



# **SCUBA DIVING OPERATIONS MANUAL**

**This is a working document and therefore subject to change.**

**University of Newcastle Health and Safety Team  
Revised August 2008**

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Modified from the University of Sydney SCUBA DIVING OPERATIONS MANUAL (with their permission) which is based on the version prepared by the working party.

NSW Scientific Divers Committee  
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## 1. INTRODUCTION

The University of Newcastle conducts Scientific Diving as a tool for teaching and scientific research.

The University of Newcastle acknowledges its responsibilities as an employer under NSW Occupational Health and Safety Act 2000, and AS/NZS 2299.2:2002. **All scientific diving operations will be conducted according to AS/NZS 2299.2:2002.** Any diving activity which encroaches on commercial diving practices shall be conducted in accordance with the Australian Standard for Occupational Diving (AS/NZS 2299.1).

The purpose of this SCUBA Diving Operations Manual is to assist in the interpretation of AS/NZS 2299.2:2002 and to define roles and responsibilities in diving operations at the University of Newcastle. Through this SCUBA Diving Operations Manual, the University of Newcastle seeks to manage its obligations by identifying hazards, removing any associated risks and/or installing control measures to prevent or minimise the level of risk to the employees, students, visitors, contractors, and volunteers engaged in scientific underwater diving at the workplace. Employees, students, visitors and volunteers have responsibilities and obligations that are also identified in this manual. These guidelines should be regarded as the minimum standards needed to ensure safe and efficient diving operations.

This SCUBA Diving Operations Manual will address and assist the planning and implementation of safe diving practices by identifying hazards, limitations and responsibilities of each member of the dive team through to administrative levels of management for all aspects of diving within the University of Newcastle. The SCUBA Diving Operations Manual will be reviewed both periodically and as required.

This document outlines the procedures for conducting diving operations using compressed air, for scientific research under the auspices of the University of Newcastle. The risk assessment component of this manual shall be used for activities such as snorkelling unless an acceptable alternative is available.

Except for honours research projects the University of Newcastle does not currently permit SCUBA diving to be conducted in undergraduate tertiary courses

Users of this manual should note the usage of the following terms:

**must / shall** : there are no circumstances under which this instruction may be ignored.

**should** : normal diving practice requires that this instruction be obeyed but there may be circumstances in which it is appropriate for it to be relaxed.

**can / may** : scientific diving may well benefit from using this technique.

**should consider** : a helpful hint for scientific divers.

### 1.1 REFERENCED DOCUMENTS

The following publications are referred to in this manual:

- AS/NZS 2299.2:2002 Scientific diving
- AS 2815.1-1992 Training and certification of occupational divers Part 1: SCUBA diving to 30m

This document should be read in conjunction with the University of Newcastle's Fieldwork Safety Guidelines, as they cover more general aspects of fieldwork that must also be taken into account when planning and carrying out scientific diving.

Copies of these and other referenced documents are available for reference from the Health, Safety and Environment Team or the Diving Officer.

## 2. DEFINITIONS

**Bottom time** – the total time elapsed from when a diver leaves the surface to the time (next whole minute) at which ascent is commenced, measured in minutes.

**Breathing gas** – the compressed gas intended for respiration by the diver.

**Breathing hoses** – hoses attached to a regulator that are designed to:

- (a) supply breathing gas to the diver;
- (b) carry away expired breathing gas; and
- (c) operate at near ambient pressure

**Buddy system** – a system in SCUBA diving operations whereby a team of two or three free-swimming divers communicate through visual or other means in order to help each other.

**NOTE:** Generally, one member of the team is nominated, and agreed to as the leader and controller of the actions of the team.

**Caisson gauge** – a pressure gauge specifically designed for the use inside pressure vessels.

**Competent person** – a person who has acquired, through training, qualifications or experience (or a combination of these), the knowledge and skills enabling that person to safely perform a specified task.

**Compression (recompression) chamber** – a surface chamber in which a persons may by subjected to pressures equivalent to or greater then those experienced when under water, or under conditions which simulate those experienced on an actual dive.

**Decompression illness** – a generic term for acute illness resulting when pathological consequences arise from decompression. This term covers the condition known as decompression sickness (also known as bends) and arterial gas embolism, but does not include barotraumas of ascent.

**Decompression schedule** - a specific decompression procedure for a given combination of depth and bottom time as listed in a decompression table; it is normally described in terms of maximum depth (MSW) and bottom time (minutes).

**Decompression stop** - the specific length of time that a diver must hold their ascent at a specified depth to allow for the elimination of sufficient inert gas from the body to allow a safe ascent to the next decompression stop or the surface.

**Demand gas supply device** – a device that provided breathing gas to the diver via a mechanism which provides a flow of breathing gas when the diver inhales.

**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.

**Dive coordinator** – a person who supervisors and coordinates any dive and is responsible for the dive team safety.

**Dive leader** – a person in charge of a specific part of a diving operation.

**Dive plan** – a procedure specific to a given diving operation.

**Diver** – a person who performs diving work underwater and who, for the purposes of this Diving Operations Manual, is trained and experienced in accordance with one of the categories mentioned within.

**Diving Officer** – a person who has been nominated in writing by the employer and is ultimately responsible for all diving activities.

**Diving program** – one or more dives that are related by purpose, place or time to form a series.

**Diving team** – divers and support personnel operating together

**Diving work** – work in which diving is conducted using underwater breathing apparatus, including work by the dive team in direct support of the diver.

**Effective Bottom Time (EBT)** – for a diver carrying out repetitive diving, the bottom time calculated after taking into consideration the residual nitrogen from previous dives.

**Effective depth** – for a dive at altitude, the depth of an equivalent dive at sea level.

**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.

**Float line** – a buoyant 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.

**Lazy shot** – a rope running from the surface (dive coordinating position) to an attached weight, hanging free and positioned off the bottom or worksite. The rope is marked with depth graduations to facilitate decompression stops at the correct depth.

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

**Limiting line** – a line shown in some decompression tables, which indicates time limits (bottom times) beyond which decompression schedules are less safe.

**Multi-place compression chamber** – a hyperbaric chamber designed for occupancy by more than one person at a time.

**Occupational diving** – diving performed in the course of employment (irrespective of whether or not diving is the principle function of employment or merely an adjunct to it) and comprising all diving carried out:

- as part of a business;
- as a service;
- for research; or
- for profit.

**Quick release mechanism** – a readily operated mechanism that enables the immediate release, eg of diver's equipment, from the secured position by a single operation of one hand, but which is designed to minimize the risk of accidental release.

**Repetitive dive** – any dive conducted within 18 h of a previous dive or that has a repetitive factor greater than 1.0 when calculated using DCIEM tables.

**Repetitive factor** – for DCIEM tables, a figure determined by the repetitive dive group and the length of the surface interval after a dive and used for repetitive diving.

**Reserve air supply** – that quantity of air that will enable a diver to return safely to the surface from the planned depth of the dive, completing any planned decompression stops.

**Residual nitrogen** – nitrogen that is still dissolved in a diver's body tissues after the diver has surfaced.

**Restricted Scientific Diver** – This category is specifically for persons who are involved in research requiring diving but who have limited diving experience and are deemed by the Diving Officer not to have experience equivalent to a Scientific Diver. They are allowed to

dive under restricted conditions with limited duties. A person cannot dive as a restricted diver other than for a single initial period of up to twelve months.

**Saturation** – that condition where the person’s body tissues are totally saturated with the particular inert element of the breathing medium.

**Scientific diving** – diving performed for the purpose of professional scientific research, natural resource management or scientific research as an educational activity.

**Self-contained underwater breathing apparatus (SCUBA)** – open-circuit diving equipment which supplies the wearer with breathing gas from cylinders carried by the wearer.

**Shot rope** – a rope running from the surface (dive coordinating position) and fixed to the worksite or bottom with a weight or attachment. The rope is marked with depth graduations to facilitate decompression stops at the correct depth.

**Surface Interval (SI)** – the time which a diver has spent on the surface following a dive, beginning as soon as the diver surfaces and ending upon commencement of the diver’s next descent.

**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.

**Tethered mode (in relation to SCUBA diving)** – SCUBA diving in which a diver is secured by a lifeline and tended by a diver’s attendant, or is secured to a tended float line.

**Therapeutic recompression tables** – tables used for the treatment of decompression injury and other pressure-related injuries.

**Visiting Restricted Scientific Diver** – A trained, certified visiting diver from a country outside Australia or New Zealand who has a current diving medical certification but with limited diving experience and are deemed by the Diving Officer not to have experience equivalent to a Scientific Diver. They are allowed to dive under restricted conditions with limited duties as outlined for a Restricted Scientific Diver. A person cannot dive as a restricted diver other than for a single initial period of up to twelve months

**Visiting Scientific Diver** – 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 this Standard during his or her visit.

### 3. ADMINISTRATION

#### 3.1 AUTHORITY

- The University of Newcastle recognizes its Deputy Vice Chancellor Research as responsible for the regulation of diving matters
- The Health Safety and Environment Team in co-ordination with the Diving Officer is responsible for reviewing and advising legislative changes
- The Diving Officer is responsible to the Deputy Vice Chancellor Research for day-to-day diving operations and the adherence by University personnel to the procedures and safety codes represented in this operations manual

### 4. PERSONNEL AND RESPONSIBILITIES

#### 4.1 EMPLOYER

The University of Newcastle shall:

- Install a management process to ensure that all scientific scuba diving activities performed by staff, students, contractors, volunteers and visitors under the auspices of The University of

Newcastle comply with the under NSW Occupational Health and Safety Act 2000, AS 2299.2:2002 Scientific diving and this Diving Operations Manual and allocate necessary resources where applicable;

- Appoint and consider recommendations made by the Diving Review Committee;
- Periodically review the management process regarding diving practices under their responsibility; and
- Appoint Diving Officer(s) with the responsibilities as set out under 4.3 and in Appendix M.

#### **4.2 DIVING REVIEW COMMITTEE**

A Diving Review Committee (DRC) will be convened annually by the Diving Officer to review the diving practices of the University, or at any other time in the light of new information, legislation, technology and equipment arising, at the Diving Officer's discretion. The DRC shall consist of the Diving Officer/s, at least three staff members (one of which must be a representative from the Health, Safety and Environment Team), and one postgraduate or honours student. All members of the DRC other than the representative from Health, Safety and Environment Team shall be qualified in SCUBA diving. The minutes of the DRC meetings will be submitted to the University's OH&S Committee.

#### **4.3 DIVING OFFICER (refer to APPENDIX M for full position description)**

The University of Newcastle shall appoint Diving Officer(s) who shall be experienced Scientific Diver(s) trained to a level equal to or exceeding that specified in AS2815.1 (Commercial Diver) and have a certificate to that effect issued by a relevant authority. They shall have at least 100 h of underwater diving experience and have extensive experience in the supervision of diving operations in relation to scientific research programs. The Diving Officer will also satisfy any other reasonable requirements as specified by the University. The responsibilities of the Diving Officer are described in AS/NZ 2299.2:2002. The Diving Officer shall:

- (a) have the power to restrict, prohibit or suspend any diving operations, program or practice which he or she considers unsafe;
- (b) have the power to require such additional safety practices, procedures or equipment as he or she thinks necessary in any diving operation;
- (c) assess diver's competencies, or delegate this to a suitably qualified dive instructor and record the evidence used in the assessment.
- (d) be familiar with any legislation and guidelines which may apply to the diving operations, including AS/NZ 2299.2:2002, this manual and ensure that any dive proposals that he/she approves comply with the requirements of this manual.
- (e) provide information, guidance and advice to Directors, Heads of Schools, Supervisors, principal researchers, employees, staff, students and visitors regarding diving policy and practice, recommend and disseminate modifications of policy and practice to all levels of University management, staff, students and visitors

When approving dive proposals, the University of Newcastle Diving Officer(s) shall ensure that the divers are certified medically fit, trained and competent for the diving operation proposed, and have any extra training they may require prior to particular dives. The Diving Officer(s) may authorize a diver to dive on certain diving operations only, depending on the qualifications of the diver and relevant legislative requirements. When approving dive proposals the Diving Officer(s) will also consider the adequacy of the risk assessment and emergency plan for each dive proposal.

The Diving Officer position will be directly supported by the School of Environmental and Life Sciences and administration support will be provided by the Health Safety and Environment Team. The University will cover the cost of maintaining the level of accreditation required for the position.



#### **4.4 DIVE COORDINATOR**

A dive coordinator appointed in writing by the diving officer shall be present at all times while a diver is in the water or under pressure in a compression chamber. The dive coordinator shall be responsible for the safe conduct of diving and shall coordinate and direct the activity of the diving teams and ensure that all diving is carried out in accordance with AS/NZ2299.2:2002. They shall also be trained in the recognition and management of diving emergencies.

A dive coordinator shall have at least 15 hours experience as a scientific scuba diver with qualifications equivalent or exceeding AS 2299.2 and have experience in the diving, equipment and procedures used in the diving operation to be performed. They shall:

- (a) prepare a dive plan and ensure that it complies with operational procedures;
- (b) conduct pre-dive risk assessments;
- (c) ensure that the members of the dive team understand the dive plan;
- (d) ensure all required diving equipment is available at the dive site and is fully operational;
- (e) supervise each diving operation and liaise with the boat handler where appropriate;
- (f) terminate the dive under necessary circumstances or conditions;
- (g) prepare Diver Emergency Service and Evacuation Procedures for diving operations;
- (h) ensure that all required medical and emergency equipment is available at the dive site;
- (i) coordinate recompression support facilities where required;
- (j) ensure the dive times of all divers and air pressures are logged post dive;
- (k) know the emergency radio/telephone procedures and a contingency evacuation plan;
- (l) report all diving incidents or potentially hazardous situations to the Diving Officer and via the University's Incident reporting system;
- (m) debrief divers after diving and prepare a dive report on the day's operations as required;
- (n) report to Diving Officer, any breach of the procedural guidelines and/or problems with procedures or techniques.

#### **4.5 DIVE LEADER**

A dive leader is a person in charge of a specific part of a diving operation. Where two or more divers are in the water at one time, one shall be assigned the role of dive leader by the dive coordinator. A dive leader shall be:

- (a) the dive coordinator or a person appointed by the dive coordinator; or
- (b) a scientific diver or a visiting scientific diver with adequate knowledge and experience of the diving techniques and equipment to be used.

The Dive Leader has operational responsibility for the conduct of the actual dive. When a dive leader is the person in charge of a single group of divers who are diving in free-swimming SCUBA mode, that person shall take responsibility for any decisions required as the dive proceeds, in consultation with the dive coordinator where possible, and:

- (a) shall ensure other buddy diver/s in the group are familiar with the pre-dive plan;
- (b) shall conduct the dive in accordance with this manual and, as far as possible, in accordance with the pre-dive plan.
- (c) may abort the dive or make minor changes to the dive plan if deemed necessary provided it does not compromise the safety of the operation.

#### **4.6 CLASSIFICATION AND COMPETENCY OF DIVERS**

Every diver shall be classified as a restricted scientific diver, a scientific diver, visiting scientific diver or a visiting restricted scientific diver. All divers shall be made aware of their occupational

health and safety responsibilities and the organisation's relevant procedures, including this manual.

#### *4.6.1 Scientific Scuba Diver*

In order to carry out scientific diving using scuba a scientific diver shall:

- (a) have a certification as an open water diver through a certified recreational instructor, or equivalent training through any other certification scheme;
- (b) have at least 15 hours of underwater diving experience after certification;
- (c) demonstrate competency and satisfactory performance in diving theory and diving practical units as specified in AS/NZ 2299.2:2002;
- (d) be competent to safely carry out the work required in the operation;
- (e) be familiar with and fully understand the pre-dive plan before diving;
- (f) dive in accordance with the pre-dive plan;
- (g) act as a buddy diver during the dive to others in his or her designated buddy group, unless diving alone in tethered SCUBA mode. Free-swimming buddy divers shall maintain effective two-way communication with each other at all times while in the water and be able to render assistance;
- (h) be on the Dive Register of his/her institution with a current (within the last 12 months) diving medical;
- (i) comply with the instructions of the Dive Co-ordinator;
- (j) maintain an up-to-date log of all dives;
- (k) maintain and service diving equipment issued to him/her, and keep a record of repairs and maintenance of all personal issue equipment;
- (l) abide by the procedures for diving as described in AS/NZS 2299.2:2002 and this manual.

#### *4.6.2 Restricted Scientific Diver*

This category is specifically for persons who are involved in research requiring diving but who have limited diving experience and are deemed by the diving officer of their host institution not to have experience equivalent to a scientific diver.

As a minimum, a restricted scientific diver should:

- (a) be 18 years of age;
- (b) hold an open water diver certificate from a recognized SCUBA training and certifying organisation;
- (c) have at least 15 hours of underwater diving experience after certification.
- (d) only dive when conditions are suitable for untethered SCUBA mode;
- (e) not dive deeper than 18 m depth;
- (f) not act as a standby diver or a dive leader;
- (g) not dive as a restricted scientific diver other than for a single initial period of up to 12 months; and
- (h) not use powered tools or lift bags.

#### *4.6.3 Visiting Scientific Diver and Visiting Restricted Scientific Diver*

There shall be full reciprocity for scientists who are qualified to dive under the auspices of scientific diving organisations outside Australia and New Zealand. The Diving Officer may issue a 'visiting scientific diver' or 'visiting restricted scientific diver' certification as appropriate, subject to special conditions.

The Diving Officer may arrange appropriate dives at the start of a visiting diver's stay in Australia so that person's overall competence to participate in the diving planned can be assessed. Visiting scientific divers and restricted scientific divers are subject to relevant sections (4.6.1. and 4.6.2) of this manual.

#### *4.6.4. Volunteer and non-employee divers*

Volunteer and visitors must be assessed for official diving status by the Dive Officer before any Scientific Diving can be performed with the University.

### **4.7 DIVER'S ATTENDANT**

#### *4.7.1 Availability and knowledge*

Dive teams shall have a diver's attendant who is competent to administer cardiopulmonary resuscitation (CPR) and oxygen resuscitation and have a working knowledge of the following:

- (a) diving and the requirements of underwater work.
- (b) signals in use, in particular, the systems of hand and rope signals to be used in the diving operations.
- (c) decompression procedures.
- (d) diving equipment in use, including ancillary fittings such as pressure gauges, compressors and filters.

The diver's attendant shall not be engaged in any task other than that of diver's attendant while the dive team is in the water or under pressure.

#### *4.7.2 Duties*

The diver's attendant, or other person nominated by the dive coordinator, shall:

- (a) Record the time of descent and surfacing of each diver;
- (b) Maintain a constant vigil during a dive for divers surfacing at a distance from the boat or other dive control position;
- (c) Assist in the recovery of divers and all equipment and samples from the water;
- (d) Ensure that the dive flag is deployed
- (e) If tending a diver's lifeline, maintain the ability to communicate with the diver by means of that lifeline.

### **4.8 STANDBY DIVER**

#### *4.8.1 General*

A standby diver shall be present whenever a single diver is underwater in tethered mode, and shall be a qualified diver and located on the surface, dressed and equipped to enable immediate entry into the water for the purpose of providing aid or assistance to a distressed diver. The dive profile of the standby diver shall be planned to allow all necessary assistance to be given to a distressed diver without the standby diver incurring a decompression commitment. The only exceptions to this shall be:

- (a) In an emergency; or
- (b) When the depth of the water is such that the standby diver will automatically incur a decompression commitment.

**NOTE:** The surface standby diver may perform certain minor duties, eg tending the lifeline, provided the safety of the diver in the water is not compromised in any way.

#### 4.8.2 Two divers in the water

Where two divers are in the water at the same time, one may act as standby diver for the other provided that both divers have no decompression commitment and maintain visual contact with, and direct access to, each other. That is, the buddy diver may act as the standby diver.

### 4.9 HEALTH, FITNESS and FIRST AID

#### 4.9.1 Health and fitness

All divers must be certified as medically fit to dive in accordance with the requirements of AS/NZS 2299.1:1999 (refer to South Pacific Underwater Medicine Society [www.spums.org.au](http://www.spums.org.au) for a comprehensive list of Medical Practitioners (Diving Doctor List), trained specifically to perform Occupational Diving Medicals).. A certificate of fitness to dive shall have been issued within 12 months prior to diving by a medical practitioner appropriately trained in underwater medicine. An increase in the frequency of examinations in individual cases is at the discretion of the Medical Practitioner.

All divers involved in diving shall also ensure that they are fit to dive. Fitness should be maintained by exercise and regular diving. Where a diver has not dived for a period of time exceeding six months, the diver shall carry out a check out dive or program of dives with the diving officer or the diving officer's delegate qualified to undertake such an evaluation.

#### 4.9.2 First Aid for Diving Teams

All divers and attendants shall possess a Senior First Aid Certificate (Diving Related) and Oxygen Provider Course certification so that, as a minimum, they are able to:

- (a) control bleeding;
- (b) administer 100% oxygen to spontaneously breathing patients and oxygen-enriched resuscitation to non-breathing patients using the oxygen resuscitation equipment at the dive site;
- (c) care for an unconscious patient; and
- (d) carry out cardiopulmonary resuscitation.

**NOTE:** It may in some circumstances be possible to make adequate provision for the delivery of emergency first aid with not all personnel being trained, provided that no less than two persons are trained and available to ensure first aid will be available if required. Approval must be obtained from the Diving Officer.

Divers and attendants should contact the Health, Safety and Environment Team (ext 17721) to book in for Senior First Aid and then Advanced Resuscitation courses which will ensure they meet the requirements listed above.

Appropriate first aid equipment, training or other resources should be made available to cope with any reasonably foreseeable emergency.

#### 4.9.3 Intoxicants

Diving should not be undertaken while the diver is under the influence of any intoxicants, within 8 hours of consuming any intoxicants or if the diver is under the influence of any drugs that may impair his or her mental or physical capacities.

## 5. ORGANISATION, PLANNING AND RECORDS

### 5.1 GENERAL

Diving procedures must be carried out according to the provisions of AS/NZS 2299.2:2002 and this manual. Many scientific locations are remote from search and rescue, medical and recompression facilities and risk assessment and planning must take this into account.

## 5.2 ACTION PLAN

All diving must be in accordance with the following action plan. More detailed guidance on the processes of hazard identification, risk assessment and risk control can be found in Section 6. Documentation of these processes should be carried out using the forms referred to in Appendices C and E as a minimum.

### 5.2.1. Diver Registration – see Appendix A

All staff, students, contractors, visitors and volunteers who are required to scuba dive in diving operations conducted by the University of Newcastle must register and be approved for diving by the Diving Officer. Each diver will be approved as a scientific diver, a restricted scientific diver, visiting scientific diver or a visiting restricted scientific diver.

### 5.2.2. Project Approval – (Safety Clearance)

**All** University research projects and undergraduate practical activities with safety implications must have safety clearance(s) before commencing. The appropriate application form <http://www.newcastle.edu.au/service/ohs/teachressafety/trforms.html> must be completed and submitted to the Health Safety and Environment Team. Applications for all projects/activities involving Scuba Diving will be forwarded to the Diving Officer for approval (Scuba diving component).

### 5.2.3. Dive Site Registration and Risk Assessment

At the beginning of a scientific program, or as new dive sites are used during a project a risk assessment will be conducted by the Dive Coordinator and, upon return to the University, the site shall be registered with the diving officer. The registration should include the results of a general risk assessment of the site and the type of work proposed, along with emergency numbers, emergency response plans, exposure, isolation, known or anticipated water depths and tidal currents, and other special hazards as appropriate. Travel aspects, such as altitude exposure in travelling to or from a site, should also be included. Risk assessments should be reviewed as divers gain more experience at dive sites.

Diving operations using SCUBA shall only be carried out where:

1. any tools or equipment used by a diver using SCUBA are of such type, size and dimensions as can be manually handled and controlled by the diver.
2. prolonged physical exertion is not required.
3. sufficient air supply is available in the cylinder to permit the diver's projected bottom time plus an adequate safety margin as determined by the dive plan.
4. the maximum depth of the dive does not exceed 30m (note limits for restricted scientific divers of 18 m).
5. air from the diver's SCUBA supply is not used for any purpose other than support of the diver, ie as a breathing medium or for buoyancy control.

### 5.2.4. Dive Proposal – see Appendix C

The Dive Proposal (included with the application for safety clearance) must be approved by the Diving Officer before every diving operation. It comprises a dive proposal, risk assessment and emergency plan.

- (a) Dive Proposal - details of location of diving operations and dive team
- (b) Risk Assessment - identify possible hazards and precautions to be taken
- (c) Emergency Plan - identify emergency facilities and procedures

### 5.2.5. On Site Pre-Dive Plan and Risk Assessment Update – see Appendix E

At the dive site before every dive, the dive coordinator, divers, divers' attendants and any non-diving support personnel shall discuss in detail and agree upon the pre-dive plan and update

the risk assessment. The On Site Pre-Dive Plan and Risk Assessment must be lodged with the Diving Officer on return to the University of Newcastle.

#### *5.2.6. Diver's Record and Employer's Record of Dives*

All divers shall keep and maintain a permanent record of all diving undertaken for the duration of the diver's working life. At the end of a diving operation the Dive Coordinator shall deposit with the Diving Officer, a copy of each diver's log for dives conducted during that diving operation.

The diver's permanent record of diving usually takes the form of a logbook, which shall include:

- (a) the diver's photograph
- (b) next of kin information
- (c) diver's name, current address, date of birth and signature
- (c) a record of medical examinations conducted for the purpose of scientific diving;
- (d) a record of diving activity undertaken; and
- (f) a record of accidents and incidents including decompression treatment(s).

The logbook shall be presented at each diving medical examination. The diver's record of dive (including a brief summary of any incidents or accidents) should be entered into this permanent record of diving at the completion of each dive, and signed by the Dive Coordinator for verification.

Detailed dive records maintained by the diving officer provide following:

- administration records of time spent in training and work;
- record of training and experience;
- evidence in case of an accident;
- a basis for certification for further training;
- a record of cumulative time spent underwater;
- evidence of safe diving procedures.

#### *5.2.7. Equipment Maintenance Records (also refer to section 7- Equipment for diving)*

Where tests are conducted for:

- (a) breathing gas purity, records of test results, together with identification of the breathing gas supply or air compressor;
- (b) regulators;
- (c) pressure and Depth Gauges;
- (d) buoyancy Compensators;

refer to Appendix B - Register of Service of Dive Equipment. The records of test results shall be maintained by the Diving Officer for a minimum period of 7 years.

### **5.3 DIVING PROCEDURES**

#### *5.3.1. Restrictions on diving operations*

Diving operations shall only be carried out when:

- The dive does not involve planned decompression stops. Decompression diving is not permitted while undertaking Scientific Diving for the University of Newcastle
- The maximum depth does not exceed 30 metres
- The dive does not involve "Cave diving" as defined by the Cave Diving Association of Australia (<http://www.cavedivers.com.au/>)

### 5.3.2. Dive Teams

Dive teams must include a Dive Coordinator and should comprise:

- Two divers and a competent boat person or shore watch (diver's attendant) OR
- Three divers and a competent boat person or shore watch (diver's attendant) OR
- More than three divers grouped into buddy pairs (preferably) or trios, but no more, and one competent boat person or shore watch (diver's attendant).

When diving in "Sheltered conditions", divers are permitted to dive without a shore watch, ie in a team of two divers.

**NOTE: Sheltered conditions are defined as: depth less than 10 metres, visibility greater than 4 metres, wave height less than 0.5 metre, current nil to slight, and daylight hours.**

### 5.3.3. Dive Leader

Before the divers enter the water, one member of each group of divers shall be designated by the Dive Coordinator as the underwater dive leader of that group. Prior to the dive, the Dive Leader should confirm the means to be used by the group for summoning attention and recalling divers to the surface, such as banging on the tank with the knife. The Dive Leader should also confirm that any diver feeling distressed or uncomfortable may terminate the dive at any time.

### 5.3.4. Night dives

In addition to normal diving procedures, the following procedures must be followed for a night dive:

- The entry and exit points shall be adequately and distinctively illuminated.
- Every diver shall carry at least two lights, one of which may be a chemically-activated light stick.

Consideration should be given to the use of other safety measures according to circumstances. They include tethered mode diving, and the use of emergency lighting such as the chemically-activated light stick attached to the diver and to one or more buoys at the dive site.

### 5.3.5. Blue water diving for tracking particles

These procedures are not appropriate for open ocean blue water diving, but are to be applied to blue water diving in waters 20-40 m deep over the continental shelf. For open ocean blue water diving, the use of a mother ship for coordination must be considered and appropriate procedures developed in conjunction with the Diving Officer.

Diving will be conducted from a small, outboard-powered boat, with a dive team comprising two divers and one boat operator. The operator will circle the divers' bubbles at idle speed at a radius of 20-30 m. A dive flag is displayed throughout. If the boat operator loses sight of the divers' bubbles, he/she motors at idle speed into the wind constantly scanning the area until the divers surface. The boat operator keeps track of vessels in the vicinity, and wards off any vessels approaching too close to the divers.

If conditions are such that the boat operator cannot easily keep track of the divers' bubbles at the surface, one of the divers must be equipped with a light line attached to a small surface float to enable the boat operator to stay in the vicinity of the divers. In addition to normally-required dive gear, divers must be equipped with a dive computer and a compass.

### 5.3.6. Recompression Chamber

The time of availability of recompression shall be estimated realistically in accordance with arrangements made in the **On site pre-dive plan and risk assessment**, and the location of the nearest emergency medical and hyperbaric facility. All diving undertaken without on-site compression chamber support should be low risk diving with controlled ascents and routine safety stops performed. Where multiple dives are undertaken on one day, residual nitrogen

times from previous dives shall be taken into account in calculating the time allowable for a subsequent dive. Any significant risk-increasing factor (eg cold water or hard work) should lead to further shortening of dive times or extra safety time, determined by moving an additional one or two time or depth levels up the DCIEM tables or, for dives to 12m or less, up Table 3.1. Divers should carry out a precautionary decompression stop at the end of each dive.

Depending upon the availability of emergency recompression, diving shall be limited as follows:

(a) *Diving where recompression is available within 2 hours*

Where recompression is available within 2 hours of the dive site, the maximum bottom time for any single dive shall be as listed in Column A of **Table 1** for the appropriate depth. Where a second or subsequent dive is undertaken, the maximum bottom time shall be determined by reference to Column A of **Table 2**, which will provide a repetitive group limit

for the dive. The DCIEM repetitive dive tables shall be used to ensure that the bottom time for second and subsequent dives does not result in the diver exceeding this repetitive group limit.

(b) *Diving where recompression is available within 6 hours*

Where recompression is available within greater than 2 hours but less than 6 hours of the dive site, the maximum bottom time for any single dive shall be as listed in Column B of **Table 1** for the appropriate depth. Where a second or subsequent dive is undertaken, the maximum bottom time shall be determined by reference to Column B of **Table 2**, which will provide a repetitive group limit for the dive. The DCIEM repetitive dive tables shall be used to ensure that the bottom time for second and subsequent dives does not result in the diver exceeding this repetitive group limit.

(c) *Diving where recompression availability exceeds 6 hours*

Where it would take 6 hours or more to effect emergency recompression, the maximum bottom time for any single dive shall be as listed in Column C of **Table 1** for the appropriate depth. Where a second or subsequent dive is undertaken, the maximum bottom time shall be determined by reference to Column C of **Table 2**, which will provide a repetitive group limit for the dive. The DCIEM repetitive dive tables shall be used to ensure that the bottom time for second and subsequent dives does not result in the diver exceeding this repetitive group limit.

**TABLE 1**

**TIME LIMITS FOR DIVES, DEPENDING ON LEVEL OF RECOMPRESSION CHAMBER SUPPORT**

| MAXIMUM<br>Depth<br>m. | MAXIMUM BOTTOM TIME     |                    |                       |
|------------------------|-------------------------|--------------------|-----------------------|
|                        | A<br>chamber within 2 h | B<br>chamber 2-6 h | C<br>chamber over 6 h |
| 3                      | No limit                | 240 (400)          | 190                   |
| 6                      | 240 (400)               | 240 (300)          | 190                   |
| 9                      | 180                     | 140                | 110                   |
| 12                     | 120                     | 70                 | 55                    |
| 15                     | 75                      | 60                 | 50                    |
| 18                     | 50                      | 40                 | 30                    |
| 21                     | 35                      | 30                 | 20                    |
| 24                     | 25                      | 20                 | 15                    |
| 27                     | 20                      | 15                 | 10                    |
| 30                     | 15                      | 10                 | 10                    |



**NOTES:**

1. Shallow water dive times listed in brackets and italics represent possible extensions of maximum bottom times where low hazard, 'square profiles', single ascent dives of constant depth are conducted.
2. For depths between 12 m and 30 m, the bottom time limits are based upon the DCIEM tables. Column A lists the 'no-deco' limits. Columns B and C represent one and two repetitive groups less than the 'no-deco' limits. For depths between 3 m and 12 m, the time limits have been selected with the aim of providing approximate equivalence of risk within each column, estimated with reference to data provided by DCIEM.

**TABLE 2**

**LIMITS FOR REPETITIVE DIVES, DEPENDING ON LEVEL OF RECOMPRESSION  
CHAMBER SUPPORT (BASED ON DCIEM TABLES)**

| MAXIMUM<br>Depth<br>m. | MAXIMUM BOTTOM TIME     |   |   |
|------------------------|-------------------------|---|---|
|                        | A<br>chamber within 2 h | B<br>chamber 2-6 h                                  | C<br>chamber over 6 h                               |
| 3                      | No limit                | G ( <i>H</i> )                                      | G   |
| 6                      | G ( <i>J</i> )          | G ( <i>H</i> )                                      | G   |
| 9                      | H                       | G   | F   |
| 12                     | H                       | E   | F   |
| 12 to 30               | DCIEM no deco limits    | One repetitive group less than DCIEM no deco limits | Two repetitive group less than DCIEM no deco limits |

Divers should note that UDT, the licensee and manufacturer of DCIEM tables have recommended amendments covering the use of these tables (see Appendix G).

#### 5.3.7. Repetitive Dives and Multiple Ascents

Attention is drawn to inherent problems associated with repetitive dives, multiple ascents and multi-day diving that increase the possibility of Decompression Illness. Every effort should be made to limit dives and multiple ascents to the minimum necessary to perform the task.

*A repetitive dive is defined as "Any dive conducted within 18 hours of a previous dive that has a repetitive factor greater than 1.0".*

Consideration should be given to a lay day or very shallow diving on day 5 or 6 of an extended diving cruise or field trip where 3 or 4 dives a day are being undertaken. On extended field trips involving repetitive diving over a series of days there shall be a day without diving after every 6 days of diving.

The deepest dive should be carried out first. Should this be impossible, consideration should be given to adding planned safety stops – however the Dive coordinator should assess the risks for such stops as part of the dive risk assessment.

Having regard to the need for a conservative approach to working diving exposure, the following maximum number of dives per day shall apply:

|                 |                        |
|-----------------|------------------------|
| <b>0 - 12m</b>  | <b>6 dives per day</b> |
| <b>12 - 21m</b> | <b>4 dives per day</b> |
| <b>21 - 30m</b> | <b>2 dives per day</b> |

It should be noted that these exposures should be (ideally) worked over a working day of approximately 6-8 hours. Multiple ascents during the dive should be kept to a minimum and (ideally) limited to one (1) per dive.

#### 5.3.8. Safety stop

On each dive, divers should do a safety stop of at least 3-5 minutes at 3m.

#### 5.3.9 Termination of Dive

##### **Termination**

A dive shall be terminated in accordance with the pre-dive plan, or when:

1. The dive coordinator or person remaining at the surface requests termination;
2. A diver requests termination;
3. A diver loses contact with, or fails to respond correctly to communications from a buddy diver;
4. A diver fails to respond correctly to communications from the diver's attendant;
5. A diver begins to use his or her reserve gas supply;
6. A diver is aware of any sign of malfunction of equipment or of any sign or symptom of distress; or
7. A diver becomes aware of any unusual or unplanned situation which threatens the health or safety of any dive team member.

##### **Resumption**

Diving activity may be resumed, after a decision has been made to terminate the dive under (3) or (4) above, if contact between buddy divers or the diver and the diver's attendant is restored.

#### 5.3.10 Diving with other institutions and divers from other institutions

When a dive operation is conducted by The University of Newcastle all divers must be registered with the University of Newcastle and follow the procedures of AS/NZS 2299.2:2002 and this manual.

When The University of Newcastle divers participate in diving operations conducted by another institution, they must follow the procedures of AS/NZS 2299.2:2002, this manual and the procedures of the institution conducting the diving operation.

#### 5.3.11. Incident Reporting

All unusual incidents, unexpected hazards, accidents and injuries will be reported as soon as possible to the relevant Diving Officer and to the Health Safety and Environment Team using the Online Incident Reporting System. Where injuries occur or there are mechanical breakdowns or accidents that affect completion of the work, safe return of staff or students, or endanger life, these must be reported verbally as soon as practical to the contacts at the University. Less serious events shall be reported to the Diving Officer on return to the University. Refer to the Procedures and Action Plan for Diving Emergencies – see Appendix D.

The Dive Coordinator must investigate all incidents, hazards, injuries and breakdowns with the other people involved to determine the causes and any actions that may be taken to prevent a recurrence of the incident. Detailed guidance on the investigation of accidents and incidents can be found in Section 7 of AS/NZS 2299.2:2002.

When an event occurs which affects work or future work, a debriefing must be held soon after the return of the dive team, in accordance with procedures developed by the University. The debriefing should cover issues such as the adequacy of the planning, risk assessment and preparation for the dive, any incidents which occurred and how they were managed and any lessons learned that could benefit future dives by members of the University.

The University's Incident Reporting System and a DAN incident report form will be used for reporting diving incidents as per the University's Policy on Accident Reporting - see Appendix D and I. The University of Newcastle Online Incident Reporting System is located at <https://inraweb.newcastle.edu.au/imsentry/incidenttype.asp>.

#### 5.3.12. Lost Diver Routine

In the unlikely event that a diver becomes separated from their buddy:

- The divers will do a 360° search for each other for a maximum of 1 minute looking for bubbles or visual sign of lost diver
- If the lost diver is not located the searching diver will then return to surface at the correct ascent rate, still performing a 360° search on ascent
- Once on surface, deploy safety sausage, utilize whistle (or vocally question where diver is) and wait on surface for 4 minutes
- If lost diver is still missing, return to boat or shore and initiate emergency procedures, ie alert Diving Coordinator/ shore attendant and contact emergency services.

#### 5.3.13. Diving Before or After Travel

##### a) Diving after travel

The diver shall have had adequate rest before diving. Divers should recover from 'jet lag' before diving.

##### b) Travel after Diving

Altitude exposure after diving is a potent precipitator of decompression illness. After a dive, a minimum delay time should be observed prior to exposure to altitudes (eg air travel and road travel over mountains) – see Appendix J for a list of the minimum delay times which should be observed relative to altitudes.

Divers who have experienced adverse events such as rapid ascent and divers who feel tired, generally unwell or otherwise not in normal health following diving are possibly suffering from pre-clinical decompression illness or a high bubble load. Travel to altitude should not be undertaken until it is clear that the diver is in completely normal health or until specialist diving medical advice has been obtained.

##### (c) After decompression illness

Following treatment for decompression illness, divers should obtain specialist diving medical advice regarding the time that should pass before exposure to altitude. Until medical clearance has been obtained for travel to higher altitudes, a diver should remain below 150 m effective altitude.

## 6.0 HAZARD IDENTIFICATION AND RISK ASSESSMENT

### 6.1 GENERAL DIVING HAZARDS

Hazard identification and risk assessment should be performed at the dive proposal stage and as part of the pre-dive plan. Hazards that arise during a dive should be immediately brought to the attention of the Dive Coordinator so that the dive plan can be altered to ensure the health and safety of the divers or the dive aborted.

The following steps are used to manage occupational health and safety risks arising in scientific diving operations.

- Step 1 Identify hazards and hazardous tasks
- Step 2 Assess the nature of the risk created by those hazards and hazardous tasks
- Step 3 Assess the degree of exposure to the risks and the potential of the risks to cause injury or illness
- Step 4 Eliminate or control the risks
- Step 5 Review the adequacy and effectiveness of the adopted control measures.

Risk assessment of diving operations should identify and take into account the following:

- Environmental conditions, eg
  - strength and direction of wind and its potential influence on diving operations and emergency response capability
  - atmospheric temperature and humidity currents and tides
  - time of day
  - water temperature
  - visibility
  - underwater terrain
  - entrapment hazards
  - contaminants,
  - isolation of the site, etc
- Task factors, eg complexity, non-routine tasks may increase level of risk
- Hyperbaric/Physiological factors, eg
  - depth and duration of dive
  - frequency of diving, multiple ascents, repetitive diving, multi-day diving
  - breathing gas
  - exertion required to reach site and conduct tasks
  - immediate pre-dive fitness
  - altitude exposure
  - excessive noise, etc
- Factors relating to associated activities, eg manual handling, boat handling and dive platforms, etc
- Emergency response factors, eg location and availability of emergency facilities and systems, etc
- Other hazards that could be encountered during the diving operations, eg dangerous marine animals (see 6.2 and 6.3), water inlets, shipping, use of hazardous substances, biological pollutants (see 6.4) or explosives, etc.

Hazard identification and risk assessments should be documented using the forms in appendices C and E, together with any additional documentation relevant to the particular situation.

Risks in diving operations should be controlled in accordance with the hierarchy of controls, ie

1. Elimination – if the risk cannot be adequately controlled, no diving should take place
2. Substitution – if an alternative method is available that entails less risk, it should be considered
3. Design – procedures and equipment should be designed to minimise risk
4. Isolation – divers and others should be separated from identified hazards if feasible
5. Administrative – covers many aspects of dive safety including adequate training, supervision and experience of the dive team members, adequate organisation and planning of the dive and selection of appropriate means of communication to minimise risk; the dive plan should minimise the duration and degree of each diver's exposure to risk
6. Personal Protective Equipment – appropriately designed and sized equipment provided, used and maintained and the limitations of the equipment understood in order to minimise risks to the dive team.

Further guidance on hazard identification, risk assessment and control can be found in Appendix G of AS/NZS 2299.2:2002

## **6.2 SHARKS**

Most sharks do not present a hazard, however when planning a diving operation the following precautions must be taken or implemented:

- (a) An injured or bleeding diver should leave the water immediately and the dive should be cancelled.
- (b) While shark attacks on divers are extremely rare there is a clear need to assess and manage the risks. There are some circumstances that it is believed raise the risk of shark-human interactions and diving under these circumstances will, for the purposes of this manual, be classified as High Shark Risk dives. In order to ensure diver safety shark cages are mandatory on all High Shark Risk dives.
- (c) A dive will be considered High Shark Risk if it involves:
- Diving around aquaculture farms that contain fish and are known to attract sharks
  - Diving within an aquaculture farm known to contain dangerous sharks
  - Diving near breeding seal colonies (Dangerous Reef, Neptune Islands, etc)
  - Diving within 10km of any location where there has been a shark attack in the last month
  - Diving in any area where it is known that fisherman have been or chumming in such a way as to create an increased shark risk. To ensure up-to-date information on fishing activities is available, as far as possible local fishing clubs in the vicinity of the proposed dive should be contacted prior to the dive to determine whether chumming will be occurring at the time diving operations are planned.
- (d) All dives that are not classified above will be considered low shark risk dives. On any low risk dive the University strongly recommends that all divers use the shark shields provided by the University. However, where one diver in a group chooses to use a shark shield all other divers in the water must also use one. Dive Coordinators should discuss the use of shark shields with divers prior to any dive and ensure that enough charged devices are available for the dive duration. Boat shields will also be available as an option for all diving operations. Where divers have chosen to use shark shields a boat shield is required to allow safe reentry to the boat as this necessitates the switching off of the shield in the water to avoid electric shock.
- (e) If prior to or during any low risk dive the circumstances change or knowledge comes to hand which would change the rating of a dive from low risk to high risk then the dive cannot proceed without access to shark cages.
- (f) When choosing to employ shark or boat shields reference should be made to the safe operating procedures for such devices as there are risks associated with the use of electronic devices that must be considered and understood. It is the Dive Coordinators responsibility to check that sufficient devices with full charge and in working order are available for each dive.
- (g) In 2005 a Research Assistant from the University of Adelaide died when taken by a shark during a University diving operation. The findings from the Coroner's inquest held in February 2008 can be found at [http://www.courts.sa.gov.au/courts/coroner/findings/findings\\_2008/stebhens.finding.htm](http://www.courts.sa.gov.au/courts/coroner/findings/findings_2008/stebhens.finding.htm).

Much of the inquest focused on the fact that the victim was not wearing a shark shield, although the Coroner stopped short of recommending the University make them mandatory. He instead recommended that effective shark repellent devices be available and the use of these devices be actively encouraged (refer to Section 6.6 of the findings).

### **6.3. DANGEROUS MARINE ANIMALS (OTHER THAN SHARKS)**

Most dangerous marine animals other than sharks occur in tropical waters and are often concentrated around reefs and shallow water. Similar dangerous animals are also found in temperate waters but they are usually related species that may only inflict painful stings rather than being life threatening.

Marine life recognition and first aid techniques are not discussed in this manual, as these are commonly subjects in their own publications or extensive chapters in various manuals. The standard reference in Australia is Carl Edmonds, *Dangerous Marine Animals of the Indo Pacific* (1989) or *Diving and Subaquatic Medicine*, Edmonds, Lowry & Pennefather (1981).

#### **6.4. DIVING IN CONTAMINATED WATERS**

Where divers have to work in waters that are known, or suspected to be, contaminated, the following precautions shall be taken:

1. Establish the source and concentration of contamination.
2. Evaluate the type of equipment available to best protect the diver from contact.
3. Deploy diver/s to task with the appropriate equipment.
4. Establish and implement after-dive wash down procedures.
5. Monitor diver/s to ensure no contamination has occurred.

### **7. EQUIPMENT FOR DIVING**

#### **7.1 EQUIPMENT STANDARDS AND MAINTENANCE (also refer to 5.2.7.)**

Each member of the diving team must know the capabilities and limitations of any equipment used. The dive leader must select appropriate equipment, based on the work site conditions and the dive plan. Equipment must not be altered, modified, or changed in any way that might impair its safe and efficient operation. All equipment to be used for diving must be authorized by the Diving Officer.

All Divers are required to maintain an up to date equipment register, detailing service history, of their personal diving equipment, copies of which must be submitted to the Diving Officer. Any equipment used on a University diving operation must be listed in the University Dive Equipment Register as in service.

All diving equipment, including cylinders, regulators and accessories necessary for the safe conduct of the diving operation must be:

- of approved design, sound construction, adequate strength, free from any defect and maintained in a condition that will ensure its continued operation for the purpose and depths for which it was originally designed and subsequently used;
- examined, tested, overhauled and repaired in accordance with the manufacturer's recommendations and used in accordance with AS/NZS 2299.2:2002.

#### **7.2 SERVICE AND MAINTENANCE OF EQUIPMENT**

Regulators, buoyancy vests (where they serve as an alternative air supply), gauges and metering equipment shall be serviced according to manufacturer's requirements. Any malfunction must be rectified without delay.

Records of maintenance and testing of the University of Newcastle and personal equipment used in the University of Newcastle diving operations will be kept by the Diving Officer for at least seven years.

#### **7.3 LIST OF PERSONAL DIVING EQUIPMENT**

Each diver shall have the following equipment:

- (a) open-circuit scuba, complete with cylinder and two demand regulators. The Diver's breathing air cylinder shall be durably marked with the word 'AIR' in letters not less than 50 mm high and in a contrasting colour to the body of the cylinder.
- (b) Face mask
- (c) Swimming fins

- (d) Snorkel for surface swimming
- (e) Weight belt or weight jacket with quick release closure
- (f) Submersible contents gauge for measuring remaining air pressure in cylinder
- (g) Wetsuit or protective clothing appropriate to the condition of work and the temperature of the water
- (h) Buoyancy compensator of an approved design that is inflatable orally and from a compressed air cylinder
- (i) Alternative air supply which could comprise: a spare second stage regulator such as an octopus regulator, a pony bottle, or a second stage regulator incorporated into the oral inflation hose of the buoyancy compensator
- (j) Watch or elapsed time indicator or dive computer
- (k) Depth gauge which should incorporate a maximum depth indicator
- (l) Diver's knife
- (m) Surface signalling device - Safety sausage.

### 7.3.1 Non-issue diving equipment

Requests for non-issue diving equipment should be made direct to the Diving Officer, detailing the operational use of the equipment.

### 7.3.2 Breathing Apparatus

#### *Design parameters*

Breathing apparatus shall be designed and constructed of non-toxic, corrosion-resistant materials, and shall:

- Provide the wearer with respirable gas at the required pressure and volumetric flow rate at all times during the effective life of the apparatus.
- Be constructed of materials suitable for air.
- Prevent ingress of water to the breathing circuit.
- Prevent leakage from the breathing circuit except through the exhaust valve(s).
- Ensure that couplings provide a secure and gastight joint and that, when such
- Couplings are detached, any sealing washers are retained in position.
- Ensure that component parts likely to require maintenance are readily detachable without risk of accidental disconnection.  
Not unduly impede the wearer when swimming and working underwater.  
Ensure that the method of fastening the equipment to the wearer is secure in action.
- Permit quick release in cases of emergency.

**NOTE:** Regulators must be serviced every **12 MONTHS** or more frequently. All servicing must be carried out by an approved service facility and the service sheet or copy forwarded to the Diving Officer for inclusion on the equipment register.

#### *Masks*

Masks shall be designed and constructed to:

- provide a watertight and gastight seal.
- enable all the component parts to withstand, without failure or displacement, a pressure of 15 kPa above or below ambient pressure.
- cause the least possible interference with vision.
- minimize build up of carbon dioxide gas (CO<sub>2</sub>).
- be purgable of water.

#### *Mouthpiece*

A mouthpiece shall be designed to meet the following requirements:

- Provide a watertight and gastight seal when fitted correctly and held with normal mouth pressure.

- Prevent closure of the aperture of the mouthpiece by normal mouth pressure.
- Include a positive means of retention by the diver to prevent accidental dislodgment or slippage from the diver's mouth.

### *Cylinders*

Gas storage cylinders used in association with diving operations shall comply with the specifications listed in AS 2030.1 or AS 3848.2, as appropriate.

Industrial or medical gases used or stored at the site of diving operations shall be colour-coded in accordance with AS 4484 and systems shall be established to prevent any inadvertent misuse or cross-contamination between these gas cylinders and cylinders containing breathing gas for divers.

### *Diver's breathing air cylinders*

Diver's breathing air cylinders shall be durably marked with the word 'AIR' in letters not less than 50 mm high and in a contrasting colour to the body of the cylinder. Diver's breathing air cylinders shall not be used for the storage of any gas mixture other than air.

**NOTE:** Cylinders must be tested every **12 MONTHS** or more frequently, if required. All servicing must be carried out by an approved service facility and the service sheet or copy forwarded to the Diving Officer for inclusion on the equipment register.

## *7.3.3 Breathing Gas Supplies*

### *Breathing Air*

Breathing air used in diving operations shall:

- Have no objectionable or nauseous odour.
- Contain not less than 20% and not more than 22% by volume of oxygen.
- Contain not more than 11 mg/m<sup>3</sup> of carbon monoxide at 15°C and 100 kPa (10 p.p.m. by volume).
- Contain not more than 900 mg/m<sup>3</sup> of carbon dioxide at 15°C and 100 kPa (480 p.p.m. by volume).
- For high pressure cylinders, contain not more than 100 mg/m<sup>3</sup> of water at 15°C and 100 kPa (130 p.p.m. by volume).
- Contain not more than 1 mg/m<sup>3</sup> of oil at 15°C and 100 kPa when sampled from a cylinder filled to a pressure of at least 12 Mpa.
- Where supplied from a compressor, not be used for diving operations unless the compressor has, within the SIX MONTH period preceding the operations and every SIX MONTHS during the operation as appropriate, undergone a test to ensure that the compressed air satisfies the requirements specified in (1) to (6).

## *7.3.4 Air Compressor Systems*

### *Pressure relief devices*

A receiver shall be fitted with relief valves of sufficient capacity to prevent the rated pressure of the receiver from being exceeded. In addition, compressors may be fitted with 'off loading' mechanisms.

### *Filtration, drying and odour absorption*

Materials used for filtering, drying or odour absorption shall not introduce contaminants into the air supply. Drain cocks shall be provided to draw off any water and oil that may accumulate in filters. The drain cocks shall be arranged so that they can be operated while the filter is in use.

### *Supply lines*

The supply line between the compressor and the receivers shall be either permanent pipe or high quality air grade hose with external grade protection suitable for the delivery of breathing gas and shall be free of contaminants.



All supply lines shall be located or guarded so that they are protected against mechanical damage, fatigue and vibration.

#### *Operation and maintenance*

Compressors and their power sources (prime movers) shall be operated and maintained in accordance with the manufacturer's instructions to maintain the required air quality. Manufacturer's recommendations for types of lubricating oils suitable for air compressor systems for diving purposes should be strictly adhered to. The air filters on the intake and delivery sides of the compressor should have their elements renewed as recommended by the manufacturer, or more frequently if contaminated air is noted. The drain valve on the air reservoir should be operated momentarily at intervals, when the compressor is running, to prevent the accumulation of moisture.

#### **NOTE:**

1. For guidance on plant, see NOHSC:1010.
2. The compressor must have within the **SIX MONTH** period preceding the operations and every **SIX MONTHS** during the operation as appropriate, undergone a test to ensure that the compressed air satisfies the requirements specified above with regard to Breathing Air.

#### *7.3.5 Pressure Gauges*

##### *Gauge calibration*

A gauge used in, or in connection with, diving operations shall:

1. If it is used to measure the depth of the diver be calibrated either in feet or metres head of sea water.
2. If it is a personal depth gauge, dive computer (including computer/watches) or low pressure gauge, be measured against a tested gauge or accurately measured depth of water at intervals not exceeding **SIX MONTHS**.
3. If faulty, gauges shall be removed from service and clearly marked as having a malfunction.

##### *Gauge accuracy*

A gauge used in diving operations for measuring depths less than 30 m, shall have an accuracy within 1% of the maximum scale reading.

##### *Contents gauges for SCUBA cylinders*

Contents gauges shall be tested at regular intervals to ensure that accurate reporting of cylinder pressure is maintained as the contents drop from working pressure to near empty.

NOTE: Comparison with other contents gauges may be used to check a gauge's operation.

#### *7.3.6 Emergency Gas Supplies*

Emergency gas supplies shall be of sufficient capacity for the diver to return to the surface. In self-contained breathing apparatus, any emergency supply used shall be capable of being brought into operation manually when the warning device operates. Every SCUBA diver shall carry a sufficient quantity of compressed gas to complete the planned dive and retain a reserve gas supply.

#### *7.3.7 Gas Supply Safety Warning System*

The diver's gas supply system shall incorporate one of the following:

- (a) A second gas cylinder containing sufficient gas to allow a safe ascent to the surface from the maximum dive depth, and which has a separate valve that can be easily operated by the diver underwater. The cylinder shall have an over-pressure relief valve fitted to the reducing regulator if the gas supply is activated by a valve downstream of the reducing regulator. The relief valve pressure shall be set lower than the maximum pressure of the low pressure hose connected to the cylinder regulator.

- (b) A cylinder contents gauge that has been tested at regular intervals to ensure that accurate reporting of cylinder pressure is maintained as the contents drop from working pressure to near empty, is visible to the diver underwater and which features a warning mark for low pressure.

In conditions of poor visibility, the second gas cylinder (a) is required, and the cylinder contents gauge (b) is not recommended.

#### *7.3.8 Diving Suit*

Diving suits shall be a suitable fit and designed to maintain the diver at a comfortable temperature during diving operations.

#### *7.3.9 Weight Belt or Weights*

Where weights are worn by a diver, some or all such weights shall be fitted with a reliable quick-release mechanism which cannot be accidentally released, but which can be readily operated by the diver underwater. Sufficient weight shall be readily releasable to ensure positive buoyancy regardless of the diving depth or degree of air filling of any dry suit, buoyancy compensator or other item of variable buoyancy. Releasable weights and weight belts shall be worn in such a manner that when released, they will not foul any other piece of the diver's equipment. In addition, the weights shall be attached in such a manner as not to slide and foul the quick-release mechanism.

#### *7.3.10 Diver's Knife*

Every diver shall carry a knife at all times when engaged in a diving operation or underwater. The knife shall be worn in such a position that it will not foul any discarded equipment, eg released weights.

#### *7.3.11 Surface Signalling Device*

A highly-visible surface-signalling device such as a 'safety sausage' should be carried by each diver.

#### *7.3.12 Dive Computers*

Dive computers **must not** be used to plan dives, control the dive profile or to plan decompression stops.. They may be used, however, as an ancillary aid, a dive log facility, to monitor depth and time and an aid to ascent rates.

### **7.4. OTHER EQUIPMENT**

#### *7.4.1 Flags and Signals*

At each dive site or when operating from a small vessel of less than 9m, a dive flag (international code signal A), at least 1m high, must be flown in a position best placed for all round visibility. For vessels over 9m in length refer to the Ships Master and the Rules For Prevention Of Collisions At Sea.

#### *7.4.2 Towed Surface Marker*

These are lines attached to spherical surface floats of various sizes depending on the dive operation. The float line can be adjusted depending on the planned depth of the dive and prevailing conditions by figure-of-eight turns around the float. The Towed Surface Marker is designed to unwind as the diver descends. The purpose of the marker is to enable the surface support personnel to locate, follow and communicate with the diver/s.

#### *7.4.3. Buddy-Lines*

These are short lines of about a meter or two in length, with snap clips on both ends, which are used for safely fixing one diver to another. Longer lines may be used, but if there are any currents or obstructions, which may foul the longer buddy-lines, their use is not recommended.

A Buddy-line is a tool that can be used to maximize safety in certain diving operations, usually conditions of poor visibility or where divers must remain together to cover a set area of sea bottom. Conversely, there are other conditions and operations where use of a Buddy-line would not increase safety and may cause problems. When deciding whether or not to use a Buddy-line, the Dive Supervisor should consider the following:

- Are the divers likely to stay easily within visual range of each other during the dive.
- Will the current, tide or wave action tend to cause the divers to become separated beyond visual range?
- Are the divers engaged in operations that would inhibit their ability to effectively maintain visual contact?
- Are the divers encumbered with equipment in such a way that a Buddy-line may become entangled?
- Are the divers working in an area of bottom relief which may cause entanglement?

The diver is responsible for ensuring that his/her equipment remains in a serviceable condition.

On issue of the diving equipment, the diver must complete a Dive Equipment Inventory and return it to the Diving Officer.

Any loss or damage to equipment must be reported to the Diving Officer.

#### *7.4.4 Lifeline*

A lifeline shall be:

- A cordage line with a diameter not less than 8 mm;
- A combined communications line and cordage line of diameter not less than 8 mm;
- The diver's hose (see divers hose for requirements of a divers hose) and its attachments;  
or
- A diver's umbilical consisting of more than one component.
- The minimum breaking strain of any potentially load-bearing sections (including connections) shall be at least 6 kN.

#### *7.4.5 Lazy Shot*

A rope running vertically from the surface (dive coordinating position) to an attached weight, hanging free and positioned off the bottom or worksite. The rope is marked with depth graduations to facilitate decompression at the correct depth.

#### *7.4.6 Pneumatic Tools*

Gas for hand-held pneumatic tools shall be taken from a source entirely separate from the diver(s) breathing gas supply.

**NOTE:** Divers qualified as Scientific Divers or Visiting Scientific Divers are qualified to use hand-held pneumatic tools only. Restricted Scientific Divers and Visiting Restricted Scientific Divers are not permitted to use pneumatic tools of any form

#### *7.4.7 Shark Shields*

On any low risk dive the University strongly recommends that all divers use the shark shields provided by the University. However, where one diver in a group chooses to use a shark shield all other divers in the water must also use one. Dive Coordinators should discuss the use of shark shields with divers prior to any dive and ensure that enough charged devices are available for the dive duration. Boat shields will also be available as an option from the Diving Officer for all diving operations. Where divers have chosen to use shark shields a boat shield

is required to allow safe re-entry to the boat as this necessitates the switching off of the shield in the water to avoid electric shock.

When choosing to employ shark or boat shields reference should be made to the safe operating procedures for such devices as there are risks associated with the use of electronic devices that must be considered and understood. It is the Dive Coordinators responsibility to check that sufficient devices with full charge and in working order are available for each dive.

### **7.5 SAFETY EQUIPMENT FOR DIVE TEAM**

The following equipment must be available at the dive site:

- (a) Oxygen resuscitation equipment  
Oxygen resuscitation equipment shall be available at the dive site for immediate use if required. The oxygen equipment shall be capable of providing an inspired oxygen concentration of as close as practical to 100% to a patient who is breathing spontaneously and capable of providing an inspired oxygen concentration in excess of 50% to a non breathing patient. Sufficient oxygen shall be available to supply the resuscitator taking into account the location of the dive site and access to medical facilities.

Sufficient emergency oxygen must be available to ensure medical evacuation to a hyperbaric or ambulance facility. Consideration must be given to the likelihood of more than one diver requiring oxygen therapy. When determining oxygen requirements for a diving operation a delivery rate of 15 litres per minute will be used. All University divers are required to complete an approved Oxygen Provider Course and at each dive site there must be at least two people qualified in the administration of oxygen therapy.

**NOTE:** Nitrous oxide or "ENTENOX" an analgesic gas used by St John's Ambulance as a pain relieving agent **MUST NOT** be given to a diver suspected of suffering from decompression illness as it may increase the severity of the disease.

- (b) First aid kit  
(c) Dive flag  
(d) Communications (mobile phone or satellite phone or radio)  
(e) Copy of dive proposal and emergency procedures

The dive coordinator shall ensure that at or close to every dive site there are adequate means of immediate communication in the event of an emergency. Each dive operation must have adequate telephone or radio communications. Following initial contact, scheduled calls should be made on a regular basis during the dive operation. The frequency of calls should be based on location and estimated time of the operation. If communications cannot be re-established, consideration should be given to cancellation of the operations as soon as possible, and returning to the place of departure and reporting arrival via a land-line.

### **7.6 BOATS: EQUIPMENT AND OPERATION**

Every boat from which diving operations are conducted shall:

- be safe and suitable for the purpose.
- have suitable means, appropriate to the type of boat, by which a diver can enter and leave the water.
- display a diving flag and other signals required by the International Regulations for Preventing Collisions at Sea (1972).
- have Flares.
- have VHF radio charged and working.

**8 APPENDIX A - DIVER REGISTER****PERSONAL DIVING RECORDS**

|                                   |  |
|-----------------------------------|--|
| Name:                             |  |
| Address:                          |  |
| Date of Birth:                    |  |
| Contact Number:<br>Mobile Number: |  |
| Email Address:                    |  |
| Office location:                  |  |
| Signature and Date:               |  |
| Status:                           | Permanent Staff, Temporary Staff, Visitor, Honours Student, Post Grad Student, Volunteer |
| Home Institution:                 |  |

**Next of Kin**

|               |  |
|---------------|--|
| Name:         |  |
| Address:      |  |
| Phone Number: |  |
| Relationship: |  |

**Diving** (attach clearly legible copies of all licences and certificates stated)

|  | Details     | Sighted by DSO |
|--|-------------|----------------|
| Highest Diving Qualification:                    |             |                |
| Senior First Aid Cert Number                     |             |                |
| Advanced Resuscitation:                          |             |                |
| Additional Qualifications:                       |             |                |
| Most Recent Diving Medical:                      | PASS / FAIL |                |
| Number of Logged Dives:<br>(attach last 3 dives) |             |                |
| Number of Logged Hours:                          |             |                |

**Any Diving Related Accidents or Incidents** (if YES attach details)

|  |  |
|--|--|
| Have you suffered decompression sickness?  | YES / NO   |
| Have you been involved in a dive related accident?   | YES / NO   |
| I have read the University of Newcastle Scuba Diving Operations Manual and the AS2299.2:2002<br>(Signature and Date)   |  |
| Certification that diving equipment has been serviced within last 12 months and personal equipment register lodged with Diving Officer<br>(Signature and Date) |  |
| Approved as:   | Dive Coordinator, Scientific Diver, Restricted Scientific Diver, Visiting Scientific Diver, Visiting Restricted Scientific Diver |
| DSO's signature and Date:  |  |

## 9 APPENDIX B - REGISTRAR OF SERVICE OF DIVE EQUIPMENT

Where applicable, this list must be submitted to the Dive Officer completed with dates of inspection.

1. Depth gauges (visual check against known depth, every 3 months).  
Date checked.....  
Comments.....
  
2. Regulators (service every 12 months): Date checked.....  
Date checked.....  
By which company .....  
Comments.....
  
3. Buoyancy compensator (service every 12 months): Date checked.....  
Date checked.....  
By which company .....  
Comments.....
  
4. Compressors (service every 6 months): Date checked.....  
Date checked.....  
By which company .....  
Comments.....

**10 APPENDIX C - DIVE PROPOSAL FOR SCUBA** (Page 1 of 3)

|                   |  |                       |  |
|-------------------|--|-----------------------|--|
| Dive coordinator: |  | Date of last medical: |  |
| Phone Number:     |  |                       |  |

**List of Dive Team Members:**

|       |  |                       |  |
|-------|--|-----------------------|--|
| Name: |  | Date of last medical: |  |
| Name: |  | Date of last medical: |  |
| Name: |  | Date of last medical: |  |
| Name: |  | Date of last medical: |  |
| Name: |  | Date of last medical: |  |

**Person to be notified on leaving and returning to the University/ Field Camp:**

|       |  |               |  |
|-------|--|---------------|--|
| Name: |  | Phone number: |  |
|-------|--|---------------|--|

**Location(s)** (Place name and latitude and longitude or Grid Reference) of Dive(s):

|             |  |
|-------------|--|
| Location 1: |  |
| Location 2: |  |

**Date(s):**

|       |  |     |  |
|-------|--|-----|--|
| From: |  | To: |  |
|-------|--|-----|--|

**Type of Dive(s):**

|  |  |
|--|--|
| ie Boat type and name, shore, drift, etc |  |
|--|--|

**Dive Profile:**

|                 | Dive 1 | S1 (min) | Dive 2 | SI (min) | Dive 3 | SI (min) |
|-----------------|--------|----------|--------|----------|--------|----------|
| Start time      |        |          |        |          |        |          |
| Max depth*      |        |          |        |          |        |          |
| Total dive time |        |          |        |          |        |          |

\* The maximum depth of the dive must not exceed 30m (18m for restricted scientific divers).

**Risk Assessment:**

Does this site have a registered Risk Assessment and Emergency Plan? YES / NO

Sighted by Diving Officer YES / NO

|   |          |
|---|----------|
| (YES) Is there a copy on site?  | YES / NO |
| (NO) I affirm that a Risk Assessment will be conducted on site. (Signature) |          |

**Sheltered Open Water Site:**

Is this site a 'Sheltered Open Water Site' as specified in 5.3.2 in the Scuba Diving Operations Manual? YES / NO

**Equipment:**

Has all of the SCUBA equipment to be used been serviced in the past 12 months or as required by AS/NZ 2299.2:2002? YES / NO

|                                    |  |       |  |
|------------------------------------|--|-------|--|
| Signature (Coordinator):           |  | Date: |  |
| Signature (Diving Safety Officer): |  | Date: |  |

## APPENDIX C - DIVE PROPOSAL FOR SCUBA : GENERAL RISK ASSESSMENT FOR DIVE PROPOSAL (Page 2 of 3)

1. What type of work is proposed?

|  |
|--|
|  |
|--|

2. Hazards

| General Hazards            | Yes/ No | General Hazards                         | Yes/No  |
|----------------------------|---------|---|---------|
| Sharp Edges                | Yes/ No | Soft sediment benthos                   | Yes/ No |
| Entanglement               | Yes/ No | Gases                                   | Yes/ No |
| Exceeding Maximum Depth    | Yes/ No | Remote Sites                            | Yes/ No |
| Overhead Environment       | Yes/ No | Sharks & other Dangerous Marine Animals | Yes/ No |
| Shipping                   | Yes/ No | Difficult Access                        | Yes/ No |
| Tide/ Currents             | Yes/ No | Cold                                    | Yes/ No |
| Decompression              | Yes/ No | Pollution                               | Yes/ No |
| Boat Traffic               | Yes/ No | Thermal Hazards                         | Yes/ No |
| Distance                   | Yes/ No | Isolation                               | Yes/ No |
| Dispersion                 | Yes/ No | Altitude                                | Yes/ No |
| Walls                      | Yes/ No | Noise                                   | Yes/No  |
| Adverse Weather Conditions | Yes/No  | Anticipated Depth*                      | Yes/No  |
| Repetitive Dives           | Yes/No  | Poor Visibility                         | Yes/ No |
| Other                      |         | Fishing competitions involving chumming | Yes/ No |

3. If any of the above applies, indicate your mitigating measures:

|  |
|--|
|  |
|--|

|                                |  |       |  |
|--------------------------------|--|-------|--|
| Dive Proposal Approved by DSO: |  | Date: |  |
|--------------------------------|--|-------|--|

Two person dive team, approved subject to conditions as specified in 5.3.2 in the UoN Scuba Diving Operations Manual? YES / NO

|                                   |  |       |  |
|-----------------------------------|--|-------|--|
| Record Submitted (DSO Signature): |  | Date: |  |
|-----------------------------------|--|-------|--|



**APPENDIX C - DIVE PROPOSAL FOR SCUBA : EMERGENCY PLAN FOR DIVE PROPOSAL**

(Page 3 of 3)

2 COPIES:

- One copy for Dive Team
- One copy to be retained by Diving Officer

|                                 |            |
|---------------------------------|------------|
| <b>Emergency Phone Number:</b>  | <b>000</b> |
| <b>Mobile Emergency Number:</b> | <b>112</b> |

**Divers' Emergency Service (DES):**

|               |                |
|---------------|----------------|
| In Australia  | 1800 088 200   |
| International | 61 8 8212 9242 |

|            |  |
|------------|--|
| Dive Site: |  |
|------------|--|

(If there are multiple sites, then a Emergency plan MUST be completed for each location)

What are the directions to the dive site for Emergency Services?

|  |
|--|
|  |
|--|

Where is/are the nearest hospitals to your proposed dive site and Telephone Number?

|  |
|--|
|  |
|--|

Where is the nearest Recompression Chamber and Telephone Number?

|  |
|--|
|  |
|--|

Where is your home base while carrying out the proposed dives?

|  |
|--|
|  |
|--|

|                            |  |
|----------------------------|--|
| Phone number at home base? |  |
|----------------------------|--|

|   |          |
|---|----------|
| Do you have OXYGEN at the dive site?    | YES / NO |
| Do you have FIRST AID at the dive site? | YES / NO |

**Communications with dive team:**

|                              |                  |
|------------------------------|------------------|
| Mobile 1                     |                  |
| Mobile 2                     |                  |
| Satellite Phone              |                  |
| Boat Radio                   | VHF / HF / 28Mhz |
| Does the boat have an EPIRB? | YES / NO         |

## 11 APPENDIX D – PROCEDURES AND ACTION PLAN FOR DIVING EMERGENCIES

(Page 1 of 2)

Diving related emergencies are Decompression Illness, Cerebral Arterial Gas Embolism or Direct physical injury underwater. The latter may precipitate the others by causing a rapid ascent.

### GENERAL PROCEDURES:

1. **“RESCUER” must not put themselves in danger.**
2. **Maintain airway.**
3. **Administer First Aid.**
4. **Remove casualty from danger if safe to do so.**
5. **Seek Medical / Rescue Assistance.**

*The exact order of these will vary with the incident, and the resources available.*

### DIVERS’ EMERGENCY SERVICE (DES) PROCEDURE

**In any diving incident the first consideration is for the injured diver. Any symptoms, no matter how trivial, should be investigated.**

Initial response is to contact DES on 1 800 088200. This is a 24 hour monitored diver advice service that can outline the necessary treatment and evacuation procedure. Your call will put you in immediate contact with an on-call specialist diving doctor.

The diving doctor should be advised of the following:

- Name of diver, age, sex and any pertinent medical history.
- Details of the dive:
  - Depth;
  - bottom time;
  - any decompression or safety steps carried out;
  - dives in previous 48 hours.
- Accident description:
  - Location (name of vessel, call sign, GPS position, ETA at retrieval location);
  - Details of the incident;
  - Patient’s symptoms, how long after dive before symptoms occurred, and whether buddy has any symptoms;
  - Results of Neuro-exam if possible;
  - First aid treatment given.
- Further treatment will then be advised and details of evacuation if necessary.

*The DES facility is there for your use and you personnel should not hesitate to use this service if they are in doubt over a diving incident or just need advice on a diving medical problem.*

### DURING DIVING OPERATIONS

#### Shore Diving:

- Remove the diver from the water or danger and assist the injured person(s) immediately as required. If a diver shows signs or symptoms of decompression illness or has had ANY ABNORMAL ASCENT, ie rapid ascent, place casualty on 100% oxygen immediately and request advice/assistance.
- **If casualty is unconscious** call for an ambulance (000) first, then contact Hyperbaric Units (Divers’ Emergency Service (see procedure on previous page)).

**APPENDIX D - PROCEDURES AND ACTION PLAN FOR DIVING EMERGENCIES** (Page 2 of 2)

- **If casualty is conscious** contact Divers Emergency Service (see procedure on previous page) and follow instructions. Rescue Divers and those with more advanced rescue and/or first aid qualifications to manage the incident.
- recall all divers and any surface support personnel. Ensure that other members of the diving and support teams are not at risk and that all personnel are accounted for.

**Boat Diving:**

- Same steps as Shore Diving (above).
- Contacts: Coastguard on VHF Ch16 and follow instructions, if radio is not answered try mobile phone, follow action as in 1(a-c), if phone is not answered then proceed to nearest safe haven and repeatedly try to contact Coastguard (marine radio or phone). .
- If signs or symptoms appear on land (up to 24 hours post-diving), follow action as if shore diving.

**EVACUATION**

- Proceed as directed to the retrieval point. In the event of any diver being evacuated to a hospital or hyperbaric chamber, he or she should where possible, be accompanied by the diving coordinator, or other diver not in need of treatment, the destination noted and passed to the University contact person and DSO. If this is not possible, then the diving coordinator or an uninjured diver **MUST** ensure that they have a record of where the casualty goes.

**NOTE:** The buddy/s of a diver, who develops decompression illness, may also develop symptoms later and should either accompany the diver or be monitored closely for the next 24 hours.

**POST INCIDENT**

- Ensure that, in the haste of the emergency, no equipment has been left in a dangerous condition.
- Recover as much equipment as possible after the emergency and keep it apart from other equipment so that it can be examined by experts (if required) at a latter date. The Dive Coordinator may decide not to recover items if to do so would be unsafe or cause undue delay.
- Disposition of equipment - in any case in which component malfunction was likely or was suspected to have been a likely cause of a serious accident, then this equipment shall be immediately sealed and conveyed to an appropriate laboratory for testing and report. In any case where a fatality has occurred, all equipment shall be left in the condition that it was in at the time of the accident until it has been investigated by the relevant authorities.
- **NOTE:** *Notwithstanding the above, the air supply of the equipment noted should be isolated to retain the remaining air. During such isolation the number of turns, any undue force or other actions, required to isolate the air supply should be noted and recorded.*
- Only when the situation is stable and/or the emergency services have taken over should University Health, Safety and Environment Team (02 4921 5263) be notified (during office hours) and the University Security Service (02 4921 5888) (after hours).
- A full record of the incident must be compiled and a detailed incident report must be submitted to the Health Safety and Environment Team
- **NOTE:** *Emergencies involving fatalities, serious injuries or serious decompression illness must be reported as soon as possible to the University contacts. The Health Safety and Environment Team must also be promptly informed of any such emergencies in order to comply with legal requirements.*

**12 APPENDIX E – ONSITE PREDIVE PLAN AND RISK ASSESSMENT** (Page 1 of 2)

To be completed before **each dive** and returned to the Diving Officer.

|                   |  |
|-------------------|--|
| Dive Coordinator: |  |
| Date:             |  |

**Site Registration:**

|                              |  |
|------------------------------|--|
| Location:                    |  |
| Maximum depth for each team: |  |
| Bottom time for each team:   |  |

Circle all applicable hazards and measures taken, tick when done and then sign:

| Identified Hazards   | Possible Hazards  | Measures Taken   | Comments and Sign |
|--|---|--|-------------------|
| Weather  | Nil, Wind Speed, Direction  | Forecast, Monitor, Cancel                                |                   |
| Sea state  | Smooth, Slight, Moderate, Rough   | Monitor, Revise Plan, Cancel                             |                   |
| Underwater   | Nil, Low Visibility, Entrapment, current, Tide, Terrain                                     | Check Visibility, Revise Plan, Cancel                    |                   |
| Pollution  | Assumed negligible, High Level  | Monitor, Revise Plan, Cancel                             |                   |
| Depth  | Nil, Possibility of exceeding depth   | Max Depth/ Direction given                               |                   |
| Temperature  | Nil, Excessive Cold / Heat  | Suitable diving protection                               |                   |
| Access   | Shore, Boat, Platform, Isolated   | Ladder provided, Other                                   |                   |
| Shipping   | Nil, Port Traffic, N/A  | VHF monitored, Lookout, Flag Alpha, Liaison with Skipper |                   |
| Diving Safety  | Ears, Lungs, Separation, Air Checks   | Briefed, SMB, Times and Depths etc.                      |                   |
| Dangerous Marine Animals   | Assumed negligible, Present, Abundant   | Brief, Monitor, Revise Plan, Abort                       |                   |
| Fishing competitions (eg chumming) that may attract dangerous marine animals | Competition involving large amounts of chumming, No fishing competitions involving chumming | Monitor, Cancel  |                   |
| Thermal Exposure   | Shade, Rehydration, Sunscreen, Protective clothing  | Monitor, Revise Plan, Abort                              |                   |
| Other / Comments   |   |  |                   |

**NOTE:** Diving operations shall not be undertaken in rough seas, unusual tides or currents, or other adverse conditions unless the Dive Coordinator, Dive Leader and the Diver consider that the diver's safety will not be jeopardised.

**APPENDIX E – ONSITE PREDIVE PLAN AND RISK ASSESSMENT (Page 2 of 2)**

**Checklist:**

| Category         | Prompts   | Done? |
|------------------|---|-------|
| Divers           | Feeling fit for the dive? Adequately experienced for dive?  |       |
| RCC              | Available and location determined   |       |
| Dive Plan        | Dive plan signed? Permit to dive granted?   |       |
| Safety Equipment | Oxygen checked and working? First aid kit? Diver recall system? Mobile phone (min of 2) signal/charged? VHF working? Knife? Safety sausage? Shark shield? |       |
| Dive Site        | Pre-dive equipment checks? Authorities notified?  |       |

**HYPERBARIC / PHYSIOLOGICAL FACTORS:**

*Do the dives include?*

|                        |          |
|------------------------|----------|
| Multiple ascents       | YES / NO |
| Repetitive dives       | YES / NO |
| Multi-day dives        | YES / NO |
| Excessive exertion     | YES / NO |
| Other (please specify) |          |

If YES, describe hazard and precautions taken:

|  |
|--|
|  |
|--|

| Dive Team Members: | Repetitive Group: |
|--------------------|-------------------|
|                    |                   |
|                    |                   |
|                    |                   |
|                    |                   |

|   |          |
|---|----------|
| Are all the divers fit to dive? (eg prior physical exertion, fatigue, recent illness, dehydration, alcohol imbibed) | YES / NO |
|---|----------|

**Dive coordinator:**

|                     |  |       |  |
|---------------------|--|-------|--|
| Name (please print) |  |       |  |
| Signature:          |  | Date: |  |

**Dive Team:**

|       |  |            |  |
|-------|--|------------|--|
| Name: |  | Signature: |  |
| Name: |  | Signature: |  |
| Name: |  | Signature: |  |
| Name: |  | Signature: |  |
| Name: |  | Signature: |  |

13 APPENDIX F – UNIVERSITY OF NEWCASTLE DIVE LOG

Project: \_\_\_\_\_ Vessel: \_\_\_\_\_ Date: \_\_\_\_\_  
Location: \_\_\_\_\_ Current Speed: \_\_\_\_\_  
Weather: Wind- \_\_\_\_\_ Swell- \_\_\_\_\_ U/W vis \_\_\_\_\_ Water Temperature \_\_\_\_\_

To be completed FOR each dive and returned to the Diving Officer with the Onsite Pre-dive Plan and Risk Assessment.

| Date | Dive # | Divers | Depth | Bar In | Bar Out | Time In | Time Out | Bottom Time | RG | SI | RF | EBT (BTxRF) | Diver Well? |
|------|--------|--------|-------|--------|---------|---------|----------|-------------|----|----|----|-------------|-------------|
|      |        |        |       |        |         |         |          |             |    |    |    |             |             |
|      |        |        |       |        |         |         |          |             |    |    |    |             |             |
|      |        |        |       |        |         |         |          |             |    |    |    |             |             |
|      |        |        |       |        |         |         |          |             |    |    |    |             |             |
|      |        |        |       |        |         |         |          |             |    |    |    |             |             |
|      |        |        |       |        |         |         |          |             |    |    |    |             |             |
|      |        |        |       |        |         |         |          |             |    |    |    |             |             |
|      |        |        |       |        |         |         |          |             |    |    |    |             |             |
|      |        |        |       |        |         |         |          |             |    |    |    |             |             |
|      |        |        |       |        |         |         |          |             |    |    |    |             |             |
|      |        |        |       |        |         |         |          |             |    |    |    |             |             |
|      |        |        |       |        |         |         |          |             |    |    |    |             |             |
|      |        |        |       |        |         |         |          |             |    |    |    |             |             |
|      |        |        |       |        |         |         |          |             |    |    |    |             |             |
|      |        |        |       |        |         |         |          |             |    |    |    |             |             |
|      |        |        |       |        |         |         |          |             |    |    |    |             |             |
|      |        |        |       |        |         |         |          |             |    |    |    |             |             |
|      |        |        |       |        |         |         |          |             |    |    |    |             |             |

Dive Coordinator’s Signature: \_\_\_\_\_

Dive Officer’s Signature: \_\_\_\_\_

Date: \_\_\_\_\_

Date: \_\_\_\_\_

**14 APPENDIX G – DECOMPRESSION PROCEDURES****Reduced Bottom Time Limits For Remote Locations**

| Maximum depth of dive (m) | Maximum bottom time (mins)         |                                      |                                  |
|---------------------------|------------------------------------|--------------------------------------|----------------------------------|
|                           | COLUMN A<br>Chamber within 2 hours | COLUMN B<br>Chamber within 2 – 6 hrs | COLUMN C<br>Chamber over 6 hours |
| 3                         | No limit                           | 240 (400)                            | 190                              |
| 6                         | 240 (400)                          | 240 (300)                            | 190                              |
| 9                         | 180                                | 140                                  | 110                              |
| 12                        | 120                                | 70                                   | 55                               |
| 15                        | 75                                 | 60                                   | 50                               |
| 18                        | 50                                 | 40                                   | 30                               |
| 21                        | 35                                 | 30                                   | 20                               |
| 24                        | 25                                 | 20                                   | 15                               |
| 27                        | 20                                 | 15                                   | 10                               |
| 30                        | 15                                 | 10                                   | 10                               |

**Amendments to DCIEM procedures**

- The rate of ascent should be 10 metres  $\pm$  3 metres per minute.
- A 3 minute stop is recommended for all dives below 12 metres.
- Repetitive dives should always be shallower than the previous dives.
- A maximum depth of 27 metres is recommended for second dives and 15 metres for the third dive.
- The group letter for each repetitive dive must be higher than the RG from the preceding dive. Otherwise add one letter to the preceding dive RG and use the higher RG letter, eg 1<sup>st</sup> dive RG = C, 2<sup>nd</sup> dive RG = D, 3<sup>rd</sup> dive RG = E.
- If more than two dives a day are conducted on three consecutive days, diving should not be carried out on the fourth day.
- When diving in remote locations add 2 consecutive letters when calculating the RG group for conservative measures, eg 1<sup>st</sup> dive RG = B, then calculate the EBT using RG = D.

Canadian Defense and Civil Institute of Environmental Medicine (DCIEM) Tables are available at <http://bonicadive.com/webpages/page6.html> or any retail or commercial supplier of diving supplies.

## 15 APPENDIX H - NITROX DIVING (INFORMATIVE)

Nitrox is a combination of oxygen and nitrogen where the percentage of oxygen is increased from standard air, which is approximately 21% oxygen and 79% nitrogen. In Nitrox diving the mix of oxygen is from 22% to 40% in water depths less than 130fsw/40msw.

Nitrox divers have less nitrogen in their tanks than air divers. For an equivalent dive they absorb less nitrogen into their bodies and are less exposed to Decompression Sickness (DCS). Using Standard Air Dive Tables on Nitrox gives increased physiological safety, especially for people who are more at risk from DCS. The increased risk factors include: obesity, illness, older age, fatigue, heavy exertion during and or after a dive, are reduced by the use of Nitrox. Divers can benefit through increased bottom time and shorter surface intervals if they are not affected by such risk factors.

Diving cylinders used for Nitrox are defined with a Green band and labeling these are only used for Nitrox, this is to avoid a person using a tank thinking it is air when it is Nitrox or using a Nitrox tank thinking it is for air. This sort of mistake can result in a diver extending the no decompression limits thinking he is using Nitrox or, alternately, thinking he has air, the diver exposes himself to central nervous system (CNS) oxygen toxicity with Nitrox. Regulators using less than 39% oxygen can be used for air or Nitrox diving. Divers must check their own Nitrox fills with an oxygen analyzer and sign off on the fill log at the fill facility. Cylinders are tagged describing fill pressure, oxygen, analysis date, maximum oxygen depth, name of user and cylinder number.

A standard Nitrox course will equip a diver with the understanding and training to use this gas mix to increase safety margins, while working to air dive tables. It can increase dive times and shorten dive time intervals.

*Information sourced from Technical Diving International*



## 16 APPENDIX I- DAN DIVING INJURY REPORT FORM

### DIVING INCIDENT REPORT

DAN is a non-profit dive safety organisation whose aim is to sponsor data collection and research into diving incidents, and their prevention. To support this research, DAN collects and analyses information about diving incidents. DAN SEAP undertakes to hold the names and contacts of individuals involved as confidential.

---

#### INFORMATION ABOUT THE INCIDENT

Date:

Time:

Nearest Town:

Country:

---

#### BRIEF DESCRIPTION OF INCIDENT

---

#### TYPE OF INCIDENT

Decompression Illness

Drowning / near drowning

Trauma

Other:

---

#### DETAILS OF INJURED PERSON

Name:

Contacts:

Age / Birthdate:

Gender:

#### Certification Level

Not known

In Training Open Water

Advanced

Divemaster

Instructor

Technical

Commercial

#### Experience:

Years diving:

Total no. of dives:

Total dives in last 12 months:

#### Outcome:

Fatal

Non-Fatal

---

#### REPORTED BY:

Name:

Contact Ph:

Email:

**17 APPENDIX J – MIMIMUM DELAY BEFORE EXPOSURE TO ALTITUDE**

*Minimum Delay before Exposure to Altitude*

| ALTITUDE (METERS)    | TIME AFTER LAST DIVE (HOURS)  |            |            |
|----------------------|-------------------------------|------------|------------|
|                      | Category of dive (see legend) |            |            |
|                      | Category 1                    | Category 2 | Category 3 |
| 0 – 150              | Nil                           | Nil        | 2          |
| 150 - 300            | Nil                           | 2          | 4          |
| 300 - 600            | 2                             | 12         | 24         |
| 600 – 2 400 (Note 1) | 12                            | 24         | 48         |
| Greater than 2 400   | 24                            | 48         | 72         |

**LEGEND:**

Category 1 = Single dive to ≤50% of no-decompression limits, with no decompression or repetitive dives in previous few days.

Category 2 = Routine no-decompression diving; Single decompression dives.

Category 3 = Multiple decompression dives;  
 Extreme exposure;  
 Omitted decompression;  
 Other adverse events.

**NOTES:**

- 1) Routine air travel – In pressurized aircraft, the altitude referred to is the effective altitude within the cabin. Commercial aircraft are usually pressurized to an effective cabin pressure of 2400 meters or less.
- 2) The recommendations given in Table 3.1 are for routine diving operations. The risk of decompression illness varies substantially with differing dive profiles, and data regarding the risks associated with altitude exposure after diving is limited. The advice of a medical practitioner appropriately trained in underwater medicine is recommended where altitude exposure after diving is required.

(AS/NZS2299.2:1999)

## 18 APPENDIX K - HAND SIGNALS

(Normative)

Figure A1 illustrates the hand signals most commonly used in SCUBA diving operations.

|   |   |   |  |
|---|---|---|--|
|  <p>1. Stop, hold it, stay there</p> |  <p>2. Something is wrong</p>              |  <p>3. OK? OK.</p>                         |  <p>4. OK? OK. (glove on)</p> |
|  <p>5. Distress, help</p>            |  <p>6. OK? OK (on surface at distance)</p> |  <p>7. OK? OK. (one hand occupied)</p>    |  |
|  <p>8. Danger</p>                  |  <p>9. Go up, going up</p>               |  <p>10. Go down, going down</p>        |  |
|  <p>11. Low on air</p>             |  <p>12. Out of air</p>                   |  <p>13. Buddy breathe or share air</p> |  |

|  |  |  |
|--|--|--|
|  <p>14. Come here</p>             |  <p>15. Me, or watch me</p>       |  <p>16. Under, over, or around</p>   |
|  <p>17. Level off, this depth</p> |  <p>18. Go that way</p>           |  <p>19. Which direction</p>          |
|  <p>20. Ears not clearing</p>    |  <p>21. I am cold</p>            |  <p>22. Take it easy, slow down</p> |
|  <p>23. Hold hands</p>          |  <p>24. Get with your buddy</p> |  <p>25. You lead, I'll follow</p>  |

## 19 APPENDIX L - LIFELINE SIGNALS

All personnel involved in diving operations shall know that the following lifeline signals:

- (a) Four pulls:                    Come up! (attendant to diver)  
    May I come up? (diver to attendant)
  
- (b) Succession of pulls (has to be more than four)  
    Emergency – pull me up immediately (diver to attendant)

## POSITION DESCRIPTION

|                              |                                   |
|------------------------------|-----------------------------------|
| <b>ROLE:</b>                 | DIVING OFFICER/s                  |
| <b>HEW LEVEL:</b>            | N/A                               |
| <b>FACULTY/DIVISION:</b>     | N/A                               |
| <b>IMMEDIATE SUPERVISOR:</b> | DEPUTY VICE-CHANCELLOR (Research) |

### Role Statement

Staff member/s nominated by the University who is responsible for all scientific diving activities.

### Role Description

The Diving Officer is responsible to the Deputy Vice Chancellor Research for day-to-day diving operations and the adherence by University personnel to the procedures and safety codes represented in the Scuba Diving Operations Manual and in AS/NZS2299.2.

This position will be supported directly by the School of Environmental and Life Sciences and the Health Safety and Environment Team

The assessment of Scientific Diving Projects is included in the Safety Clearance System operated by the Health Safety and Environment Team and the Diving Officer will be acting as a Subject Matter Expert (SME) for diving activities within this system.

*The Diving Officer shall:*

Have the delegation to restrict, prohibit or suspend any diving operations, program or practice which he or she considers unsafe;

Have the delegation to require such additional safety practices, procedures or equipment as he or she thinks necessary in any diving operation;

Assess diver's competencies or delegate to suitably qualified dive instructor in accordance with Appendix A of AS/NZ 2299.2:2002 and record the evidence used in the assessment;

Be familiar with any legislation and guidelines which may apply to the diving operations, including AS/NZ 2299.2:2002, and the University of Newcastle Scuba Diving Operations Manual and to ensure that any dive proposals that he/she approves comply with the requirements of the manual.

Provide information, guidance and advice to DVC's, Directors, Heads of Schools, Supervisors, principal researchers, employees, staff, students and visitors regarding diving policy and practice, recommend and disseminate modifications of policy and practice to all levels of University management, staff, students and visitors.

In approving dive proposals, the University of Newcastle Diving Officer(s) shall ensure that the divers are trained and competent for the diving operation proposed, and have any extra training they may require prior to particular dives. The Diving Officer(s) may authorise a diver to dive on certain diving operations and/or defined conditions only, depending on the qualifications of the diver and relevant legislative requirements. When approving dive proposals the Diving Officer(s) will also consider the adequacy of the risk assessment and emergency plan for each dive proposal.

Ensure that Divers are trained and experienced in diving and in the use of equipment relating to diving operations to a level equal to or exceeding that given in the appropriate part of AS 2299.2.

Approve all planned diving operation.

Appoint Diving Coordinators and ensure that, for each Diving Operation, a Dive Coordinator(s) is present.

Maintain a detailed Diver Register of all divers, which will include their diving qualifications and annual dive medicals.

Ensure all Scientific Divers are aware of their responsibility to maintain an up to date service history of their diving equipment, which must be submitted to the Diving Officer to enter onto the Dive Equipment Register.

Ensure that all Scientific Divers are aware that any personal equipment used on a diving operation must be listed in the Dive Equipment Register as in service.

Ensure that every Scientific Diver has an annual diving medical examination.

Co-ordinate formal training of Scientific Diving personnel in work related diving practices.

Ensure that Scientific Divers are trained in the use of emergency and resuscitation equipment.

Monitor the use and maintenance of non-personal and specialised Scientific Diving equipment.

Advise on the purchase and procurement of all diving equipment.

Report occupational health and safety incidents or problems using the University's incident reporting system.

Be familiar with any legislation and guidelines that may apply to the diving operations, and ensure compliance with this Standard and with the employer's diving operations manual.

Administer and update the Scientific Diving Procedures Manual in consultation with appropriate staff members as required.

Ensure all Scientific Divers are informed of the Diving Procedures Manual and relevant updates.

Be familiar with and have a thorough knowledge of University wide policies and the external environment, eg government legislation, codes, guidelines, and requirements.

Be able to identify and address possible conflicts of interest in regard to projects they may be assessing.

### **Essential Qualifications and Experience**

- Must be an experienced Scientific Diver(s) trained to a level equal to or exceeding that specified in AS2815.1 (Commercial Diver) and have a certificate to that effect issued by a relevant authority.
- Must have at least 100 h of underwater diving experience.
- Must demonstrate extensive experience in the supervision of diving operations in relation to scientific research programs.
- Computer skills across standard software applications.
- Demonstrated capacity to maintain confidentiality.

- Ability to develop positive collaborative working relationships with, peers and team members through good communication and negotiation skills.
- High level communication skills (both written and oral)
- The Diving Officer will also satisfy any other reasonable requirements as specified by the University



## 20 APPENDIX N – DOCUMENTATION PROTOCOL

### Diver interview

- Supervisor reviews dive log (copy of relevant sections made)
- Discussion of dive experience – conditions, locations, previous problems
- Explain to new diver our programs and experiences
- Supervisor matches competencies to projects

### Diver Registration

- Form completed
- Authorized by Diving Officer
- Sent to Health Safety and Environment for online registration and filing

### File created for Diver to include

- Photocopy of Dive Qualification(s)
- Photocopy of Dive Log (or relevant sections)
- Photocopy of current First Aid Certificate
- Photocopy of current Oxygen Provider Certificate
- Photocopy of current Certificate of Fitness to Dive
- Photocopy of current Boat License (where required)
- Signed Induction Form

### Register of Dive Equipment

- Spreadsheet maintained by Diving Officer

### Proposal to Dive

- Fill out Dive Plan – 3 pages including
  - Dive proposal signed by Dive Coordinator
  - Risk Assessment approved by Diving Officer
  - Emergency Plan
- Copy of plan included with Application for Safety Clearance submitted to Health Safety and Environment (copy retained by Dive Coordinator to be taken into the field for reference)
- Copy of plan forwarded to Dive Officer
- Evaluation prepared by Dive Officer forwarded to HSE and Safety Clearance finalised
- On return to University copy of dive plan including any on site changes lodged with Diving Officer
- Copy reviewed by Diving Officer

### 'Practical Assessment'

A practical assessment is required of any new diver by the School Diving Officer or nominee; until such time as a new diver has been assessed as competent they will be a "Restricted Scientific Diver".

### Formal nomination of Diving Officer/s

- Memo from HRS