76-92, and >92->). A dive is logged to the maximum depth reached during the dive. Note: Only "The Number of Dives Logged" and "The Number of Divers Logging Dives" will be collected for this category.

Specialized Environments:

- Required Decompression: Any dive where the diver exceeds the no-decompression limit of the decompression planning method being employed.
- Overhead Environments: Any dive where the diver does not have direct access to the surface due to a physical obstruction.
- Blue Water Diving: Openwater diving where the bottom is generally greater than 200 feet/60 meters deep and requires the use of multiple-tethers diving techniques.
- Ice and Polar Diving: Any dive conducted under ice or in polar conditions. Note: An Ice Dive would also be classified as an Overhead Environment dive.

- Saturation Diving: Excursion dives conducted as part of a saturation mission are to be logged by "classification", "mode", "gas", etc. The "surface" for these excursions is defined as leaving and surfacing within the Habitat. Time spent within the Habitat or chamber must not be logged by AAUS.
- Aquarium: An aquarium is a shallow, confined body of water, which is operated by or under the control of an institution and is used for the purposes of specimen exhibit, education, husbandry, or research (Not a swimming pool).

Incident Types:

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

Incident Classification Rating Scale:

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

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

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

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

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

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

APPENDIX 11
CHECKLISTS FOR DIVING

CHECKLIST 1: ON-SITE RISK ASSESSMENT

University of Tasmania

Scientific Diving

Environmental/Worksite Factors
Wind (strength/direction)
Current/Tide (strength/direction)
Sea State
Predicted Weather Changes
Contaminated Water/Biological Hazards
Water Temperature (& thermal protection divers)
Atmospheric Temperature (& thermal protection crew)
Underwater Visibility (& bottom composition)
Maximum Depth of Worksite
Dangerous Marine Animals
Vessel Movement (live-boating or anchorage)
Watercraft Traffic in Area
Emergency Response Capability
Location/Isolation/Remoteness
Evacuation Plan changes/contingencies (incl bushfire)
Communications - types/contingencies
Marine Radio/Satellite Phone/Mobile Coverage
Medical O2 Supply Sufficient & Operation Checked
First Aid Kit Present & Checked
Diver & Team Related Factors
Sufficient Trained Personnel (size/experience of team)
Diver Experience
Diver Fitness/Wellness Pre-Dive
Fatigue, Sleep Deprivation, Distraction
Diver Dehydration
Drugs/alcohol Use
Expected Level of Exercise/Exertion During Dive
Expected Level of Exercise/Exertion Pre & Post-Dive
Task Related Factors
Lifeline Entanglement
Entrapment/Entanglement/Overhead/Confined Space
Animal Handling Methods/Modifications
Equipment Handling Methods/Modifications
Entry/Exit Methods/Modifications
Dive Profile - Modifications
Repetitive Diving
Multi-Day Diving
Planned Travel to Altitude Post-Dive

CHECKLIST 2: PRE-DIVE BRIEFING

All Crew Present
Divers Fit and Well (alcohol, decongestants, hydrated)
Roles Assigned (divers/attendant/standby)
Dive Site
Orientation: Depth/Topography/Features
Onsite Risk Assessment Complete?
Reminders on Site Specific Hazards
Local Regulations/Restrictions
Dive-Ops Specifics
Task/Procedures for each Phase of Dive Op
Briefing each Diver- specific tasks
Equipment to Be Used
Max Depths and Times (Profile)
Direction & Course of Travel U/W
Confirm Turnaround Time/SPG
Safety Stop
Minimum SPG to Leave Bottom/Begin Ascent
Buddy System procedures
Entry/Exit Procedures
Communications/Signals
Diver to Diver
Diver to Surface
Surface to Diver
Diver Recall Signals
Dive Termination Procedures
Minimum Gas Requirements
Time/Profile/Scrubbed Duration
Fatigue, Cold, Distraction, Any Reason
Oxygen Toxicity Limits
Surface Initiated (weather, vessel, etc)
Diver Emergency Procedures
Low Gas/Out of Gas/Gas Problems
Buddy Separation
Missing Diver
Surface Attendant/Standby Duties
Tracking Divers/Recognise Problems
Rescue procedures
Evacuation Procedures
Questions?

CHECKLIST 3: DEPLOY DIVER CHECKS

University of Tasmania

Scientific Diving Checklist

Pre-Dive Prep
SPG at Zero Before Turning on Gas Supply
Gas (type/volume) Adequate & Recorded
Gas Analysed & Recorded MOD checked (EAN)
Dive Computer Function/Battery check
Gas Mix Entered into Computer
Compare Planned Profile to Computer Status
Communication Equipment Pre-Check
Dive Flag Up
Sampling Equipment (Project Specific)
Prepped/Functional/Good Condition
Life Support Dress In
Back Gas Valves OPEN
Hoses Good Condition/Secure/ Routed Correctly
Breathing Check both Regulators
Mouthpieces Secure/Intact both Regs
SPG Clipped Off/Pressures Recorded
BCD Check incl Inflation & Connections
BCD Dump & OPV Function
Cylinder secure to BCD
Sling Gas Px Check/Hose Charged/Valve On-Off
Weight Adequate/Secure/Releases Checked
Drysuit Zippered/Seals Checked/Inflation/Deflation/Connections
Accessory Dress In
Dive Compass & Computer On diver
Cutting Devices Secure/Accessible both Hands
Hood & Gloves
Mask and Snorkel
SMB & Wet Notes
Comms check (if using)
Standby Diver Ready? (incl. checklist to here)
Diver Deployment
Enter by Safest Means
Signal to Surface all OK
Post- Dive
All Divers Well & Accounted For
RECORD Depth, Bottom Time, Gas Pressures
Any Gear Issues
Report Any Incidents, Near Miss, Hazards
Note Planned vs Actual Exercise/Exertion
Notify Divers of Profile Status/Restrictions (Altitude/Heavy Work)
Dive Record Forms signed

CHECKLIST 4: POST-DIVE DEBRIEFING

University of Tasmania

Scientific Diving

Define
Aims/Goals/Objectives of the dive and did we achieve them?
Time/Scope of the debrief to manage expectations of time
Example
Set example as leader. Talk about a mistake you made
Set the scene that it is ok to talk about errors/learn from failures
Basics
Basics & admin of the dive
(entry time, logistics and the plan)
Was plan achievable,
did it need to be changed before/during dive?
What could be improved about pre-dive aspects?
Focus on non-operational aspects of dive.
Review Execution
Chronologically step through the execution against
the plan, highlighting key points.
Focus on key highlights so that learning is managed.
Level of detail may vary from top level to real detail.
What happened & why rather than future learning points
Internal
One thing I did well. Why?
One thing I need to improve. How will I do that?
Each team member answers this in turn, starting with leader
External
One thing we as a team did well. Why?
One thing we need to improve. How will we do that?
Focus is on team aspects of the dive.
Be specific, no generalities
Describe what worked and why.
Follow-up/File Report
Reinforce what needs to be done following debrief
Includes file incident or learning report
Examples: modification of equipment,
revision to planning assumption,
post report where others can learn of event.
Share the learning!

Source of Content: The DEBRIEF model

Re-printed with permission

APPENDIX 12

EQUIPMENT SERVICE INTERVALS

All diving and safety equipment used for UTAS diving operations (including personal equipment) must be maintained and serviced to the manufacturer's specifications, or more often if in regular use. At a minimum, the following service schedules must be met for all equipment used in UTAS diving:

Item	Type of Service/Test	Service Period
Scuba cylinder/valve	Hydrostatic testing required at certified test station, valve service	12 months
HP gas storage cylinder and valve	Hydrostatic testing required at certified test station, valve service	5 years for marine service, or 10 years for land-based
Diving regulator and demand valve	Service and function test to manufacturer's specifications by a qualified technician. If >12 months, a competent person[17] must inspect it for correct function every 12 months.	12 or 24 months depending on brand
Scuba equipment HP and LP diving hoses	Inspection and leak test	12 months
Submersible Pressure Gauge (cylinder contents), *mechanical*	Accuracy check[18]	12 months
Submersible Pressure Gauge (cylinder contents), *electronic*	*Includes dive computer depth sensors*. Accuracy check	12 months
Divers depth gauge: *mechanical*	Accuracy check[19]	3 months
Divers depth gauge: *electronic*	Accuracy check	6 months
BCDs	Service and function check to manufactures specifications, and pressure test required by a qualified technician. If > 12 months, a competent person must inspect it for correct function every 12 months.	12 or 24 months depending on brand
Breathing air compressor systems	Breathing gas quality test to AS/NZS 2299.1:2015	3 months
	Filter replacement, servicing and function checks to manufacturers specifications	
HP cylinder fill panel regulators, valves & OPRV	Service and function check by a qualified technician	24 months
HP flexible fill and supply hoses	Inspection and leak test	12 months
SSBA umbilical gas delivery hose	Pressure test to 1.5 times working pressure	12 months
Oxygen resuscitation unit	Service and function test to manufacturers specifications by a qualified technician	24 months

* A competent person is a person who has completed the manufacturer's service training or equivalent).

[17] A competent person is a person who has completed the manufacturer's service training or equivalent

[18] Contents gauges must also be annually tested for accuracy, to ensure that accurate reporting of cylinder pressure is maintained as the contents drop from working pressure to near empty. Comparison with other contents gauges may be used for this purpose.

[19] Any gauge used in diving operations for measuring depths of <30m must have an accuracy of within 1% of the maximum scale reading.

APPENDIX 13
DIVE COMPUTERS IN USE AT UTAS (Comparison)

AIR:

Depth (m)	DCIEM *(short)*	USN *(doppl. adj.)*	Mares Quad *P0*	Mares Quad *P1*	Suunto Vyper *P1*	Divesoft Freedom *Firmware 1.17.2 GF 30:80*	Divesoft Freedom *Firmware 1.17.2 GF 50:75*	Scubapro Aladdin One	Oceanic Veo 4
6	720	325	>99	>99	>99	>99	>99	>99	>99
9	300	205	>99	>99	163	>99	>99	>99	283
12	150	130	>99	80	89	126	106	>99	144
15	75	70	66	55	57	64	52	66	85
18	50	50	47	39	39	37	31	46	59
21	35	40	34	29	29	24	20	33	41
24	25	30	27	23	24	17	14	24	32
27	20	25	21	17	18	13	11	19	25
30	15	20	17	14	14	9	8	15	20
33	12	15	14	12	11	7	6	13	17
36	10	10	12	10	9	6	5	11	14
39	8	5	10	9	8	5	4	9	11
42	7	-	9	8	6	4	4	8	9
45	6	-	8	6	5	4		7	8
48	-	-	6	5	NA	3		6	7
51	-	-	6	4	NA	3		6	6
54	-	-	5	4	NA	2		5	6

EAN 32:

Depth (m)	DCIEM *(short)*	USN *(doppl. adj.)*	Mares Quad *P0*	Mares Quad *P1*	Suunto Vyper *P1*	Divesoft Freedom *Firmware 1.17.2 GF 50:75*	Scubapro Aladdin One	Oceanic Veo 4
6	-	350	>99	>99	>99	>99	>99	>99
9	-	245 (10m)	>99	>99	>99	>99	>99	599
12	-	205	>99	>99	158	625	>99	285
15	-	130	>99	86	92	179	>99	157
18	-	70 (19m)	74	61	61	89	74	99
21	-	50 (22m)	55	46	44	50	53	68
24	-	40 (26m)	41	34	33	33	41	53
27	-	40 (26m)	32	27	27	23	31	39
30	-	30 (29m)	26	22	22	NA	24	31
33	-	25	22	18	NA	NA	20	26
36	-	NA	NA	NA	NA	NA	NA	NA
39	-	NA	NA	NA	NA	NA	NA	NA
42	-	NA	NA	NA	NA	NA	NA	NA
45	-	NA	NA	NA	NA	NA	NA	NA
48	-	NA	NA	NA	NA	NA	NA	NA
51	-	NA	NA	NA	NA	NA	NA	NA
54	-	NA	NA	NA	NA	NA	NA	NA

Noting we do not use DCIEM for EAN, due to requirement to use of Equivalent Air Depths.

EAN 36:

Calculated for EAN 36 mix			New computers		*Previous computers (still several in use)*	*Current rebreather backup*		
Depth (m)	DCIEM *(short)*	USN *(doppl. adj.)*	Mares Quad *P0*	Mares Quad *P1*	Suunto Vyper *P1*	Divesoft Freedom *Firmware 1.17.2 GF 50:75*	Scubapro Aladdin One	Oceanic Veo 4
6	-	300	>99	>99	>99	>99	>99	>99
9	-	325	>99	>99	>99	>99	>99	561
12	-	205 (13m)	>99	>99	197	625	>99	403
15	-	160	>99	>99	125	179	>99	211
18	-	130 (17m)	89	73	74	89	94	131
21	-	70	65	54	54	50	64	84
24	-	50	50	41	40	33	48	62
27	-	40 (28m)	38	32	31	23	38	48
30	-	NA	NA	NA	*14*	NA	NA	NA
33	-	NA	NA	NA	*11*	NA	NA	NA
36	-	NA	NA	NA	*9*	NA	NA	NA
39	-	NA	NA	NA	*8*	NA	NA	NA
42	-	NA	NA	NA	NA	NA	NA	NA
45	-	NA	NA	NA	NA	NA	NA	NA
48	-	NA	NA	NA	NA	NA	NA	NA
51	-	NA	NA	NA	NA	NA	NA	NA
54	-	NA	NA	NA	NA	NA	NA	NA