
# RECOMMENDED MINIMUM PRACTICE FOR SCIENTIFIC DIVING IN NEW ZEALAND

November 2021

## FOREWORD

This document represents the recommended minimum best practice for operational scientific diving in New Zealand. As diving science progresses so must these guidelines, and it is the responsibility of the organisations using these guidelines to see that they always reflect state of the art safe diving practice.


## ACKNOWLEDGEMENTS

Science Diving New Zealand thanks the numerous dedicated individual and organisational members for their contributions and editorial comments in the production of these guidelines.


## REVISION HISTORY

| Revision Date | Revision Details | Document Version | Revised By |
|---|---|---|---|
| 19/03/2024 | Changed the total number of required dives with a baailout to 4 in the 20m Micro-credential for 20 and 30 metres | V10 | Crispin Middleton |
| 10/6/22 | Added Flying after diving recommendations and amended after group feedback from 3/6 SDNZ meeting | | Dean Tully |
| | | | |

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# 1 General

## 1.1 Scope

These recommended minimum practice guidelines specify requirements for divers belonging to SDNZ member organisations undertaking occupational underwater diving operations that are performed for the purpose of professional scientific or archaeological research, or related educational activities; hereafter 'Scientific Diving'.

These guidelines are not intended to be used for snorkelling, breath-hold freediving, or for divers within the construction industry, military, police or emergency services.

These guidelines predominantly apply to scientific diving where breathing gas is supplied through self-contained underwater breathing apparatus (SCUBA). The guidelines are strucured around a base level of training where divers can work to a maximum depth of 10 m. Pathways to increase the depth limit and add other micro-credentials where specific operational tasks require it (e.g. Dive Coordinator, Nitrox Diving, Drysuit Diving, Air Fillers, Full-Face Mask, Tethered diving or alternate diving modes) are available.

### 1.1.1 How to read the guidelines

The following CAPITALISED keywords in these guidelines indicate the level of requirement for SDNZ member organisations and must be interpreted as follows:

- **MAY** means that the item is truely optional for SDNZ member organisations
- **MUST** indicates a mandatory requirement for SDNZ member organisations
- **MUST NOT** indicates an absolute prohibition for SDNZ member organisations
- **SHOULD** or the adjective **RECOMMEND** mean there may be valid reasons in a particular circumstance SDNZ member organisations may wish to deviate from the minimum requirements presented within these guidelines, but the full implications must be understood and carefully weighed before choosing a different course.

### 1.1.2 Organisational Auspices and Responsibilities

These guidelines cover scientific diving operations with which a SDNZ member organisation is connected because of ownership of life support equipment used, locations selected, or relationship with the individual(s) concerned. This includes all cases involving the operations of authorised individuals of the SDNZ member organisation or auxiliary organisations.

### 1.1.3 Science Diving New Zealand's responsibilities

Within New Zealand the health and safety of each SDNZ member organisation remains the full responsibility of the Person Conducting a Business or Undertaking (PCBU) as defined by the Health and Safety at Work Act (2015) Part 1 – Section 17. Consequently, the SDNZ member organisation has a requirement to oversee and administer all aspects of its scientific diving program.

SDNZ provides guidance on how individual member organisations can meet their obligations

under the Health and Safety at Work Act (2015), but assumes no responsibility to the SDNZ member organisations.

## 1.2 Membership

Membership to SDNZ is open to organisations that meet the membership criteria and agree to abide by the conditions set by the SDNZ Terms of Reference (Section 8.1).
Organisations wishing to apply MUST review and accept the Terms of Reference and complete the checklist in Section 8.2. This checklist should be signed by an officer of the organisation applying for membership. The completed and signed checklist can be sent to science.diving.nz@gmail.com

### 1.2.1 Roles at SDNZ

Chair – Daniel McNaughtan. Arranges meetings and responsible for overseeing SDNZ activities.

Treasurer – Crispin Middleton. Monitor SDNZ expenditure.

Information – Crispin Middleton. Administer SDNZ website.

Certifications – Scott Edhouse. Administer SDNZ Badger certification platform.

Membership – Shane Geange. Administer SDNZ membership applications

SDNZ Manual – Dean Tully. Review and revise SDNZ manual as required.

# 2 Risk Management

## 2.1 HSWA

The Health and Safety at Work Act (2015) (HSWA) is New Zealand's key work health and safety legislation, and WorkSafe New Zealand (WorkSafe) is the government agency that is the workplace health and safety regulator. The HSWA sets out the health and safety duties that MUST be complied with by both SDNZ member organisations and workers, and all workplaces are covered by HSWA unless specifically excluded.

Health and safety regulations like the General Risk and Workplace Management (GRWM) Regulations sit under HSWA and prescribe certain requirements to be met for certain duties under HSWA. Of note are the Health and Safety Employment Regulations 1995 (which detail the requirements for certificates of competence for diving) and the Health and Safety at Work (Hazardous Substances) Regulations 2017 (the Hazardous Substances Regulations).

### 2.1.1 Worker engagement to manage risk

Under Part 3 – Section 58 of the HSWA, the PCBU is required, so far as is reasonably practicable, to engage with the workers who carry out work for it and who are, or are likely to be, directly affected by a work health or safety matter. In addition, PCBUs must engage with workers when:

a) identifying hazards and assessing risks to health and safety;
b) proposing changes that may affect workers' health or safety;
c) making decisions about:
   - ways to eliminate or minimise health and safety risks;
   - procedures for resolving health or safety issues;
   - procedures for engaging with workers;
   - procedures for monitoring workers' health;
   - procedures for monitoring workplace conditions;
   - procedures for providing information and training for workers;
   - developing worker participation practices;
   - carrying out any other activity specified in regulations.

PCBUs must also have practices that give their workers reasonable opportunities to participate effectively in improving health and safety in the business or undertaking on an ongoing basis (these are known as worker participation practices). This includes processes for workers to report health and safety issues such as concerns that risks are not being adequately managed.

In the scientific diving sector, workers are the divers that are undertaking diving activities for the PCBU. Divers could be-

a) staff employed directly by the PCBU;
b) divers from an external organisation working with or alongside the PCBU;
c) students;
d) volunteers;

e) associates to the PCBU.

and all would be defined as workers under the HSWA.

### 2.1.2 Workplaces

Under HSWA, a 'workplace' is defined as any place where a worker goes or is likely to be while at work, or where work is being carried out or is customarily carried out (Part 1 – Section 20) and the responsibilities of PCBU's extend to all workplaces. Some sites, however, will only be classed as workplaces while work is being carried out in those locations. For example, a site where science diving activities are taking place is only considered a workplace while those diving operations are being performed. Consequently, the responsibilities of the PCBU performing the diving extend to any workplace where diving activities are taking place.

### 2.1.3 Information, training, instruction and supervision of divers

The PCBU has a duty of care towards every diver who carries out diving work of any kind and uses plant (e.g., vessel, personal protective equipment, tools) of any kind, in a diving workplace (HSWA Part 2 –Section 36). They must ensure, so far as is reasonably practicable, that every diver:

a) has adequate knowledge and experience of similar places, and work, or plant, to ensure that the diver carrying out the work is not likely to adversely affect the health and safety or cause harm to the diver or another person; OR
b) is adequately supervised by a person who has adequate knowledge or experience.

For science diving, this means that any PCBU conducting diving activities must ensure the divers are trained and competent to perform the diving tasks or are supervised by someone that is.

### 2.1.4 Working with other PCBUs

Sometimes more than one PCBU can have a duty in relation to the same matter (overlapping duties). This can occur when divers from two or more PCBU's are undertaking diving activities as part of a joint project or collaboration.

Part 2 – Section 34 of HSWA requires that PCBUs with overlapping duties must, so far as is reasonably practicable, consult, co-operate and coordinate activities with other PCBUs so that they can all meet their joint responsibilities. PCBUs do not need to duplicate each other's efforts.

A PCBU cannot contract out of its duties (Part 4 – Section 28) but can enter into reasonable agreements with other PCBUs to meet duties. However, these PCBUs still retain the responsibility to meet their duties. The extent of the duty to manage risk depends on the ability of each PCBU to influence and control the matter.

### 2.1.5 Managing work risks

Risks to health and safety arise from people being exposed to hazards or anything that can cause harm. Risks that could result from work must be effectively managed. Risk has two

components:

a) the consequences (degree of harm) if it happens; and
b) the likelihood that it will occur.

A risk can be minimised by reducing the likelihood of it occurring or the level of harm caused if it does, or ideally both.

Under HSWA the first step is to try to eliminate the risk so far as is reasonably practicable (Part 2 – Section 30). If the risk can't be eliminated, it must be minimised so far as is reasonably practicable. This applies to all risks.

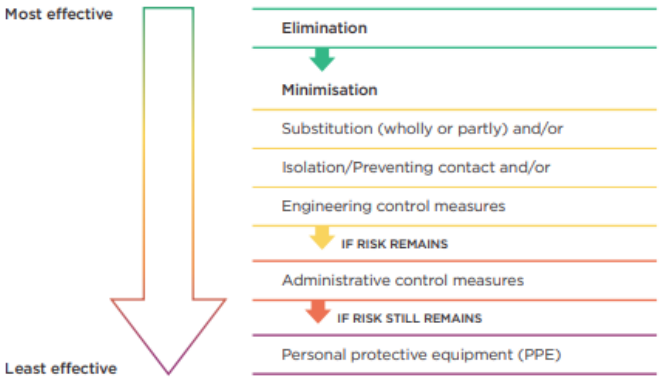
PCBUs must engage with their divers when identifying hazards and assessing risks to health and safety (Part 3 – Section 58) but also when making decisions about the ways to eliminate or minimise diving risks. PCBUs don't need to identify all potential hazards; however, they must identify hazards that could give rise to reasonably foreseeable work health and safety risks (e.g., risks to health and safety that a reasonable person should anticipate as a result of the work).

### 2.1.6 Eliminating the risk

PCBUs must first try to eliminate a risk if this is reasonably practicable. This can be done by removing the source of the harm (e.g., using alternative methods to diving). If it is not reasonably practicable to eliminate, the risk must be minimised so far as is reasonably practicable.

### 2.1.7 Minimising risk if it can't be eliminated

PCBUs must minimise the risks by putting in place control measures as described in the 'hierarchy of control measures' (summarised in Figure 1). Control measures include equipment, processes, procedures or behaviour to minimise risk. Use the most effective control measures first so far as is reasonably practicable. More than one type of control measure at a time can be used. The control measures used should be proportionate to the risk.




| ACTION | | WHAT IS THIS? |
|---|---|---|
| Elimination | | Removing the sources of harm (eg equipment, substances or work processes) |
| Minimisation | Substitution | Substituting (wholly or partly) the hazard giving rise to the risk with something that gives rise to a lesser risk (eg using a less hazardous thing, substance or work practice). |
| | Isolation | Isolating the hazard giving rise to the risk to prevent any person coming into contact with it (eg by separating people from the hazard/preventing people being exposed to the hazard).<br>Isolation focuses on boxing in the hazard or boxing in people to keep them away from the hazard. |
| | Impose engineering control measures | Using physical control measures including mechanical devices or processes. |
| | Impose administrative control measures | Using safe methods of work, processes or procedures designed to minimise risk.<br>It does not include an engineering control; or the wearing or use of personal protective equipment. |
| | Use personal protective equipment (PPE) | Using safety equipment to protect against harm. PPE acts by reducing exposure to, or contact with the hazard.<br>For information on PPE requirements, see WorkSafe's interpretive guidelines: *General Risk and Workplace Management – Part 1* |

PCBUs who implement a control measure must ensure that the control measure is effective and is maintained so that it remains effective. This includes by ensuring that the control

measure is and continues to be: –

a) fit for purpose; and
b) suitable for the nature and duration of the work; and
c) installed, set up, and used correctly.

This means that control measures must be regularly monitored and checked to ensure that they are still managing the risk effectively. This should occur on an ongoing basis – not just when the control measure is first put in place.

For example, regularly: –

a) checking the control measures are correctly installed/set up and being used correctly by workers;
b) checking the control measures are still working to manage the risk;
c) monitoring workplace exposure and/or worker health (where relevant) to check control measures are effectively reducing worker exposure.

### 2.1.8 Using PPE to manage risk

Personal Protective Equipment (PPE) may need to be used or worn to minimise health and safety risks. PPE should only be used when other control measures alone can't adequately eliminate or minimise risks. PPE should not be the first or only control measure considered, and WorkSafe expects PCBUs to give preference to other control measures that protect multiple at-risk workers at once.

PPE should:

a) reduce exposure to a potential harm to as low as is reasonably practicable, and to a level needed to protect workers' or others' health;
b) be right for the wearer and the work they do.

PCBUs must ensure that any PPE they provide or that is provided by the diver is selected to minimise health and safety risks including being:

a) suitable for the nature of the work and any hazard associated with the work;
b) a suitable size and fit, and reasonably comfortable for the diver who is to wear or use it;
c) compatible with any other PPE that is required to be worn or used by the diver;
d) capable of minimising the divers health and safety risk.

For a science diving operation, PPE could include:

a) Regulators;
b) BCD;
c) Exposure protection (e.g., Wetsuit or Drysuit);
d) Fins;
e) Mask;
f) Other equipment as required by the task.

PCBUs must not impose a levy or charge divers for anything done or provided for health and safety (Part 4 – Section 27). This includes requiring a diver to provide their own PPE as a precondition of employment or as a term or condition in an employment agreement.

A diver may genuinely and voluntarily choose to provide their own PPE for their comfort or convenience, but the PCBU must be satisfied it is suitable and may refuse this request. Divers that chose to provide their own PPE may change their minds at any time and require the PCBU to provide it instead. However, divers must give the PCBU reasonable notice of this. A PCBU must engage with workers when making decisions about PPE and divers have a duty to wear or use any PPE provided.

PCBUs must ensure PPE (either provided by the PCBU or the worker) is maintained, repaired and replaced so it continues to minimise health and safety risks to the worker who uses it. PCBUs must ensure the equipment is clean and hygienic and in good working order. Often this will mean creating an inspection, repair and destruction schedule for the PPE.

#### 2.1.9 Refusal to carry out unsafe work

A worker may cease, or refuse to carry out, work if the worker believes that carrying out the work would expose the worker, or any other person, to a serious risk to the worker's or other person's health or safety arising from an immediate or imminent exposure to a hazard (Part 3 – Section 83 of the HSWA). There are many factors that affect worker safety in a diving operation and often work is performed in a dynamic and constantly changing environment. The PCBU needs to ensure there are pathways for divers to raise safety concerns prior to – and while diving operations are being performed.

### 2.2 Health and Safety Regulations

The HSWA uses the Health and Safety in Employment Regulations (1995) to further define diving in a workplace and the requirements for divers to be the holder of a current certificate of competence as a diver.

### 2.3 Certificate of Competency

The Health and Safety in Employment Regulations (1995) require that all divers undertaking diving in a workplace need to hold a Certificate of Competence (CoC) as a diver (Part 4 – Section 48). Divers must meet the requirements listed in Part 3 – Section 32 before a CoC can be issued. Applications are made directly to WorkSafe NZ. For more information see WorkSafe NZ.

## 3 SDNZ Member Organisational control

### 3.1 Diving Safety Manual

To assist a SDNZ member organisations in meeting their legislative responsibilities and obligations, a Diving Safety Manual MUST be created that clearly defines-

a) Diving management organisational structure and responsibilities;

b) Minimum competency requirements and responsibilities for divers, the diving safety officer and diving safety board members;
c) Training pathways to becoming a scientific diver;
d) Operational procedures including minimum dive teams and diving safety procedures;
e) Emergency procedures, Incident and near miss reporting;
f) Equipment maintenance and servicing plan and record keeping;
g) Minimum equipment requirements for diving operations;
h) Ongoing competency requirements/ annual skills assessments;
i) Requirements for in-active divers to be reinstated;
j) Requirements for Diving Safety Plans and the approval process;
k) Diver health and medical requirements;
l) Annual diving activity reporting requirements for SDNZ.

## 3.2 Diving Safety Board (DSB)

All SDNZ member organisations have a responsibility under the HSWA to oversee and ensure the safety of all diving activities. SDNZ member organisations MUST implement a Diving Safety Board (DSB) to assist in meeting these obligations.

The Diving Safety Board (DSB) SHOULD consist of a majority of active scientific divers. Voting members SHOULD include the Diving Safety Officer (DSO), and other representatives of the diving program such as qualified divers and members selected by procedures established by the SDNZ member organisation. A chairperson and a secretary may be chosen from the membership of the DSB according to the SDNZ member organisations procedures. The DSB has operational control over the scientific diving program and SHOULD:

a) Establish protocols, and procedures to address organisation specific needs and concerns;
b) Approve and monitor diving projects;
c) Review and revise the diving safety manual;
d) Ensure compliance with the diving safety manual;
e) Approve the depth to which a diver has been authorised to dive;
f) Recommend disciplinary action for unsafe practices to the SDNZ member organisation;
g) Act as the point of contact for the SDNZ member organisation in matters concerning the scientific diving program;
h) Act as a board of appeal to consider diver-related problems;
i) Recommend the issue, reissue, or the revocation of diving authorisations;
j) Recommend changes in policy and amendments to SDNZ guidelines and the SDNZ member organisations diving safety manual as the need arises;
k) Maintain records of diving activities, divers qualifications and maintenance and servicing of equipment;
l) Establish and/or approve training protocols through which the applicants for authorisation as divers can satisfy the requirements of the SDNZ member organisations diving safety manual;
m) Suspend any diving operations considered to be unsafe or unwise;
n) Establish criteria for equipment selection and use;
o) Recommend new equipment or techniques;

p) Establish and/or approve facilities for the inspection and maintenance of diving and associated equipment;
q) Periodically review the DSO's performance and program;
r) Investigate diving incidents within the SDNZ member organisations diving program or violations of the SDNZ member organisations diving safety manual.

The DSB may delegate operational oversight for portions of the program to the DSO; however, the DSB MUST NOT abdicate responsibility for the safe conduct of the diving program to the DSO.

### 3.3 Diving Safety Officer (DSO)

Once the SDNZ member organisation has implemented the DSB structure, a DSO MUST be appointed to administer and oversee the diving program on an operational or daily basis.

The DSO MUST:

a) Have broad technical expertise, and experience, in scientific diving**;** and
b) Be an active dive master or higher rating from an internationally recognised diver certifying agency; and
c) Be appointed by the responsible administrative officer or designee, with the advice and counsel of the DSB; and
d) Hold a current scientific diving certification of competence from Worksafe NZ; and
e) Have engaged in sustained or successive scientific diving activities during the past two years; and
f) Have completed a course in scientific diving that meets or exceeds the requirements as specified by the most current edition of Science Diving New Zealand's Standards for Scientific Diver Training as detailed in Section 8.4; and
g) Have experience appropriate to the types of diving operations being undertaken; and
h) Have at least 100 hrs of underwater scientific diving experience.

### 3.4 Instructional Personal Qualifications

All personnel involved in scientific diver training MUST have appropriate qualifications and experience for the specific skills they are teaching and be authorised by the DSB.

## 4 Science Diver Qualifications

### 4.1 Training

All SDNZ member organisations MUST ensure that divers are competent and have the appropriate training to perform any required tasks. SDNZ has identified the base competencies required by all science divers diving to a maximum depth of 10 m using

compressed air.

Candidates MUST successfully complete all theoretical and practical competencies for each skill outlined in section 8.4.4.3. Upon completion of these requirements the diver will be eligible for certification as a Scientific Diver by SDNZ and a WorkSafe NZ Certificate of Competency (CoC). On being issued a CoC the SDNZ member organisation will be able to authorize them to dive to a maximum of 10 m and carry out scientific diving tasks as an occupational diver.

Where a diver's resume provides clear evidence of significant diving experience, the diver MAY be given recognition of prior learning for portions of the training course. The DSB MUST identify specific overlap between on-the-job training, previous scientific diving training/experience and course requirements, and then determine how potential deficiencies will be resolved. The DSB may choose to devolve this responsibility to the DSO if needed.

## 4.2 Micro-credentials

Divers will often need additional skills and competencies beyond the base level of training. When a SDNZ member organisation identifies such requirements, micro-credentialing allows a pathway for divers to increase depth limits to gain higher general diver CoC Categories, add additional training for specific dive equipment, or undertake scientific diving in specialist diving environments/conditions. Section 8.4.7 includes training guidelines for a suite of common micro-credentials, including:

a) Dive Coordinator;
b) Nitrox Diving;
c) Full Face Masks;
d) Drysuits;
e) Air Fillers;
f) Lifeline;
g) Limited / Nil Visibility;
h) Powered tools;

SDNZ member organisations choosing to use the micro-credential system MUST have procedures for its use established by their DSB and described in their Diving Safety Manual.

## 4.3 Medical Exam

The Health and Safety in Employment Regulations (1995) requires that all occupational divers be 'medically fit' to dive at the time of diving (Regulation 49). All divers belonging to a SDNZ member organisation MUST hold a current 'Diving Medical Clearance' issued by the Diving Hyperbaric Medical Directorate to be deemed 'fit to dive'.

An occupational diving medical clearance issued by WorkSafe NZ Diving & Hyperbaric Medicine Directorate includes a comprehensive medical assessment and physical examination as part of the initial assessment and subsequently as clinically indicated, but at intervals not exceeding five years. Reassessment and ongoing health monitoring MUST be

undertaken at annual intervals thereafter.

## 4.4 Maintaining active status

During any 12-month period, each scientific diver SHOULD log a minimum of 12 scientific, training, or proficiency dives. At least one dive SHOULD be logged near the maximum depth, as defined by their depth micro-credential (if any). Failure to meet these requirements will result in revocation of diver status or restriction of depth limits. The DSB MUST detail a pathway for divers to regain active status if they are unable to meet the annual 12 dive minimum and for divers whose depth authorisation has laspsed due to a lack of activity. .

At least annually all divers SHOULD demonstrate the core SCUBA competencies, buoyancy and finning techniques, skills associated with micro-credentials and complete a swim assessment as outlined in Section 8.4.6.

## 4.5 Reciprocity

On occasions, workers from other SDNZ member organisations, PCBUs or visitors from overseas (such as visiting scientists) may wish to be involved in diving work and therefore MUST be considered workers with the HSWA applying to them as it would any other occupational diver. Consequently, they MUST present satisfactory evidence that they meet training and competency requirements. Such evidence shall be in the form of the reciprocity checklist in Section 8.5, and SHOULD be presented by their home organisations DSO.

Applications for reciprocity **SHOULD** be made directly to the DSB and will be assessed on a case-by-case basis. The DSB may also request an in-water assessment of a diver's skills before reciprocity is granted. The DSB reserves the right not to grant reciprocity and **MAY** advise the home organisation with a written explanation should this occur.

# 5 Operational diving procedures

## 5.1 Qualifications, Roles and Responsibilities

The SDNZ member organisation MUST ensure that the dive team is suitably qualified with applicable recent, relevant experience for all diving operations. The minimum qualifications, roles and responsibilities for each member of a dive team is listed below:

### 5.1.1 Dive coordinator

The Dive Coordinator will act as on-site coordinator and MUST ensure that diving operations are conducted in a safe manner and in accordance with the approved dive plan. A Dive Coordinator SHOULD only supervise dives within their level of training and experience.

**Qualifications:**
A Dive Coordinator MUST have completed and be current with the 'Dive Coordinator' micro -credential. A Dive Coordinator does not have to be a current Scientific Diver; however, they MUST have authorisation from the DSO/DSB to carry out this role.

**Roles and responsibilities**:

a) Assist with the development of the Dive Plan and associated risk assessments before each diving operation they are involved in;
b) Schedule and direct diving operations;
c) Ensuring that all divers have proper and required equipment;
d) Ensuring that safety and emergency equipment is in proper working condition and is present at the dive site;
e) Evaluating environmental conditions before diving;
f) Briefing divers regarding:
   - dive objectives,
   - unusual hazards and environmental conditions,
   - emergency procedures and divers' signals;
g) Briefing Divers, or Master of Vessel, whichever is appropriate, concerning diving operations and emergency procedures;
h) Ensuring that diving operations are conducted in compliance with thier organisations diving safety manual and the approved dive plan;
i) Ensuring that proper action is taken during a diving emergency or accident;
j) Suspending diving operations, if in their opinion, conditions are unsafe;
k) May temporarily revoke or restrict diving certification of any diver during a diving operation under his/her supervision;
l) Ensure that a dive log is kept of all dive activity they are responsible for. The dive logs MUST include: date, location, divers names, equipment in use, oxygen pressure, gas used, tables/computers in use, the Dive Coordinators name, project name/details, site details, depth, time entered the water, time exited the water, bottom time, air pressure in, air pressure out;
m) At the end of a diving deployment ensure that the completed dive logs are retained and archived;
n) Reporting any accident/incident or violation of this manual during a diving operation under their supervision.

### 5.1.2 Dive Leader

A dive leader leads a buddy team during the in-water portion of the dive, they will be assigned by the dive coordinator in the field.

**Qualifications:**
A Dive Leader MUST be a Scientific Diver as described in Section 5.1.3 and be capable of leading the underwater portion of the dive. A Diver Leader MUST NOT be a Diver in Training.

A Dive Leader MUST have good knowledge of their organisations diving safety manual, the dive plan and tasks involved, dive safety, rescue techniques, diving accident management, and emergency procedures concerning diving operations.

**Roles and responsibilities:**
The dive leader MUST:

a) ensure other buddy diver(s) in the group are familiar with the pre-dive plan;
b) ensure that the dive is conducted as planned and end the dive if the plan changes significantly or a safety issue arises.

### 5.1.3 Scientific Diver

**Qualifications:**
Scientific divers MUST:

a) be trained as a Scientific Diver as specified in the SDNZ training manual (Section 8.4);
b) hold a current appropriate Certificate of Competency issued by Worksafe NZ,
c) be approved as a Scientific Diver by their organisation;
d) meet the 'Active Status' requirements of SDNZ (Section 4.4);
e) be suitably experienced/ trained with the equipment, environment, tasks and depths expected.

Where applicable (as determined by the DSO/DSB) they SHOULD**:**

a) have completed and be current with any relevant micro-credentials (Section 8.4.7) and/or additional task-specific training.

**Roles and responsibilities:**

a) Maintain minimum dive activity (as specified in Section 4.4);
b) To maintain suitable fitness for the dives to be undertaken and complete annual fitness assessments (Section 8.4.6);
c) To complete, before entering the water, a check of their equipment, complete a pre dive checklist, ensure a dive leader has been appointed and that the dive signals, plan and emergency procedures are understood;
d) Assist with the development of the Dive Plan and associated risk assessments before each diving operation they are involved in;
e) Not to dive if equipment or conditions are unsafe or beyond their capabilities, or if they consider the dive plan or procedures are considered unsafe;
f) To report immediately any equipment malfunction, a diving accident/incident, any injury or illness to the dive coordinator;
g) To record all dives, including leisure dives, in their dive log;
h) To adhere to the requirements of their organisations Diving Safety Manual and any approved dive plan they are working under.

### 5.1.4 Surface Support

The Surface Support forms part of the minimum dive team. The Surface Support does not necessarily need to be a diver but MUST be approved for the role by the DSB/DSO. They MUST have good knowledge of the diving operation, safety procedures and emergency plans. Some of the administrative tasks of the Dive Coordinator MAY be allocated to the Surface Support.

**Qualifications:**

Surface support MUST:

a) Have a working knowledge of the underwater activities and the equipment in use.
b) Be a current oxygen provider;
c) Hold a current first aid certificate;
d) Understand any signals in use (lifeline, hand and surface);
e) Be capable of recording the required dive information and be aware of expected maximum dive times and recall methods;
f) Be aware of emergency procedures listed in the dive plan and the diving safety manual;
g) Be able to identify and name the main components of dive equipment in use

**Roles and responsibilities:**

a) Record the time of descent and surfacing of each diver;
b) Assist the divers with donning and doffing dive equipment;
c) Assist the divers with completing pre and post dive checks;
d) Maintain a constant vigil during a dive for divers surfacing at a distance from the boat or other dive control position;
e) Assist in the recovery of divers and all equipment and samples from the water.
f) If tending a diver's lifeline maintain the ability to communicate with the diver by means of that lifeline;
g) In an emergency situation, raise the alarm.

The Surface Support MUST NOT be engaged in other tasks that will distract/prevent them from carrying out the responsibilities listed above.

## 5.2 Minimum Dive Teams

SDNZ member organisations MUST ensure that all dive operations are suitably supported to maximise safety. Below are RECOMMENDED minimum dive teams. SDNZ member organisations MUST assess the risk for every diving operation to determine if altering or adjusting these numbers is required or justified.

### 5.2.1 Diving from a "live" vessel

When diving from a live, moving or unsecure vessel, the minimum RECOMMENDED team is four.

The roles within the team are as follows:

a) Two Buddy divers;
b) One Surface support;
c) One Skipper.

If the team members are suitably qualified, the roles within the team MAY change during a diving deployment except for the role of dive coordinator. The dive coordinator MAY delegate the responsibility to carry out tasks such as recording dive times, depths, etc while they are in the water; however, MUST NOT delegate their responsibility as the overall dive coordinator.

### 5.2.2 Shore diving or diving from a securely moored/ anchored vessel

When buddy diving from a securely moored/anchored vessel or shore diving and when the divers are expected to remain in close proximity to the surface support (circa 70 metres) with minimal risk of currents, poor visibility or entanglement, the minimum RECOMMENDED dive team is three.

The roles within the team are as follows:

a) Two Buddy Divers;
b) One Surface Support.

If the team members are suitably qualified, the roles within the team MAY change during a diving deployment (except for the role of dive coordinator).

## 5.3 Dive Planning Procedures

### 5.3.1 Safety plan and hazard assessment

Every diving deployment MUST have a Safety Plan and Hazard assessment completed and reviewed by the DSB (usually delegated to DSO).
The safety plan SHOULD include the following:

a) Divers who are involved in the proposed diving operation;
b) The location of the diving;
c) Proposed dates and number of dives per day and number of diving days;
d) Depths of the dives;
e) Method of decompression management;
f) Gas requirements for the dives;
g) Description of the diving sites;
h) Description of the dive activities and any specialist equipment requirements;
i) Hazards associated with the proposed diving and how these hazards are managed (eliminate, minimise etc);
j) Emergency procedures and methods of evacuation from the diving sites to advanced emergency care and emergency recompression facilities.

### 5.3.2 Pre dive planning

Prior to diving, the Dive Coordinator MUST assess the site conditions to ensure they are acceptable and then conduct a pre dive briefing. This SHOULD include the following:

a) Dive Buddy assignments and tasks;
b) Dive objectives;
c) Maximum depth(s) and bottom time;
d) Turn around pressure and required surfacing pressure;
e) Entry, exit, descent and ascent procedures, including any decompression or safety stop obligations;
f) Perceived environmental and operational hazards and mitigations;
g) Emergency and diver recall procedures;
h) Ensure divers understand the plan.

### 5.3.3 Gas Requirements

During the dive planning stage, the Dive Coordinator MUST identify the expected gas requirements to complete the planned tasks and how these will be safely met. For each planned dive every diver SHOULD carry sufficient breathing gas to complete the planned dive plus a minimum safety margin of 25% of the calculated gas for dives up to 20 m and 30% for dives greater than 20 m.

For example: If a dive is planned to 18 m for 45 min with the divers using 12L cylinders and using an average Surface Air Consumption (SAC) of 15L/min, then they will use an estimated (45 x 2.8 x 15 = 1890 / 12) 157.5 Bar. If this is rounded to 160, then 25% is an extra 40 bar and the total required for this dive (including the reserve) is 200 bar in the chosen 12L cylinders.

The Dive Coordinator may decide to change the tasks in the dive plan and reduce the time spent at depth if these calculations identify that the divers need more gas than can be carried in a standard 11.7L or 12L cylinder.

Other options may include either larger cylinders (e.g., 15L steel cylinders), a twinset or to carry a separate cylinder. The divers may need extra training in how to use these systems.

Separate bailout cylinders are also an option for dives where buddy separation may occur, as it provides a completely independent gas supply that is immediately on hand if the diver requires it. There is also the benefit of being able to transfer the cylinder between divers if required.

### 5.3.4 Dive records

The SDNZ member organisation MUST ensure that written or digital records are kept with the following information for all diving deployments:

a) Divers name;
b) Gas mix used;
c) Gas pressure at start of dive;
d) Time entering the water;
e) Time exiting the water;
f) Gas pressure at end of dive;
g) Maximum diving depth.

Following the dive operation, completed dive records SHOULD be signed by the Dive Coordinator and copies submitted for review and archiving by DSO.

### 5.3.5 Dive safety checks

Divers MUST complete dive checks before entering the water and after exiting. The SDNZ member organisation should determine the most appropriate method for the divers to complete these checks and outline this in their diving safety manual. Divers MUST be trained on how to complete these checks thoroughly.

## 5.4 Diving procedures

### 5.4.1 Buddy System

Buddy diving forms the basis for most scientific diving within the SDNZ model. Buddy diving is a team of two or three comparably equipped scuba divers in constant communication/contact with each other. They MUST monitor each other's well-being during a dive and be ready to assist at any time. Within the group one diver MUST be allocated as the dive leader.

Each diver MUST be equipped with an alternative air source to offer to their buddy in the event of a catastrophic equipment failure or the exhaustion of gas supply.

Buddy diving ceases if the buddy pair lose contact with each other, in this scenario, the dive SHOULD be terminated.

### 5.4.2 Termination of a dive

Divers SHOULD be encouraged to refuse to dive or end a dive at any time if they feel the dive is unsafe or they are not comfortable with the dive for any reason.

### 5.4.3 Operational Depth Restrictions

The SDNZ member organisation MUST allocate Operational Depth Restrictions to all divers. These SHOULD be reviewed at least annually. The depth restriction should be based on the depth rating training requirements as listed in Section 8.4.5 and recent diving experience. If a diver hasn't dived at, or close to, their operational depth restriction recently their depth limit SHOULD be reduced to match recent experience. The SDNZ member organisations dive safety manual may outline the micro-credentials required for divers to increase their operational depth restrictions.

### 5.4.4 Ascent and descent rates

The SDNZ member organisation MUST specify ascent and descent rates in their Diving Safety Manual. These rates will be determined by the decompression management method used.

### 5.4.5 Low visibility

When scientific diving is carried out in low visibility, additional precautions SHOULD be in place. The suitability of buddy diving and the risk of separation needs to be assessed.

If maintaining a buddy team is likely to be difficult, tethered diving should be considered.

All divers involved in diving in low visibility environments SHOULD have completed the 'Limited Nil Vis Diver Micro credential' and if tethers are used, they MUST have completed the 'Tethered Diver Micro credential', Section 8.4.7.

The SDNZ member organisation MAY restrict diving operations to a certain visibility threshold for their diving program or for specific divers.

### 5.4.6 Nitrox

Nitrox MAY be used when approved by the DSB. All divers participating in dives using Nitrox MUST meet the minimum requirements of the 'Nitrox micro credential', Section 8.4.7. The Dive Coordinator for any diving operations using Nitrox MUST be highly experienced in its use and the calculations, tables and dive computers associated with Nitrox diving. All Nitrox diving MUST comply with the advice in the Technical Bulletin May 2020, 'Breathing oxygen and enriched mixtures while diving', available through the DIAG website, link in Section 8.9.

Nitrox dives SHOULD be planned using Nitrox dive tables, Equivalent Air depths and standard Air tables or with the use of Nitrox capable dive computers. When dive computers are used, the SDNZ member organisation MUST ensure that all divers are trained and competent in their use.

All Nitrox dives SHOULD be planned to not exceed a partial pressure of 140 KPa (1.4bar $PPO_2$) oxygen as stated in the Technical Bulletin. Consideration SHOULD be made to factor in workload, water temperature, dive duration, etc and potentially reduce the planned maximum $PPO_2$. Calculations of the expected partial pressures of oxygen SHOULD be done at the dive planning stage and be listed in the Dive Safety Plan.

Oxygen exposure times MUST be monitored by the Dive Coordinator during all diving operations and each divers exposures MUST NOT exceed the NOAA Maximum Exposure times, Section 8.6.

All equipment which, during the dive or cylinder filling process is exposed to concentrations greater than 40% oxygen at pressures above 10 bar, MUST be cleaned and maintained for oxygen service. This includes scuba cylinders, cylinder valves, scuba and other regulators, cylinder pressure gauges, hoses, diver support equipment, compressors, and fill station components and plumbing.

All cylinders MUST be handled and appropriately labelled in accordance with the Worksafe NZ Guide to Gas Cylinders, link in Section 8.9.

### 5.4.7 Altitude Diving

Because of the reduced atmospheric pressure at altitude, no-decompression limits may need to be adjusted for dives above sea-level as required by the decompression tables in use. There are various methods of making these adjustments and the altitude at which these adjustments are required vary between methods. The organisations chosen method of calculating nitrogen exposure (e.g., Dive Computer, USN Dive Tables, DCIEM Tables, etc) will all have different specific changes that need to be made. The SDNZ member organisation MUST determine a suitable method and ensure that all operational divers are trained in how to carry out these calculations.

An example of altitude corrections and procedures is the US Navy Diving manual- see link in Section 8.9.

### 5.4.8 Flying or ascending to altitude after diving

Divers MUST not fly or ascend to altitude immediately after diving as the resultant decrease in air pressure may induce decompression sickness. Appropriate guidelines should be followed when ascending to altitude after diving but as a rule of thumb, divers should plan to wait at least 24 hours following standard no-decompression diving activity or 48 hours when decompression, repetitive, or deep (>18m) diving is conducted before flying. Divers must also follow the "rules for flying after diving" according to the dive table or dive computer that they used for the dive.

Reduced time periods before flying/ ascending to altitude maybe permitted at the discretion of the DSB but must be planned and described in the Dive Plan. The DSB should consider the guidance set out in AS/NZS2299.1 2015 'Guidelines Regarding Exposure to Altitude following diving' or the US Navy ascending to altitude rules.

### 5.4.9 Tethered Diving

Tethered diving may be the most appropriate technique is some situations. All divers involved with tethered diving MUST have completed the 'Tethered Diver Micro Credential'.

Minimum teams for tethered diving, standard lifeline signals and limitations are listed in Section 8.7.

### 5.4.10 Tool Use

Limited hand tool use MAY be permitted by the SDNZ member organisation and if powered MUST comply with the Worksafe Technical Bulletin May 2020 'Diving with Underwater power tools', available through the DIAG website, link in Section 8.9.

All tools used MUST be thoroughly assessed for risk and divers MUST receive appropriate training before operational dives with tools.

### 5.4.11 Diving in Remote Locations

All diving undertaken in remote locations SHOULD ensure risks are minimised with controlled ascents, routine safety stops at the end of each dive and if more than 2 hours from a recompression chamber, planned with extra conservancy. Any significant risk-increasing factor (e.g., cold water or hard work) SHOULD lead to shortening of dive times further.

Sufficient emergency oxygen equipment MUST be available on site to provide recommended levels of medical oxygen to two breathing or non-breathing patients for the time it takes from initial response to a diving emergency to reaching medical facilities. Consideration MUST be given to the potential for multiple patients.

### 5.4.12 Other activities requiring special consideration

Other diving activities not previously mentioned are currently not supported by Science Diving New Zealand. Any SDNZ member organisation wishing to undertake such activities MUST ensure they can meet their statutory obligations under the HSWA and are advised to

seek further guidance from an appropriate source. Where possible, existing standards from overseas scientific groups or other sectors should be used. Examples of these activities are:

a) Staged decompression diving;
b) Mixed gas diving;
c) Diving using rebreathers;
d) Surface Supplied Breathing Apparatus (SSBA);
e) Twin cylinder use.

#### 5.4.13 Emergency deviations from the Diving Safety Manual

In the event of an emergency, the Dive Coordinator SHOULD have the authority to deviate from the organisations Diving Safety Manual to protect the wellbeing of the divers, but in doing so they MUST not put any member of the team at additional risk.

If a deviation from the Diving Safety Manual occurs, it MUST be reported in full to the DSO / DSB for review.

# 6 Diving Equipment

## 6.1 General duty of a PCBU to provide personal protective equipment

Section 15 of the General Risk and Workplace Management (GRWM) Regulations outlines the requirement for PCBU's to provide PPE in order to minimise health and safety risks.
The equipment suggestions in section 6 provide both minimum RECOMMENDED equipment for scientific SCUBA divers and information on other equipment that a PCBU MAY consider necessary depending on the risks that are identified and the tasks to be completed.

Further information on specific equipment considerations can be found in Section 6 under or alternatively in the appropriate micro-credentials.

## 6.2 Minimum individual equipment requirements

Diving is an equipment intensive activity and the equipment used SHOULD be maintained at a minimum as per manufacturers recommendations. Each diver will require a minimum set of equipment, as well as any task related equipment, in order to be able to safely complete the dive.

For SCUBA diving operations the RECOMMENDED minimum required equipment that each diver should have is:

a) Open Circuit SCUBA system, comprising as a minimum of a 1st stage regulator, two 2nd stage demand regulators and a submersible pressure gauge (SPG);
b) Buoyancy compensator (BCD) that is inflatable both orally and from a compressed gas cylinder and that provides ample positive buoyancy at the surface;
c) Face mask – either ½ mask or Full-Face Mask (if relevant micro-credential is held);

d) Swimming fins;
e) Suitable cutting device – either divers knife or emergency shears;
f) Weight system, with a quick release closure;
g) Suitable exposure protection (wetsuit or drysuit, depending on training and experience) for the expected conditions;
h) A dive computer that has been approved for use by the institutions Diving Safety Board (to track depth and time);
i) A signalling device appropiate for the diving conditions.

NOTE: With permission from the DSB / DSO the diver may use a suitable watch/timer and a separate depth gauge to track depth and time during the dive.

Where the organisation allows the use of personal equipment by workers, this SHOULD be authorised by the DSO and service records SHOULD be copied and kept on file.

## 6.3 Full-Face Masks (FFM's) and Communications

Full-Face Masks (FFM's) require extra training and familiarity (the separate FFM micro-credential MUST be completed); however, FFM's can provide several advantages for scientific divers. FFM's are RECOMMENDED if diving in areas where contamination or pollution may be present, allow the diver to transmit information to the surface to be recorded (especially useful in conjunction with a live video feed) and can allow buddies to co-ordinate to achieve more complex tasks.

Disadvantages of FFM's include an increased gas use (especially if talking), potential fitting issues, positive buoyancy increase, issues with providing buddy support (spare second stage) and the associated cost to purchase and maintain the masks as well as the additional training required.

There are several brands which are available, DSO's will need to decide what features are required for their program in order to choose the most suitable for their needs.
See the relevant micro-credential for any specific requirements and further information.

## 6.4 Tethered Diving

Tethered diving may be an appropriate technique under certain circumstances. For more information refer to Section 5.4.8.

## 6.5 General diving equipment considerations

Due to the nature of dive equipment it is often necessary for individuals to be issued specific sets of equipment for their use during a project. This equipment may be issued permanently for the duration of their employment, or it may be project or job specific. Considerations around how equipment is issued include contamination and cleaning, cost, how often the equipment is used and the availability. In all cases it is important that the equipment is fitted

correctly, that the diver is familiar with it and has been adequately trained in its use, and that the equipment is fit for purpose for the tasks that need to be completed.

## 6.6 Familiarity of equipment

Scientific divers are required to maintain their familiarity with the equipment that they use. This justifies the minimum activity requirement of 12 dives per year and divers are encouraged to exceed this number if possible.

Divers are also encouraged to dive with their preferred equipment configuration as often as possible as this lowers the inherent risk of diving by reducing the level of task loading that a diver is subjected to during a dive.

## 6.7 Servicing and record keeping

All equipment used in an organisations scientific diving program should be serviced at a minimum as per the manufacturers recommendations. Maintenance records should be kept for a period of at least 7 years for all serviced equipment. This applies even if a worker chooses to supply their own equipment.

## 6.8 Emergency oxygen equipment

The use of oxygen in diving related emergencies has been recommended for many years. Since 1878 it has been shown that breathing 100% oxygen can relieve the symptoms of decompression illness. All diving operations **MUST** have sufficient medical grade oxygen available (and staff trained to deliver it) to provide recommended levels of oxygen to a breathing or non-breathing patient until emergency services arrive or they can be transported to medical facilities.

The diving coordinator must take into account the location of the dive site, potential for multiple patients, access to medical facilities and assess the risk associated with the diving that is occuring.

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. Oxygen equipment should be tested and serviced at least every year and after every use, or as recommended by the manufacturer and only medical-grade oxygen is to be utilised.

In New Zealand, emergency oxygen training is usually valid for 2 years from the date of training.

## 6.9 Compressors and air quality

The Dive Coordinators are responsible for ensuring that breathing gases used in diving

operations do not present a risk to the divers. SCUBA cylinders MUST be filled from either a reputable certified (e.g., NZUA Clean Air) supplier of compressed gas, or by the organisations own compressor that has maintenance and filling logs compliant with the requirements from AS3848.2:1999. Filling SCUBA cylinders in New Zealand is regulated by Worksafe NZ and requirements are specified in the Health and Safety at Work (Hazardous Substances) Regulations 2017.

In all cases, divers are recommended to check the contents of their cylinders when attaching the regulator first stage ("sniff test") – if there are any objectionable odours or tastes, then the cylinder should not be used. The Dive Coordinator is required to set any contaminated cylinders aside, mark them so that they are not used again and empty and clean the cylinders before they are filled again.

# 7 Required incident reporting

All diving and snorkelling incidents, including unsafe acts (where work was observed to be undertaken unsafely, but no incident occurred), near misses (an unplanned event that didn't result in injury but had the potential to do so), incidents requiring recompression treatment, or resulting in moderate injury shall be reported by the Dive Coordinator to the DSO as soon as practical.

If the incident results in serious harm or death, the incident must be reported by the Dive Coordinator to the DSO and WorkSafe NZ immediately.

In any case where equipment malfunction was likely or was suspected to have been a likely cause of a serious accident, then this equipment should be immediately sealed. In any case where a fatality has occurred, all equipment should be left in the condition that it was in at the time of the accident until it has been investigated by the relevant authorities. Notwithstanding this, the breathing gas supply should be isolated to retain the remaining gas in the cylinder and the type of breathing gas used noted. During such isolation, the number of turns, any undue force or any other actions required to isolate the gas supply should be noted and recorded.

Maritime incidents must be notified to Maritime New Zealand who will likely investigate. See https://maritimenz.govt.nz/commercial/safety/accidents-reporting/default.asp

# 8 Appendices

## 8.1 Science Diving New Zealand (SDNZ) Terms of Reference

**Background**

Scientific Diving is diving performed for the purpose of professional scientific or archaeological research, or related educational activities. It is neither recreational nor commercial diving. Scientific diving exists in a health and safety framework that involves persons conducting a business or undertaking (PCBUs), certified scientific divers, dive safety officers, dive leaders, scientific project leaders and regulatory authorities.

The New Zealand scientific diving sector has a long-standing safety record and greater input from all organisations undertaking scientific diving will assist in preserving this record. Science Diving New Zealand (SDNZ) includes members from organisations conducting scientific diving in New Zealand, with the objective of promoting safety in scientific diving and providing an avenue for the sector to have greater say in the regulatory framework that governs it.

**Purpose**

The purpose of Science Diving New Zealand is to:

a) enhance the visibility of the scientific diving sector as a high quality, safe, sustainable, and well-connected sector;
b) facilitate, promote and maintain communication between organisations within the scientific diving sector;
c) to promote best practice in scientific diving operational and safety issues;
d) to encourage standardisation and coordination of scientific diver training and operational procedures;
e) to become established as a recognised body with the responsibility to provide advice and guidance to regulatory authorities on training and operational standards for scientific diving;
f) to foster links with international scientific diving initiatives (e.g., American Academy for Underwater Sciences, European Scientific Diving Panel).

SDNZ has no legal status and will operate according to the structure described below.

**Chair**

A chair will be appointed from within the SDNZ membership for an initial term of two years. The chair will be responsible for:

a) ensuring that SDNZ members are aware of the Terms of Reference, and that the Terms of Reference are adhered to by all members;
b) convening SDNZ meetings, with the option of postponing meetings or convening supplementary meetings as may be required;
c) requesting and documenting the names and affiliations of participants at each meeting and ensuring that these are noted in the meeting minutes;
d) setting the rules of engagement for meetings, facilitating constructive questioning, managing conflict resolution and focussing on relevant issues;
e) striving for consensus while ensuring the transparency and integrity of the meeting;
f) overseeing the progress of SDNZ activities.

**Membership**

The SDNZ membership will be open to organisations that are undertaking activities recognised as scientific diving providing, they meet the participation threshold, agree to these Terms of Reference (TOR), and receive the agreement of the committee. Organisations will be represented at SDNZ by their diving safety officer (DSO) or equivalent. The DSO must be recognised by the organisation they represent as the point of communication for raising and discussing issues with SDNZ. The DSO must also remain affiliated to the organisation they represent throughout their term on SDNZ. Members must commit to:

a) preparing for, attending and participating actively in meetings;
b) participating appropriately in discussions;
c) resolving issues;
d) following up on agreements and tasks;
e) maintaining confidentiality of meeting discussions and deliberations (unless otherwise agreed in advance);
f) adopting a constructive approach;
g) avoiding repetition of earlier deliberations, particularly where agreement has already been reached;
h) facilitating an atmosphere of honesty, openness and trust;
i) respecting the role of the Chair;
j) listening to the views of others, and treating them with respect;
k) consulting with and advising as required within their organisations;
l) sharing information between SDNZ members;
m) submit statistics summarising diving activity when requested by the chair.

**Conduct**

Members must contribute towards concrete outputs from SDNZ in the form of scientific diving standards and consultation documents, focussing on operational and safety issues related to scientific diving and diving as a tool for scientific research.

Where practicable, members should develop recommendations by consensus, noting differences of opinion when and where they continue to exist. Where consensus cannot be reached, decisions will be made by majority vote. Each member organisation will have the right to cast one vote (completed by the organisations dive safety officer or nominated representative). Voting should be done in person at an SDNZ meeting; however, remote

voting may in some cases be possible upon approval of the chair.

Members will expect open and honest discussion that considers the purpose of the group. Members who do not adhere to the terms of reference, or use information presented at meetings inappropriately, may be requested by the Chair to leave a particular meeting or to refrain from attending one or more future meetings. In more serious instances, members may be removed from SDNZ.

**Conflicts of interest**
Conflicts of interest, whether real or perceived, will be disclosed to the group at the start of each meeting, noted and managed by the chair.

**Meetings**
Meetings will occur at least once a year at a time agreed by the members. Additional meetings, if required, may be proposed by the Chair. A meeting quorum will be reached when the Chair and at least three other members are present. In the absence of a quorum, the Chair may decide to proceed as a sub-group, with outcomes being discussed with the wider group electronically or taken forward to the next meeting at which a quorum is formed. Members will need to be self-financing to attend meetings. Attendance via Teleconference / Video conferencing is acceptable; however, members should endeavour to meet in person when possible.

Meeting agendas will be provided by the Chair. Significant issues for discussion at meetings should be undertaken via the Chair, through the submission of relevant supporting material. The Chair will circulate these to all members in a timely manner no less than 7 days prior to the convening of the meeting. However, it is also likely that some documents may be made available for the first time during the meeting due to time constraints. If a document is not available for sufficient time before the meeting, the Chair may provide for additional time following the meeting for additional comments from members.

Minutes of meetings shall be taken by SDNZ members on a rotational basis, verified by the Chair and circulated to SDNZ members. Comments on meeting minutes should be returned to the Chair within 10 days of circulation. Minutes are to be finalised within 15 days of circulation.

All communication of consequence/relevance will be copied to all SDNZ members.
Experts in specialized fields or from regulatory bodies may be invited to the meetings on an ad hoc basis

**Amendment, modification or variation**
Amendment, modification or variation to these terms of reference shall be made by consensus agreement of SDNZ and noted below.

**Amended**
V1.0 Adopted June 2022

## 8.2 SDNZ Applicant checklist

For an organisation to become a SDNZ member and have the ability to train and certify scientific divers according to the SDNZ manual, this form must be completed and signed by an Officer of the organisation applying for membership (refer to Health and Safety at Work Act 2015, Part 1, Subpart 3, section 18 for the definition of a 'Officer).

Once signed, a scanned copy should be sent to SDNZ for review.

| | |
|---|---|
| I confirm that _____ (Add PCBU's name) _____ agrees to the Terms of Refence for Science Diving New Zealand | Initialled by an Officer of the PCBU |
| I also confirm that:<br>A Dive Safety Board (DSB) has been appointed in accordance with the requirements of the DSB as set out in the SDNZ manual Section 3.i | |

The Members of the DSB are as follows (state which of the members are active scientific divers)

| | DSB member/ position title | Active scientific diver (Y or N) |
|---|---|---|
| 1 | | |
| 2 | | |
| 3 | | |
| 4 | | |
| 5 | | |
| 6 | | |
| 7 | | |
| 8 | | |
| 9 | | |
| 10 | | |
| 11 | | |
| 12 | | |

| | |
|---|---|
| The DSB will meet at least annually | |
| A Diving Safety Officer has been appointed and their experience and qualifications meet or exceed the qualifications and experience specified in section 3.ii in the SDNZ manual | |
| The Diving Safety Officer name and contact details are: | |

| | |
|---|---|
| Name | |
| Email | |
| Cell phone | |

| | |
|---|---|
| A representative of the PCBU will attend the annual SDNZ meeting (usually the DSO). | |
| The PCBU has written a Diving Safety Manual that meets or exceeds the minimum requirements of the SDNZ manual, and this has been reviewed and approved by the PCBU's DSB. | |
| All scientific divers within the PCBU will either be Divers in Training (i.e., currently undergoing training) or be a Scientific Diver with a Certificate of Competency issued by Worksafe NZ as a Scientific Diver. | |
| All training records, servicing records, field dive log sheets and safety plans are saved and maintained for a minimum of 7 years. | |
| A summary of scientific dive activity and any diving related incidents or accidents within the PCBU will be submitted annually to SDNZ on the appropriate form by the end of January for the preceding year for annual SDNZ statistic collation. | |
| The PCBU understands that the standards set out by SDNZ are minimum standards and they are encouraged to apply additional safety standards to their own diving practices. | |
| | |

As an officer of _____(Add PCBU's name)_____, to the best of my knowledge the above statements are true and correct.

_____(Add PCBU's name)_____ wishes to become a member of Scientific Diving New Zealand.

| | |
|---|---|
| Signed (Officer of the PCBU) | |
| Print Name | |
| Role within PCBU | |

## 8.3 SDNZ Annual Stats collection form and Incident Reporting

| | | | |
|---|---|---|---|
| **Organisation** | | **Year** | |
| **Email** | | **Diving Safety Officer** | |

| **Number of Divers logging dives this reporting cycle** |
|---|
| |

**DIVING TYPES**

| | **Dive Time (mins)** | **Dives Logged** | **Number of divers logging dives** |
|---|---|---|---|
| **Scientific** | | | |
| **Training and Proficiency** | | | |

**DIVING MODES**

| | **Dive Time (mins)** | **Dives Logged** | **Number of divers logging dives** |
|---|---|---|---|
| **Open Circuit SCUBA** | | | |
| **Surface Supplied** | | | |
| **Rebreather** | | | |

**BREATHING GAS**

| | **Dive Time (mins)** | **Dives Logged** | **Number of divers logging dives** |
|---|---|---|---|
| **Air** | | | |
| **Nitrox** | | | |
| **Mixed Gas** | | | |

**DIVING DEPTH RANGE**

| **Depth** | **Dives Logged** | **Number of divers logging dives** |
|---|---|---|
| **0 – 10m** | | |
| **10 – 20m** | | |
| **20 – 30m** | | |
| **30m+** | | |

**Incident Reporting**

All diving-related incidents including divers and surface support will be reported to individual PCBU's, including unsafe acts, near misses, incidents requiring recompression treatment, or incidents resulting in moderate or serious injury, or death. SDNZ requires serious injuries and incidents to be notified annually for reporting across the sector.

| Incident rating scale | Number of incidents | Brief Description |
|---|---|---|
| Injury requiring medical treatment | | |
| Serious injury requiring hospitalisation | | |
| Hyperbaric, not requiring recompression | | |
| Hyperbaric injury, requiring recompression treatment | | |

DSO's are encouraged to bring reports of incidents, near misses and safety improvements to the annual meeting to identify trends across the sector.

## 8.4 SDNZ Science Diver competency requirements

### 8.4.1 GENERAL POLICY

#### 8.4.1.1 Scope

This Section specifies the requirements for training occupational divers undertaking underwater diving operations performed for the purpose of professional scientific or archaeological research, cultural and natural resource management, or related educational activities; hereafter 'Scientific Diving'.

These guidelines is not intended to be used for training divers within the construction industry, military, police or emergency services.

These guidelines apply to scientific diver training where breathing gas is supplied through self-contained underwater breathing apparatus (SCUBA). This standard provides initial training for scientific diving to 10 m using compressed air, and pathways to increase the depth limit and add other micro-credentials where specific operational tasks require it (e.g. Dive Coordinator, Nitrox Diving, Drysuit Diving, Air Fillers, Full-Face Mask, Tethered diving).

### 8.4.2 SCIENTIFIC DIVER TRAINING REQUIREMENTS

The following sections describe the minimum required level of knowledge and skills that candidates MUST meet before they are considered scientific divers by SDNZ. Individual diving programs are encouraged to expand upon and augment these requirements, develop or utilise appropriate educational materials, and optimise instructional programs to suit and reflect their specific needs.

#### 8.4.2.1 PREREQUISITES

##### 8.4.2.1.1 Administrative

The candidate MUST complete all administrative and legal documentation required by their organisation.

##### 8.4.2.1.2 Entry Level Diver Certification

The candidate MUST, at a minimum, show documented proof of Diver Certification or equivalent from an internationally recognized training agency. Organisations who wish to train and certify entry level divers may do so under the standards of the most current version of the RSTC/WRSTC and/or ISO entry-level diver standards. Entry level diver training is a prerequisite to scientific diver training and therefore MUST NOT be counted in any way toward scientific diver training.

a) Minimum Course Content for Open Water Diver Certification"- World Recreational Scuba Training Council (WRSTC), www.wrstc.com;
b) Safety related minimum requirements for the training of recreational scuba divers -- Part 2: Level 2 -- Autonomous diver". ISO 24801-2:2007- International Organisation for Standardisation (ISO) - www.iso.org.

#### 8.4.2.1.3 Medical Examination

The candidate MUST be medically qualified for diving and hold a current Medical Clearance for Occupational Diving issued by Diving & Hyperbaric Medicine Directorate

#### 8.4.2.1.4 Swimming/Watermanship Evaluation

The candidate MUST demonstrate the following in the presence of the DSO or designee. All tests are to be performed without swim aids; however, where exposure protection is needed, the candidate SHOULD be appropriately weighted to provide for neutral buoyancy.

a) Swim 400m;
b) Fin swim 800m;
c) Tread water for 15 minutes with the final 2 minutes without the use of hands (for a total of 15mins);
d) Swim underwater for a distance of 15 m without surfacing;
e) Transport a passive person of approximately equal size a distance of 50 m in the water.

### 8.4.2.2 Minimum Training Requirements

The candidate MUST successfully complete all theoretical aspects, practical training, and a minimum of 16 open water scientific training dives for a combined time of 360 minutes (see Table 1). Upon completion of the requirements of this standard the diver will be eligible to dive to a maximum of 10 m, and carry out scientific diving tasks, as an occupational diver for a scientific organisation.

Micro-credentialing allows a pathway for divers to increase depth limits, add additional training for specific dive equipment, or undertake scientific diving in specialist diving environments/conditions.

**Table 1.** Required training and experience for depth ratings.

| Depth rating | Required training and experience |
|---|---|
| 0-10 | Theory and practical components laid out in Section 3 and 4 |
| 10-20 | Competencies as defined in Section 8.4.5.1, plus diving experience |
| 20-30 | Competencies as defined in Section 8.5.4.2, plus diving experience |
| 30+ | Competencies as defined in Section 8.4.5.3, plus diving experience |

Any candidate who does not convince the DSB, through the DSO, that they possess the necessary judgment, under actual diving conditions, for the safety of the diver and his/her buddy, SHOULD be denied organisational scientific diving privileges.

### 8.4.2.3 Recognition of Prior Learning

The DSB MAY acknowledge recognition of prior learning for specific requirements of training, examinations, depth authorisations, and minimum activity to maintain authorisations. Medical standards MUST NOT be waived.

### 8.4.3 DIVE THEORY AND KNOWLEDGE REVIEW

The following are the specific areas of theoretical competency required to meet this training standard. Each organisation MAY develop their own methodology for meeting the required elements of competency and performance criteria in each section.

#### 8.4.3.1 Scientific Diving Regulations

| Elements of competency | Performance criteria |
|---|---|
| Conform to statutory requirements for work health and safety in diving operations | a) Explain the main duties of the PCBU and worker under The Health and Safety at Work Act 2015 (HSWA)<br>b) Explain any requirements of, and duties imposed by relevant health and safety regulations in regard to diving, including the Health and Safety at Work Act 2015, and the Hazardous Substances and New Organisms (HSNO) Compressed Gas Regulations (2004).<br>c) Act according to these requirements during all practical exercises |
| Conform to general requirements of Good Practice Guidelines, Australian/New Zealand Standards and Codes of Practice | d) List the Guidelines and Standards applicable to diving operations and training of divers<br>e) Explain the general requirements of Guidelines, Standards and relevant Codes of Practice in performing occupational diving work<br>f) Explain the requirements for testing and examination applicable to diving plant and equipment<br>g) Demonstrate compliance with the general requirements of any relevant guidelines, Standards and Codes of Practice when performing diving work |
| Maintain health and safety of individuals and others | h) Maintain own health and safety and that of others in the team, or others in the vicinity of the work site<br>i) Cooperate with the employer and dive coordinator/supervisor in following defined work health and safety procedures<br>j) Observe basic regulatory requirements<br>k) Identify and explain hazards other than those directly relating to diving affecting individuals of a dive team |
| Undertake site and task-specific risk assessment and select appropriate risk control measures | l) Identify site and task-specific hazards<br>m) Analyse and evaluate risk, according to relevant regulations, guidelines, Standards (e.g. AS/NZS 2299.2), policies and procedures<br>n) Select appropriate risk control measures, according to relevant regulations, guidelines, standards, policies and procedures |
| Scientific Dive Planning | o) Identify site and task specific risks<br>p) Analyse and evaluate the identified risks<br>q) Select appropriate risk control measures for the identified risks |
| Equipment servicing and | r) Demonstrate an understanding of servicing and |

| | |
|---|---|
| records of service | maintenance requirements according to the manufacturer's instructions<br>s) Demonstrate an understanding of appropriate record keeping within an organisation for equipment servicing and maintenance |

#### 8.4.3.2 Roles within a scientific diving team/organisation

| Elements of competency | Performance criteria |
|---|---|
| Describe underwater work conducted by scientific divers | a) Describe the main types of work carried out by scientific divers<br>b) Describe, in broad terms, some of the problems associated with scientific diving |
| Describe available qualifications for the occupational diver | c) List available qualifications for the occupational diver<br>d) Describe pathways to different qualifications within the diving industry<br>e) Describe the basic principles of competency-based training and how this is applied to current diving qualifications<br>f) State which countries offer reciprocal recognition of Australian/New Zealand qualifications |
| Describe, in broad terms, the institutions, industries and government bodies associated with scientific diving in New Zealand | g) List orgnisations, industry and government agencies associated with restricted occupational SCUBA diving in New Zealand<br>h) Describe the diving purpose and function of these organisations, industry and government agencies |
| Describe the core roles involved in the administration of an organisations scientific diving programme | Describe the responsibilities of the following roles in administering an organisations scientific diving programme:<br>i) Diving Safety Board (DSB)<br>j) Diving Safety Officer (DSO)<br>k) Dive Coordinator<br>l) Dive Leader<br>m) Diver |
| Describe the minimum dive team | Describe the responsibilities of the following roles within a dive team:<br>n) Dive Coordinator<br>o) Dive leader<br>p) Dive team member<br>q) Divers attendant<br>r) Standby diver |

#### 8.4.3.3 Diving First Aid

| Elements of competency | Performance criteria |
|---|---|
| Assess and establish the needs of a diving casualty | a) Perform a systematic examination of a person simulating an injured or ill diver in accordance with appropriate procedures<br>b) Determine whether first aid procedures or oxygen therapy |

| | |
|---|---|
| | is needed in a timely manner<br>c) Identify situations where recompression treatment may be needed in a timely manner<br>d) Determine whether the assistance of a more experienced person is required for assessment of a diving casualty and obtain assistance if necessary |
| Give first aid to a diving casualty | e) Ensure availability of first aid equipment, including pure oxygen administration kit, at dive site<br>f) Determine whether the assistance of a more experienced person is required and obtain assistance if available<br>g) Give appropriate first aid promptly, in accordance with operational procedures<br>h) Maintain hygiene standards to an acceptable level |

#### 8.4.3.4 Dive Rescue

| Elements of competency | Performance criteria |
|---|---|
| RSTC Entry Level Rescue Diver | a) Complete rescue diver certification |
| Act as in-water standby diver (when divers are near enough to communicate and act as standby diver for each other) | b) Describe appropriate emergency/rescue procedures according to the equipment used<br>c) Follow appropriate emergency/rescue procedures according to the equipment used<br>d) Maintain communication with surface throughout the rescue procedure to ensure surface team is prepared for any necessary action |
| Act as surface support in an emergency situation | i) Assist in the recovery of a simulated unconscious or injured diver from surface onto dry land, deck or dive platform to ensure no further injury is sustained to diver<br>j) Administer appropriate assistance as directed by the dive coordinator/supervisor<br>k) In the absence of the dive coordinator/supervisor, initiate emergency response activities |

#### 8.4.3.5 SCUBA equipment and its safe use

| Elements of competency | Performance criteria |
|---|---|
| Operate, inspect and maintain personal dive equipment | a) List a variety of SCUBA equipment configurations used in occupational diving operations and recognise the key features of each<br>b) Describe operational principles for the use of personal diving equipment covering the following:<br>i. Minimum equipment required for a SCUBA dive<br>ii. Function of each item of diving equipment<br>iii. Method of operating various items of diving equipment |

| | |
|---|---|
| | iv. Procedures for connecting and maintenance of equipment<br>v. Common types of equipment faults<br>vi. Consequences of inappropriate use of equipment<br>vii. Legal and regulatory procedures and requirements<br>c) Perform routine inspection and minor maintenance on personal dive equipment<br>d) Explain the basis for a formal maintenance system |
| Explain how to fill SCUBA cylinders, including appropriate safety procedures | e) List the different types of gas cylinders applicable to a SCUBA dive operation<br>f) Describe different methods of filling air cylinders (AS 3848.2)<br>g) Describe appropriate safety measures when filling air cylinders (AS 3848.2) |
| Test gas quality | h) Explain the need for testing gas quality and limitations of user on-site gas testing |

### 8.4.3.6 Dive Physics and Physiology

| **Elements of competency** | **Performance criteria** |
|---|---|
| Describe the main anatomical structures and physiological systems of the human body, particularly the respiratory, circulatory and central nervous systems | a) Describe the structure and principal functions of:<br>i. Musculoskeletal systems<br>ii. Central and peripheral nervous system<br>iii. Cardiovascular system<br>iv. Ears<br>v. Sinuses<br>vi. Vestibular organs<br>vii. Respiratory system<br>viii. Gastrointestinal system<br>ix. Endocrine and immune systems<br><br>b) Describe the physiological effects of changes in breathing gas composition and pressures |
| Use common units of measurement for pressure, volume and temperature | c) List common units of measurement for pressure, volume and temperature<br>d) List sources of conversion tables<br>e) Convert pressures, volumes and temperatures from one unit to another |
| Describe the relationship between pressure, volume and temperature of gases | f) Define the following terms:<br>i. Atmospheric pressure<br>ii. Hydrostatic pressure<br>iii. Absolute pressure<br>iv. Ambient pressure<br>v. Gauge pressure<br>g) Describe the relationship between pressure and volume |

| | |
|---|---|
| | (Boyle's Law)<br>h) Calculate volume changes with changing depths and pressures<br>i) Describe the relationship between pressure and temperature (Charles' Law)<br>j) Calculate pressure changes with changes in temperature |
| Explain the effects of pressure, volume and temperature changes on the diver and their implications | k) List gas spaces in the human body<br>l) Define the term barotrauma<br>m) List some typical barotrauma injuries<br>n) Explain how temperature change applies to cylinder pressures<br>o) Describe the factors affecting heat loss under water and its effect on the diver |
| Explain partial pressure and solubility of gases and their effect on the diver | p) Explain the terms:<br>i. Partial pressure<br>ii. Saturation<br>iii. Equilibrium<br>q) Explain the principles of partial pressure of gases (Dalton's Law)<br>r) Explain the need for decompression as it relates to partial pressure and solubility of gases<br>s) Explain inert gas narcosis |
| Explain the principle of buoyancy and its effect on the diver and submerged objects | t) Explain Archimedes' Principle<br>u) Explain the different effects of saltwater and fresh water on buoyancy |

### 8.4.3.7 Decompression Management Tools

| **Elements of competency** | **Performance criteria** |
|---|---|
| Use decompression tables to calculate safe diving profiles | a) Explain the purpose and use of decompression tables and dive computers and list the limitations of each<br>b) Use approved decompression tables to demonstrate the appropriate use of:<br>i. Depth increments<br>ii. Time increments<br>iii. Stop times<br>iv. Ascent rates<br>v. Total decompression time<br>vi. Bottom time<br>vii. Total dive time<br>viii. Surface interval<br>c) Use industry accepted decompression tables to calculate the following without error:<br>i. 'No stop' bottom time for given depth/time increments<br>ii. Decompression depth/time increments<br>iii. Repetitive dive time increments |

| | |
|---|---|
| | d) Explain the corrective actions necessary to compensate for deviation from the decompression schedule |
| Demonstrate competence and understanding of dive computers in use | e) Demonstrate a thorough understanding of:<br>i. Pre-dive computer setup procedures, including how to set the gas mixture, depth and NDL alerts<br>ii. The computers underwater display and warnings<br>iii. The computers dive planning functionality<br>iv. Maintenance |

#### 8.4.3.8 Dive Environments

| Elements of competency | Performance criteria |
|---|---|
| Demonstrate an understanding of special considerations for a range of diving environments | a) Describe the considerations for scientific diving in the following environments<br>i. Altitude<br>ii. Ice<br>iii. Cold water<br>iv. Blue water<br>v. Low visibility<br>vi. Night<br>vii. Remote locations<br>viii. Ports and marinas<br>ix. Overhead environments<br>x. High flow and currents<br>xi. Polluted water |

#### 8.4.3.9 Underwater data gathering techniques

| Elements of competency | Performance criteria |
|---|---|
| Explain the use of various underwater survey techniques | b) Explain the following underwater survey techniques:<br>i. Transects and Quadrats<br>ii. Mapping<br>iii. Coring<br>iv. Photography<br>v. Tagging<br>vi. Collecting<br>vii. Site Selection, Location, and Re-location |

#### 8.4.3.10 Micro-credential 'system'

| Elements of competency | Performance criteria |
|---|---|
| Explain the principles of micro-credentialing within the context of scientific | a) Describe the benefits and limitations of minimum training standards<br>b) Describe the benefits and limitations of micro-credentialing |

| | |
|---|---|
| diver training in New Zealand | c) Describe how micro-credentialing works alongside minimum training standards |

### 8.4.4 PRACTICAL TRAINING / SKILLS DEVELOPMENT

The following are the specific areas of practical competency required to meet this training standard. Each institution MAY develop their own methodology for meeting the required elements of competency and performance criteria in each section.

#### 8.4.4.1 Dive planning and leadership

| Elements of competency | Performance criteria |
|---|---|
| Assist the dive coordinator/supervisor in the preparation of a work plan for a SCUBA diving operation | a) Assist the dive coordinator/supervisor with the preparation of a comprehensive dive plan, safety plan and checklist<br>b) Assist the dive coordinator/supervisor when checking and ensuring that all essential items are present in the equipment supplied for the diving operation<br>c) Assist the dive coordinator/supervisor when conducting appropriate pre-dive tests on relevant equipment to ensure correct functioning in accordance with the procedures issued by the employer<br>d) Assist the dive coordinator/supervisor when selecting any tools necessary to allow completion of the dive objectives<br>e) Assist the dive coordinator/supervisor in conducting a risk assessment of the diving operation, identify possible hazards, and report these to the dive coordinator/supervisor and observe resulting safety precautions<br>f) Assist the dive coordinator/supervisor by acting as the dive attendant |
| Calculate air consumption rates | c) RMV's to be calculated on at least 5 dives including a variety of depths and conditions.<br>d) Calculate expected air for a dive once 5 RMV's have been calculated and compare with actual gas use |
| Lead a dive under the direction of a dive coordinator | e) Control the underwater portion of a dive<br>f) Comply with all instructions of the dive coordinator<br>g) Plan and execute a dive safely<br>h) Demonstrate judgment adequate for safe scientific diving |

#### 8.4.4.2 SCUBA equipment and its safe use

| Elements of competency | Performance criteria |
|---|---|
| Check and prepare | a) Select appropriate equipment for the dive, and ensure |

| | |
|---|---|
| equipment, enter and exit water in an appropriate manner while wearing scuba gear | appropriate storage during transport to the site<br>b) Inspect all equipment carefully for signs of deterioration, damage or corrosion and test for proper operation where required, prior to deployment to the dive site<br>c) Fit and secure breathing apparatus and other items of equipment correctly<br>d) Provide assistance to another diver to ensure equipment is secured correctly, safely and is undamaged<br>e) Test operation of main and reserve gas supplies as applicable and notify attendant accordingly<br>f) Record all required pre-dive information, including cylinder pressures<br>g) Entry and exit from water in a range of environments e.g. shore, boat, jetty<br>h) Report failed equipment to the dive coordinator/supervisor, mark accordingly and remove from service |
| SMB deployment | i) Use a SMB safely- safe stowage, efficient removal and readying for use, check for overhead obstructions, add sufficient inflation, safe line control/ handling, maintenance of line tension on ascent, re stowing at surface/ ashore/ onboard boat.<br>j) Six deployments of a SMB from 5m while maintaining buoyancy +/-1m for the duration of a safety stop<br>k) Two deployments of a SMB from 10m while maintaining buoyancy +/-1m |
| Carry out post-dive equipment checks, clean and store equipment | l) Inspect all equipment carefully<br>m) Report any deterioration, damaged or failed equipment to the dive coordinator/supervisor, mark accordingly and remove from service<br>n) Wash all equipment used in dive to remove contamination and disinfect as appropriate<br>o) Dry equipment as appropriate and prepare it for next use<br>p) Detail proper care and storage procedures for equipment<br>q) Identify any hazards associated with inadequate storage of equipment and explain appropriate safety precautions<br>r) Store equipment in accordance with safety requirements and according to organisational procedures |

#### 8.4.4.3 Underwater skills and data gathering techniques

| | |
|---|---|
| Core SCUBA skills | a) Pre and post dive checks utilising a standard process (e.g., checklists)<br>b) Demonstrate clearing of mask and regulator while submerged |

| | |
|---|---|
| | c) Demonstrate ability to achieve and maintain neutral buoyancy while submerged<br>d) Communicate effectively underwater<br>e) Monitor gas usage<br>f) No mask swimming<br>g) Demonstrate air sharing in an out of gas emergency<br>h) Demonstrate the complete rescue of an unconscious diver from the bottom<br>i) Safety Stops |
| Buoyancy and finning techniques | j) Ability to maintain a decompression/ safety stop +/- 1m with and without a visual reference<br>k) Complete a task- i.e., tying a series of knots or completing questions on a clipboard, mid water while maintaining buoyancy +/- 1m<br>l) Operate within 1m of the bottom without disturbing the sediment |
| Navigate underwater | m) Demonstrate ability to navigate to a specified location at least 50 m from the start point or 4 times the visibility and back to the start point. Two assessments using a compass and two assessments using natural navigation<br>n) Estimate distance underwater using fin kicks or arm spans |
| Search techniques | a) Carry out bottom searches using transect and circular search patterns |
| Conducting scientific tasks | b) Conduct a minimum of two dives using a range of survey techniques and equipment to collect data<br>i. Transects and Quadrats<br>ii. Mapping<br>iii. Coring<br>iv. Photography<br>v. Tagging<br>vi. Collecting<br>vii. Site Selection, Location, and Re-location |

### 8.4.5 PRACTICAL TRAINING FOR DEPTH LIMIT CERTIFICATIONS

#### 8.4.5.1 11 to 20m certification

| Elements of competency | Performance criteria |
|---|---|
| Complete initial 10 m certification | a) Complete all initial requirements |
| Complete practical diving to a depth of 20 m | b) Successfully complete and log **12** dives under the direction of the DSO, or delegate, to depths between 10 and 20 m, for a minimum total time of 4 hours. |
| Bailout | c) Carry an appropriate bailout system on at least 4 dives |

| | |
|---|---|
| | d) Quickly and efficiently switch to an appropriate bailout system |

#### 8.4.5.2 20 to 30 m certification

| Elements of competency | Performance criteria |
|---|---|
| Complete 20 m certification | a) Complete requirements for 20 m certification |
| Complete practical diving to a depth of 30 m (Including the criteria below) | b) successfully complete and log **5** supervised dives to depths between 20 and 30m, with at least **two** under direct supervision of the DSO or authorised instructor. |
| Complete one dive to a depth between 27 - 30m | c) At least one dive to between 27 and 30 m while completing an exercise to demonstrate the effects of narcosis |
| Simulated Decompression | d) Demonstrate proficiency in the use of the appropriate decompression profiling method to calculate emergency decompression obligations<br>e) Demonstrate the correct procedures during simulated decompression<br>f) Demonstrate ascent rate control and depth control at in-water stops (e.g. safety stops or stimulated decompression stop |
| Bailout | g) Carry an appropriate bailout system at least 4 dives<br>h) Quickly and efficiently switch to an appropriate bailout system |
| RMVs | i) Calculate RMVs on at least two deep dives |

#### 8.4.5.3 30m + certification

| Elements of competency | Performance criteria |
|---|---|
| Complete 30 m certification | a) Complete requirements for 30 m certification |
| Specific deep diver training | b) Complete a DCB approved course appropriate for the planned depth, that meets the requirements of your Organisations Code of Practice / Dive Safety Manual. |

### 8.4.6 ONGOING PROFICIENCY TRAINING

Divers MUST be able to demonstrate the following competencies as an active scientific diver and assessments must be logged in divers logs and recorded by the PCBU:

| Elements of competency | Performance criteria |
|---|---|
| Core SCUBA skills | a) Pre and post dive checks utilising a standard process (e.g., checklists)<br>b) Demonstrate clearing of mask and regulator while submerged<br>c) Demonstrate ability to achieve and maintain neutral |

| | |
|---|---|
| | buoyancy while submerged<br>d) Communicate effectively underwater<br>e) Monitor gas usage<br>f) No mask swimming<br>g) Demonstrate air sharing in an out of gas emergency<br>h) Demonstrate the complete rescue of an unconscious diver from the bottom<br>i) Safety Stops<br>j) SMB use |
| Buoyancy and finning techniques | k) Ability to maintain a decompression/ safety stop +/- 1m with and without a visual reference<br>l) Complete a task- i.e., tying a series of knots or completing questions on a clipboard, mid water while maintaining buoyancy +/- 1m<br>m) Operate within 1m of the bottom without disturbing the sediment |
| Swimming assessment | n) Score a minimum of 15 points across all swim test components detailed in Table 2 OR<br>o) Complete an assessment of ongoing swimming profficiency or fitness as detailed by the individuals DBC. |
| Skills associated with micro credentials | p) As applicable |

**Table 2.** Requirements of annual swimming assessment

| **Elements of competency** | **Points** | | | | | |
|---|---|---|---|---|---|---|
| | **5** | **4** | **3** | **2** | **1** | **Did not complete** |
| Swim 400 m nonstop, without swimming aids and using any stroke or combination of strokes | under 6:30 min | 6:30 to 8:40 min | 8:40 to 11 min | 11 to 13 min | more than 13 min | stopped |
| Swim 800 m face down, using mask, snorkel and fins, nonstop, without flotation aids and without using arms to swim | under 14 min | 14 to 16:30 min | 16:30 to 18:30 min | 18:30 to 21 min | more than 21 min | stopped |
| Tread water, drown-proof, bob, or float using no aids and wearing only a swimsuit for 15 minutes, with hands (not arms) out of the water during the last two minutes | Performed satisfactorily | NA | Stayed afloat, but hands not out of water the entire two minutes | NA | Used side/ bottom for momentary support no more than twice | Used side/ bottom for support more than twice |
| Swim underwater for 15 m nonstop without | NA | Complete the | Complete the | Needed 1 additional | Needed additional | stopped |

| | | | | | | |
|---|---|---|---|---|---|---|
| swimming aids | | distance | distance | breath | breaths | |
| Tow (or push) a diver for 50 m nonstop, at the surface, without assistance with both divers equipped in full scuba equipment. | under 2:10 min | 2:10 to 3:15 min | 3:15 to 4:20 min | 4:20 to 5:30 min | more than 5:30 min | stopped |

#### 8.4.6.1 Emergency Care Training

The scientific diver SHOULD hold current training in the following:

- Adult CPR and AED;
- Emergency oxygen administration;
- First aid for diving accidents.

### 8.4.7 MICRO-CREDENTIALING REQUIREMENTS

Certain types of diving, some of which are listed below, require equipment or procedures that require additional training via a micro-credentialling system. Supplementary guidelines for these are in development:

- Dive Coordinator;
- Nitrox Diving;
- Full Face Masks;
- Drysuits;
- Air Fillers;
- Lifeline;
- Limited / Nil Visibility;
- Altitude;
- Ice and Polar Diving;
- Polluted/Contaminated water;
- Powered tools;
- Ports and Harbours;
- Overhead Environments.

Organisations choosing to use these micro-credentials MUST have procedures for their use established by their Diving Safety Board, which all scientific divers working under their auspices MUST comply with.

## 8.5 SDNZ Reciprocity Recognition form

**Before any person can dive for another PCBU, their DSO should complete a copy of this form and forward it to the host PCBUs DSO for approval. This SHOULD be accompanied by a current (within last 12 months) occupational diving medical.**

| **Personal Details** |
|---|
| Full Name: |
| Contact Phone Number: |
| Contact Email: |
| Next of Kin: |
| Next of Kin Relationship: |
| Next of Kin Address: |
| Next of Kin Phone Number: |

| **Medical Information** |
|---|
| Attached copy of medical: Y / N |
| Any Special Instructions Included in Medical Clearance: |
| Does the diver have any medical conditions that may interfere with their diving safely: Yes / No<br>If YES, please provide details: |

| **Dive Equipment** | |
|---|---|
| Has the divers diving equipment been serviced in the last 12 months: Yes / No | |
| Servicing Organisation: | Service Date: |

| **Diver Experience** | |
|---|---|
| Date of Last Dive: | Number of Dives Completed: |
| Depth of Deepest Dive (last 6 moonths): | Number of Dives in Last Six months: |
| Have you ever undergone hyperbaric chamber treatment for a DCI injury or symptoms: Yes / No<br>If YES, please provide details: | |

| **Current Diver Competencies and Micro-credentials** | |
|---|---|
| Core Science Diver Competencies | Certification Date: |
| Dive Coordinator | |
| EANx | Certification Date: |
| Depth: 10m 20m 30m 30+m | |
| Full Face Mask | |
| Air Fillers | |
| Lifeline / Tethered | |
| Altitude | |
| Ports and Harbours | |
| | |
| | |
| Other Relevant Qualifications: | |

| **Diver Reciprocity** |
|---|
| Name of Home Organisation: |
| Name of Organisations Dive Safety (DSO) Officer: |
| DSO Phone Number: DSO Email: |
| DSO signature: Date: |

| **Host PCBU DSO or Delegate Only** |
|---|
| Qualifications Checked: Yes / No |
| Medical Received: Yes / No |
| Reciprocity Statement Received from Home Organisation DSO: Yes / No |
| Diver Status: |
| Comments: |

## 8.6 NOAA Nitrox exposure table

| $P_{O_2}$ | Single Dive | Daily Limit |
|---|---|---|
| 0.5 | no limit | no limit |
| 0.6 | 720 min | 720 min |
| 0.7 | 570 | 570 |
| 0.8 | 450 | 450 |
| 0.9 | 360 | 360 |
| 1.0 | 300 | 300 |
| 1.1 | 240 | 270 |
| 1.2 | 210 | 240 |
| 1.3 | 180 | 210 |
| 1.4 | 150 | 180 |
| 1.5 | 120 | 180 |
| 1.6 | 45 | 150 |

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## 8.7 Tethered Diving and Line Signals

Tethers are an effective way of allowing the surface to monitor where divers are and can also be used for communication if necessary. Tethered diving MUST NOT be carried out by divers who have not been trained (micro-credential).
There are two methods generally used for tethered diving:

- Surface float
- Tendered by a dive attendant

Both methods MAY be used either by a buddy pair or, if necessary, by a single diver. If either method is used with only a single diver in the water, then the buddy MUST be standing by in full gear (i.e., dressed and ready to enter the water within <30s) and be available during the entire dive.

See the relevant micro-credential for other specific requirements and further information.

**Minimum Dive Teams for tethered diving:**
The RECOMMENDED minimum team for tethered diving is three which includes a current, approved diver, a standby diver plus an additional Surface Support.

The roles within the team are as follows:

- One Diver
- One Standby Diver
- One Surface Support

Tethered diving SHOULD only be permitted under the following conditions:

- All team members have completed the Tethered/ lifeline diver micro-credential and have recent, relevant experience.
- The standby diver is an authorised Diver.
- The standby diver is fully dressed in (drysuit/wetsuit zipped, BCD on, masks and fins at the ready) and ready to enter the water.
- When communications are assured throughout a dive – this can be through voice communications, lifeline or progress float. Signals and communications must be discussed and agreed to prior to diving.
- A lifeline is secured to the diver, the lifeline must have a minimum breaking strain of 500kg.
- The Surface Support can monitor the diver's progress and bubbles from a position close enough to assist within less than one minute.
- If the tethered diving is deeper than four metres and without a buddy, the diver should carry an independent air supply in the form of a bailout. The bailout must be a minimum of 2.5l volume and pressurised to 150 bar or more.
- Max depth 18 metres.

**Standard Lifeline Signals**
Signals comprise either pulls or bells or a combination of both. A pull is a steady single heave on the line. A bell is a sharp quick tug, always given in pairs as with a ship's bell, i.e., five bells is given as: Two quick tugs pause with two quick tugs pause one quick tug. It should be noted

that one bell does not exist as a signal on its own.

**Signals – Attendant to Diver**

**General signals**

| | |
|---|---|
| 1 pull | To call attention. Are you alright? |
| 2 pulls | Am sending down a rope's end (or as previously arranged). |
| 3 pulls | You have come up too far. Go down slowly till we stop you. |
| 4 pulls | Come up. |
| 4 pulls followed by 2 bells | Come up, hurry up. Come up, surface decompression. |

**Direction Signals**

| | |
|---|---|
| 1 pull | Search where you are. |
| 2 bells | Go to the end of distance line, jackstay, or lifeline. |
| 3 bells | Face shot lifeline then go right. |
| 4 bells | Face shot lifeline then go left. |
| 5 bells | Come into your shot, or turn back if on a jackstay. |

**Signals – Diver to Attendant**

**General signals**

| | |
|---|---|
| 1 pull | To call attention. Made bottom. Reached end of jackstay. |
| 2 pulls | Send me down a rope's end (or as previously arranged). |
| 3 pulls | I am going down again. |
| 4 pulls | May I come up? |
| 4 pulls followed by 2 bells | Assist me up. I want to come up. |
| Succession of pulls (must be more than 4) | EMERGENCY SIGNAL (Only to be used in Great Emergency) |
| Succession of 2 bells | Am foul and need the assistance of another diver. |
| Succession of 3 bells | Am foul but can clear myself if left alone. |

**Working Signals**

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| 1 pull | Hold on or stop. |
| 2 bells | Pull up. |
| 3 bells | Lower. |
| 4 bells | Take up slack lifeline. You are holding me too tight. |
| 5 bells | Have found, started, or completed work. |

## 8.8 Air Quality standards

Air quality standards for SCUBA cylinders are specified in the Health and Safety at Work (Hazardous Substances) Regulations 2017. These MUST comply with the guidance provided in AS/NZS2299.1:2015 – Section 4 Breathing Gas Quality.
Any breathing gases used in diving operations SHOULD not present any risk to the divers.

**Water Content.**
Breathing gases used in diving operations MUST have a water content that is low enough to avoid the risk of freezing or condensation. This will be dependednt on the ambient conditions. AS3848.2 recommends that air for SCUBA operations should not exceed 50mg/$m^3$ for cylinders filled to 22500 kPa.

**Odour and Taste.**
There should not be an objectionable odour or taste that may cause nausea in any gas at the point of use.

**Breathing Gas.**
Air used in diving operations should meet the following requirements:

| Component | Concentration (at 15°C and 101.3 kPa) |
|---|---|
| Oxygen | (21 ±1) % |
| Carbon dioxide | ≤ 600 ppm |
| Carbon Monoxide | ≤ 5 ppm |
| Oil | ≤ 0.5 mg/$m^3$ |
| Odour | No objectionable odour |

## 8.9 Useful links

Dive Industry Advisory Group
https://diag.co.nz/

Health and Safety at Work Act 2015
https://www.legislation.govt.nz/act/public/2015/0070/latest/DLM5976660.html#DLM6544131

Health and Safety in Employment Regulations 1995
https://www.legislation.govt.nz/regulation/public/1995/0167/latest/DLM202257.html

Occupational Diving Medicals
https://www.divemedical.co.nz/pdm/story.asp

Worksafe Occupational Diving Page
https://www.worksafe.govt.nz/topic-and-industry/occupational-diving/

US Navy Diving Manual Revision 7
https://www.navsea.navy.mil/Portals/103/Documents/SUPSALV/Diving/US%20DIVING%20MANUAL_REV7.pdf?ver=2017-01-11-102354-393

Worksafe Guide to Gas Cylinders
https://worksafe.govt.nz/dmsdocument/20566-guide-to-gas-cylinders/latest

Working Safely in the occupational diving, snorkelling and freediving industries – A guide for PCBUs
https://www.worksafe.govt.nz/topic-and-industry/occupational-diving/occupational-diving-forms-and-guidelines/

## 8.10 Glossary

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| Air sharing | Sharing of an air supply between divers. |
| Authorisation | The DCB authorises divers to dive using specialised modes of diving, and the depths they may dive to. |
| Barotrauma | A Physical injury to the body as a result of a pressure change. |
| Bottom Time | The total elapsed time from when a diver leaves the surface to the time (next whole minute) at which ascent is commenced, measured in minutes. |
| Breathing gas | The compressed gas intended for respiration by the diver. |
| Buddy Diver | A member of a group of two or three divers. |
| Buddy Breathing | Sharing of a single air source between divers. |
| Buddy System | Two or three comparably equipped scuba divers in the water in constant communication. |
| Cave Dive | A dive, which takes place partially or wholly underground, in which one or more of the environmental parameters defining a cavern dive are exceeded. |
| Cavern Dive | A dive which takes place partially or wholly underground, in which natural sunlight is continuously visible from the entrance. |
| Certified Scientific Diver | A diver who holds a current Certificate of Competence Occupational Diver – Scientific, as issued by WorkSafe NZ. |
| Controlled Ascent | Any one of several kinds of ascents including normal, swimming, and air sharing ascents where the diver(s) maintain control so a pause or stop can be made during the ascent. |
| Cylinder | A pressure vessel for the storage of gases. |
| Decompression Sickness | A condition with a variety of symptoms, which may result from gas, and bubbles in the tissues of divers after pressure reduction. |
| Dive | A descent into the water, an underwater diving activity utilizing compressed gas, an ascent, and return to the surface. |
| Dive Computer | A microprocessor-based device which computes a diver's theoretical decompression status, in real time, by using pressure (depth) and time as input to a decompression model, or set of decompression tables, programmed into the device. |
| Dive Site | Physical location of a diver during a dive. |
| Dive Table | A profile or set of profiles of depth-time relationships for ascent rates and breathing mixtures to be followed after a specific depth-time exposure or exposures. |
| Diver | A person who stays underwater for long periods by having compressed gas supplied from the surface or by carrying a supply of |

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| | compressed gas. |
| Diving Mode | A type of diving required specific equipment, procedures, and techniques, for example, snorkel, scuba, surface-supplied air, or mixed gas. |
| Diving Safety Board (DSB) | Group of individuals who act as the official representative of the membership organisation in matters concerning the scientific diving program. |
| Diving Safety Officer (DSO) | Individual responsible for the safe conduct of the scientific diving program of the membership organisation. |
| Emergency Swimming Ascent | An ascent made under emergency conditions where the diver may exceed the normal ascent rate. |
| Enriched Air (EANx) | A name for a breathing mixture of air and oxygen when the percent of oxygen exceeds 21%. This term is considered synonymous with the term “nitrox”. |
| Freediving | Involves a diver holding their breasth until they return to the surface, instead of using snorkelling or diving equipment. Freediving includes both breath hold diving and apnea activities where the diver doesn’t use a breathing device. |
| Full Face Mask (FFM) | A face mask that encloses the nose, mouth and eyes; and incorporates an integral breathing system. |
| Guideline | Continuous line used as a navigational reference during a dive leading from the team position to a point where a direct vertical ascent may be made to the surface. |
| Half mask | A mask that covers the eyes and nose. |
| Hazard | Includes a person’s behaviour where that behaviour has the potential to cause death, injury, or illness to a person (whether or not that behaviour results from physical or mental fatigue, drugs, alcohol, traumatic shock, or another temporary condition that affects a person’s behaviour). |
| Hyperbaric Chamber | See Recompression chamber. |
| Hyperbaric Conditions | Pressure conditions in excess of normal atmospheric pressure at the dive location. |
| Life Support Equipment | Underwater equipment necessary to sustain life. |
| Lead Diver | Certified scientific diver with experience and training to conduct the diving operation. |
| Mixed Gas | Breathing gas containing proportions of inert gas other than nitrogen greater than 1% by volume. |
| Mixed Gas Diving | A diving mode in which the diver is supplied in the water with a |

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| | breathing gas other than air. |
| Nitrox | Any gas mixture comprised predominately of nitrogen and oxygen, most frequently containing between 22% and 40% oxygen. Also be referred to as Enriched Air Nitrox, abbreviated EAN. |
| Occupational Diving | Includes all diving, snorkelling and freediving activities carried out at a place of work. |
| Officer | Includes any other person occupying a position in relation to the business or undertaking that allows the person to exercise significant influence over the management of the business or undertaking (for example, a chief executive, partner or a director). |
| Personal Protective Equipment (PPE) | means anything used or worn by a person (including clothing) to minimise risks to the person's health and safety; and includes air-supplied respiratory equipment. |
| PCBU | Person Conducting a Business of Undertaking. |
| Reasonably Practicable | In relation to a duty of a PCBU set out in subpart 2 of Part 2 of the Health and Safety at Work Act, has the meaning given in section 22. |
| Safety Stop | A stop made between 15-20 feet (5-6 meters) for 3-5 minutes during the final ascent phase of a dive. |
| Scientific Diving | Scientific diving is defined as diving performed for the purpose of professional scientific or archaeological research, cultural and natural resource management, or related educational activities. |
| Scuba Diving | A diving mode independent of surface supply in which the diver uses open circuit self-contained underwater breathing apparatus. |
| Snorkelling | Involves swimming on the surface of water using a snorkel, mask and swimming aids such as fins. |
| Standby Diver | A diver at the dive location capable of rendering assistance to a diver in the water. |
| Surface Supplied Diving | Dives where the breathing gas is supplied from the surface by means of a pressurised umbilical hose. The umbilical generally consists of a gas supply hose, strength member, pneumofathometer hose, and communication line. The umbilical supplies a helmet or full-face mask. The diver may rely on the tender at the surface to keep up with the divers' depth, time and diving profile. |
| Swimming Ascent | An ascent, which can be done under normal or emergency conditions accomplished by simply swimming to the surface. |
| Worker | an individual who carries out work in any capacity for a PCBU, including work as—<br>a. an employee; or<br>b. a contractor or subcontractor; or |

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| | c. an employee of a contractor or subcontractor; or<br>d. an employee of a labour hire company who has been assigned to work in the business or undertaking; or<br>e. an outworker (including a homeworker); or<br>f. an apprentice or a trainee; or<br>g. a person gaining work experience or undertaking a work trial; or<br>h. a volunteer worker; or<br>i. a person of a prescribed class. |
| Workplace | Means a place where work is being carried out, or is customarily carried out, for a business or undertaking; and includes any place where a worker goes, or is likely to be, while at work (including a vehicle, vessel, aircraft, ship, or other mobile structure; and any waters and any installation on land, on the bed of any waters, or floating on any waters). |

## 8.11 Common Abbreviations

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| AAUS | American Academy of Underwater Sciences |
| ADAS | Australian Diver Accreditation Scheme |
| BCD | Buoyancy Control Device |
| CMAS | Confederation Mondiale des Activities Subaquatiques (World Federation of Underwater Activities) |
| CO | Carbon Monoxide |
| CPR | Cardio Pulmonary Resuscitation |
| DA | Diving Attendant |
| DSC | Diving Safety Committee |
| DC | Diving Coordinator |
| DDD | Designated Diving Doctor |
| DSO | Diving Safety Officer |
| DHMS | Diving and hyperbaric Medicine Services |
| EAD | Equivalent air depth |
| $FO_2$ | Fraction of Oxygen |
| FSW | Feet of Seawater |
| kPa | Kilo pascal |
| LD | Lead Diver |
| MOD | Maximum operating depth |
| MPa | Mega pascal |
| MSW | Metres of Seawater |
| NAUI | National Association of Underwater Instructors |
| NOAA | National Oceanic and Aeronautical Administration |
| OSHA | Occupational Safety and Health Administration (USA) |
| OSH | Occupational Safety and Health Service (NZ)- name changed in 2005 to Worksafe New Zealand |
| PADI | Professional Association of Diving Instructors |
| $PO_2$ | Partial pressure of Oxygen |
| SCUBA | Self-Contained Underwater Breathing Apparatus |
| SMB | Surface Marker Buoy |
| SPG | Submersible Pressure Gauge |
| SSI | Scuba Schools International |
| SOP | Standard Operating Procedures |