

STANDARDS FOR
THE CONDUCT OF SCIENTIFIC DIVING

June 29, 2011

OFFICE OF POLAR PROGRAMS
NATIONAL SCIENCE FOUNDATION

TABLE OF CONTENTS

- 1.0. PROGRAMOVERVIEW
- 1.1.

STANDARDS FOR THE CONDUCT OF SCIENTIFIC DIVING
NATIONAL SCIENCE FOUNDATION
OFFICE OF POLAR PROGRAM OFFICE OF POLAR PROGRAM [(4(O))5(G)5(RAM0(N

- d. Approve new equipment or techniques for polar use.
- 2.1.3. NSF Diving Safety Officer (DSO) acts as the liaison between the SDCB and the research divers. The DSO has the authority to act on behalf of the SDCB in all diving matters, pending acceptance by the SDCB at their next regularly scheduled meeting. The DSO typically represents the NSF/OPP in all technical matters concerning diving operations, diving safety, or projects utilizing diving as a tool in further research. The NSF DSO has the responsibility to:
- a. Review and approve divers, diving plans, and diving locations submitted by the various research projects;
 - b. Evaluate and recommend new equipment for polar diving use;
 - c. Recommend equipment and facilities to support scientific diving in polar regions; and,
 - d. Recommend new diving techniques or procedures to further scientific diving as a research tool in polar regions.
- 2.1.4. Home Institution DSO is the DSO at the home institution of the Principal Investigator (PI) where the scientific divers are based. The home institution DSO acts in an advisory capacity to the NSF DSO, providing information on current scientific diver status under AAUS standards. The home institution DSO ensures that specialized trainings is provided to prepare the individual divers for diving in polar waters. The home institution DSO certifies that the is current according to the AAUS standards.
- 2.1.5. Contractor Supervisor of Diving Services (SDS) is responsible for maintaining dive equipment provided onsite, conducting the diving pre-season orientation, orienting new science teams to conditions onsite, providing supervision and instruction during local familiarization dives, and generally supports all site diving activities. The SDS has the authority to suspend diving operations if in his/her opinion these are unsafe or unwise, pending review by the NSF DSO. Other duties, authority, and responsibility of an oversight nature may be assigned this individual by the NSF DSO or SHO.
- 2.1.6. Principal Investigator (PI) Generally the PI acts as the Lead Diver unless that authority is assigned to another more experienced diver in the group. The PI is responsible for ensuring all divers meet USAP diving standards and operational requirements of the project.
- 2.1.7. The Lead Diver is a person who has the diving experience, competency, responsibility, and reliability to conduct polar diving operations. The Lead Diver is responsible for managing the daily dive operations of the science team, and ensuring that all divers in that team follow the established procedures outlined in these *Standards*.
- 2.1.7. Divers individuals having the experience, training, and authorization necessary to dive under NSF OPP auspices.

2.1.8. Tenders are individuals who are trained to assist divers in their diving activities. They have no direct responsibility to intervene in diving operations.

2.2. DIVING CONTROL

2.2.1. Diving Approval

The NSF DSO determines whether a specific project's dive plan is consistent with the requirements of the *NSF/OPP Standards for the Conduct of Scientific Diving*, based on the information submitted by the Principal Investigator and approves the dive plan, upon recommendation of the SDS. Likewise, the NSF DSO reviews each individual diver's credentials and approves/disapproves the diver, as appropriate.

All divers must meet the following criteria:

- a. Certification for one year;
- b. 50 open water dives;
- c. 15 dry suit dives;
- d. 10 dry suit dives within twelve months of Antarctic dive operations;
- e. minimum depth certification of 100 fsw for McMurdo area and 60 fsw for Palmer and research vessels;
- f. current certification in first aid, cardiopulmonary resuscitation (CPR), and oxygen administration.

The PI is responsible for ensuring scuba equipment maintenance within 12 months for the following items (unless provided by USAP):

- a. r

3.0. DIVING REGULATIONS

3.1. GENERAL POLICY

In no case will individuals be allowed to dive under NSF/OPP auspices unless they are trained and proficient in the type of diving they plan to do and familiar with the equipment that they plan to use.

3.2. DIVING PROCEDURES

3.2.1. Solo Diving Prohibition

All dives conducted under the auspices of the NSF/OPP shall be planned and executed in such a manner as to insure that every diver maintains constant, effective communication with at least one other comparably equipped certified scientific diver in the water, except as permitted in Section 3.2.8 below. This buddy diver system is based upon mutual assistance, especially in the case of an emergency. Dives should be planned around the competency of the least experienced diver. If loss of effective communication occurs within a buddy team, then all divers shall surface and reestablish contact.

3.2.2. Diving under Ceilings

- a. The dive access hole must be clearly marked. If additional holes are required, they must be maintained.
- b. Diving in clear water, provided a down line is deployed and divers adhere to the buddy system, untethered diving may be permitted.
- c. Diving in low visibility, shallow water that restricts the diver's ability to see the entry hole, or if a danger of currents is present, the use of a tended tether is required.
- d. Divers

area is 100 fsw and for Palmer and rescue vessels is 60 fsw. Dives that require staged decompression are not authorized.

- b. An OPP authorized diver may only exceed his/her depth certification by one step under the following conditions:
 1. if accompanied by a diver certified to the greater depth,
 2. if an emergency situation makes this necessary.

3.2.5. Termination of Dive

A diver may terminate the dive at any time if he/she feels it would be unsafe to continue. Divers should begin terminating their dives by notifying their buddies of the termination, stopping work and commencing ascent. Divers must be at their safety stops with no less than 20 cf (see Table 1.) and must have exited the water with no less than 10 cf.

Cylinder Type (cf)	Pressure at 20 cf (psig)	Pressure at 10 cf (psig)
Single Steel 95.1	600	300
Double Steel 95.1	300	150
Single Steel 110	500	250

Table I-- Minimum Reserve Pressures for Selected Cylinder Configurations
(cf = cubic feet; psig = pounds per square inch gauge)

Examples of situations necessitating diversion include:

- a. Environmental conditions that become unsafe;
- b. One or more divers becoming chilled;
- c. Cylinder gas volume approaching 20 cubic feet;
- d. Dive profiles approaching required stage decompression; or,
- e. Equipment failure that immediately or potentially jeopardizes the safety of the diver.

3.2.6. Refusal to Dive

- a. The decision to dive is that of the individual diver. A diver may refuse to dive whenever he/she feels it is unsafe to make the dive.
- b. Safety— The ultimate responsibility of safety rests with the individual diver. It is the diver's responsibility and duty to refuse to dive if, in his/her judgment, conditions are unsafe or unfavorable, or 13(i)-2(a)4(nd dut)-12(y)20(t)-2(o r3(a)y66t)-12(y

ude:

- c) Rebreathers
- d) Mixed Gases/Oxygen Enriched Air (Nitrox)

4.0. DIVING OPERATIONS

4.1. LEAD DIVER

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

- a. Coordination. Diving shall be coordinated with other known activities in the vicinity, which are likely to interfere with diving operations.
- b. Briefing. The dive team members shall be briefed on:
 - 1. Dive Objectives;
 - 2. Any unusual hazards or environmental conditions likely to affect the safety of the diving operation;
 - 3. Any modifications to diving or emergency procedures necessitated by the specific diving operation; and,
 - 4. The need to immediately report any physical problems or adverse physiological effects, particularly symptoms of pressure-related injuries.
- c. Dive Planning. Planning of a diving operation shall include considerations of the safety and health aspects of the following:
 - 1. Diving mode;
 - 2. Surface and underwater conditions and hazards;
 - 3. Breathing gas supply;
 - 4. Thermal protection;
 - 5. Dive equipment;
 - 6. Dive team assignment;
 - 7. Residual inert gas status of dive team members;
 - 8. Decompression schedule and altitude corrections; and,
 - 9. Emergency procedures.

4.2. DIVE PLANS

Before conducting any diving operations, the must provide the following information in POLARICE

- a. Participating divers, their qualifications and depth certifications;
- b. Name, telephone number and relationship of person to be contacted for each diver in the event of an emergency;
- c. Approximate number of proposed dives;
- d. Location of proposed dives;
- e. Estimated depths and bottom times anticipated; and,
- f. Proposed work, equipment and/or boats to be employed, repetitive dives (if required), and details of any hazardous conditions anticipated.

4.3. PRE-DIVE SAFETY CHECKS

- a. Diver's Responsibility

safety and health judgment regarding the divers' qualifications to dive. Failure to provide sufficient information may result in denial of NSF/OPP diving authorization.

5.3. REQUIRED ACCIDENT REPORTING

- a. The SDS shall report to the NSF DSO, who shall record the occurrence of any diving-related injury or illness that requires any dive team member to be hospitalized for 24 hours or more, or after an episode of unconsciousness related to diving activity, or after treatment in a recompression chamber following diving. The circumstances of the incident and the extent of any injuries or illnesses shall be specified. This record shall also contain:
 1. Description of symptoms including depth and time of onset;
 2. Description and results of treatment;
 3. Printout of dive computer profile(s);
 4. Dive history for prior 7 days; and,
 5. History of flying within those 7 days.
- b. The SDS and the NSF DSO shall prepare a report of any diving accident requiring recompression or resulting in serious injury and shall immediately notify the SHO and the diver's home institution DSO.

6.0 DIVING EQUIPMENT

USAP issues regulators and dive computers to be used by scientific divers. This equipment issued to scientific divers by USAP shall be maintained according to manufacturer's specifications. The PI is responsible for ensuring that all other scuba equipment is maintained within 12 months.

6.1. EQUIPMENT INSPECTION

All inspections, tests, maintenance, and record keeping referred to in this section must be performed by the SDS or other approved maintenance facility.

Record keeping -Each equipment modification, repair, test, calibration or maintenance service shall be logged. The logs shall include the date and nature of work performed, serial number of item and the name of the person performing the work for the following equipment:

Compressors	Submersible pressure gauges
Regulators	Depth gauges
Scuba cylinders	Cylinder valves
Diving helmets	Dive computers
Gas control panels	Air storage cylinders
Air filtration systems	Drysuits

6.1.1. Breathing Masks and Helmets

Breathing masks and helmets shall have:

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

Dive: A descent into the water, an underwater diving activity utilizing compressed gas, an ascent, and return to the surface.

Dive Computer: An electronic device for tracking depth and time and computing inert gas uptake and offgassing.

Dive Site: The physical location of a dive.

Dive Table: A profile or set of profiles of depth-time relationships, including their ascent rates, for particular breathing mixtures to be followed after a specific depth-exposure or exposures (Decompression Table).

Dive Team: Divers and support individuals who are exposed to or control the exposure of others to hyperbaric conditions.

Diver: An individual in the water who uses an apparatus that supplies breathing gas at ambient pressure.

Diving Mode: A type of diving requiring specific equipment, procedures, and techniques; for example, scuba, surface supplied air, or mixed gas.

Diving Safety Officer: Individual with scientific diving expertise responsible for advising NSF/OPP on scientific diving matters and authorizing divers and dive plans to d under its aegis.

Dry Suit: An exposure suit, with airtight seals at the neck and wrists, which allows the introduction and exhaust of compressed air through valves and keeps the diver dry during the dive.

Hyperbaric: A condition defined by pressure greater than one atmosphere at sea level.

Lead Diver: A certified scientific diver with the experience and training to lead the diving operation.

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

No-Decompression Limits: The depth and time parameters of the "no

sickness, pneumothorax, mediastinal emphysema, air embolism, subcutaneous emphysema, or barotrauma.

Recompression Chamber: A pressure vessel for treatment of pressure-related dive accidents such as CAGE and DCS (Hyperbaric Chamber).

Regulator: A device for delivering air from high pressure to ambient pressure, usually for breathing purposes.

Scientific Diving Control Board (SDCB): The group of individuals that act as an appointed body of expertise to NSF/OPP in all matters relating to scientific diving operations.

Scientific Diving: All diving performed by individuals necessary to and part of a scientific, research, or educational activity, in conjunction with a project or study under the jurisdiction of any public or private research or educational institution or similarly recognized organization, department, or group.

Scientific Diving Coordinator: Individual with scientific diving expertise and logistical responsibilities, employed by NSF/OPP Antarctic support contractor, coordinates closely with DSO and Health and Safety Officer.

SCUBA Diving (scuba) A diving mode independent of surface supply in which the diver uses open circuit self