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**SECTION 1.00  
GENERAL POLICY**

**1.10. BACKGROUND AND PURPOSE**

The Occupational Safety and Health Administration (OSHA), U.S. Department of Labor, issued final guidelines in January 1985 that would permit scientific diving to be exempted from OSHA standards applicable to commercial diving [29 CFR Part 1910, Subpart T]. The first of the four guidelines provides that a Diving Control Board must be established within the organization that "...consists of a majority of active scientific divers and has autonomous and absolute authority over the scientific diving program's operations." These guidelines define scientific diving as diving that requires scientific expertise in studying the underwater environment by scientists or scientists-in-training.

Scientific diving must be under the control of a scientific diving program that includes:

- a diving safety manual with procedures covering all diving operations specific to the program; procedures for emergency care, including recompression and evacuation; and criteria for diver training and certification; and,
- a Diving Control Board, with a majority of its members being active divers, which shall, at a minimum, have the authority to approve and monitor diving projects, review and revise the diving safety manual, assure compliance with the manual, certify the depth to which a diver has been trained, take disciplinary action for unsafe practices, and assure adherence to the practice of a buddy diving system. [29 CFR 1910.401 (a)(2)(iv)].

**1.11. The Scientific Diving Standards**

The purpose of these scientific diving standards is to reflect the potential hazards and inherent risk involved in diving activities and to ensure that all scientific diving under the auspices of the Smithsonian Institution (SI) is conducted in a manner that will promote protection of scientific divers from accidental injury and/or illness, and to set forth standards for training and certification which will allow for reciprocity between SI and other scientific diving programs. Fulfillment of the purposes shall be consistent with the furtherance of research and safety.

**1.12. The SI-Scientific Diving Safety Manual**

The purpose of this document is to:

1. ensure that the SI-Scientific Diving Program (SDP) remains in compliance with applicable OSHA regulations and the scientific diving exemption from OSHA commercial diving standards;.
2. assure that the SI-Scientific Diving Control Board (SDCB) has, at a minimum, the necessary authority to fulfill its specific obligations under OSHA regulations;
3. ensure that scientific divers and their supervisors comply with SI scientific diving procedures; and,
4. set forth minimal standards for the SDP, the organization for the conduct of this program, and the fundamental regulations and procedures for safety in scientific diving operations. It also establishes a framework for reciprocity with organizations that adhere to these minimum standards for joint scientific diving projects.

Adherence to the SDP standards has proven both feasible and effective in protecting the health and safety of scientific divers since 1972.

**1.20. POLICY**

All scientific diving conducted under the auspices of the Smithsonian Institution is to be performed safely and in a manner consistent with applicable regulations and prevailing accepted practices and procedures for safe scientific diving in the United States. The diver certification, diving criteria and procedures, and all safety standards of the SDCB shall comply in all respects with the guidelines and regulations of OSHA for scientific diving.

**1.30. SCOPE**

The requirements, standards and guidelines will apply at all diving sites and to all Smithsonian organizational units, and to both Smithsonian and non-Smithsonian employees officially engaged in underwater diving activities under the auspices of, or in cooperation with, the Institution. Smithsonian employees must have scientific diving activities specified in their official position descriptions, either in their duties if appropriate, or as a point of required skills and Knowledge, Physical Demands and Work Environment.

**1.40. AUTHORITY**

Smithsonian Directive 120 (SD 120) requires all Smithsonian Institution (SI) units and organizations to comply with the regulations and procedures contained in the SI Scientific Diving Safety Manual.

**1.50. CONTROL**

**1.51. Scientific Diving Defined**

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

**1.52. Smithsonian Institution Auspices Defined**

For the purposes of these standards, the auspices of the Smithsonian Institution and its organizational units includes any scientific diving operation in which the Institution is connected because of ownership of any equipment used, locations selected, participation of Smithsonian personnel, such as employees, fellows, interns, visiting scientists, volunteers, or financial support.

**1.53. Scientific Diving Certification**

The Smithsonian Institution requires that all persons engaging in scientific diving activities under its auspices shall hold a scientific diving certification issued by the SDCB, pursuant to the provisions of this SI-Scientific Diving Safety Manual (Sec. 3.00) and a dive plan approved by the SI-Scientific Diving Officer (SDO). Temporary diving authorizations may be given to visiting scientists who need to use SCUBA to accomplish work at the Smithsonian (Sec. 3.54).

**1.54. Equipment**

All diving equipment used by SI-Scientific Divers and trainees, regardless of ownership, shall conform to the standards set forth in this SI-Scientific Diving Safety Manual.

**1.55. Sites**

The regulations herein shall be observed at all locations where Smithsonian Institution scientific diving is conducted.

**1.56. Reciprocity**

The SDCB may recognize a scientific diver's certification from another organization with reciprocity, including medical certification, under the conditions that all criteria of the SI-Scientific Diving Reciprocity Authorization are met and approved by the SDO. The visiting diver must, at a minimum, adhere to the SI-Scientific Diving Safety Manual. Upon arrival at the Smithsonian Institution, the visiting scientific diver will receive a brief orientation to the local environment and SI safety procedures, and perform a check-out dive with the SDO, DO, or authorized designee. (Sec. 3.53)

**1.57. Waiver of Requirements**

The SDCB may grant a waiver for specific requirements of training, examinations, depth certification and minimum activity to maintain certification. The SDCB may designate the SDO with the unit DO to make waivers.

## **1.60. SI-SCIENTIFIC DIVING PROGRAM AUTHORITIES AND RESPONSIBILITIES**

### **1.61. Ultimate Authority**

The Under Secretary for Science has the ultimate authority for the scientific diving program and its related activities. The Under Secretary for Science shall:

1. provide administrative oversight of, and policy approval for, matters relating to the SDP and the SDCB;
2. ensure that effective and adequate support is provided for activities of the SDCB in the conduct of its official responsibilities, and for activities related to the administration of the SDP; and,
3. appoint a full-time SDO, based on the recommendation of the SDCB, who shall serve as an advisor to and member of the SDCB. The SDO shall perform routine administrative and diving-related duties set forth in SD 120, and shall report directly to the Under Secretary for Science or his/her designee.

The Directors of the National Museum of Natural History, Smithsonian Tropical Research Institute, Smithsonian Environmental Research Center, National Zoological Park, National Museum of American History, and other research units or major offices involved with the SDP (together, "research units") shall appoint from their respective staff or possibly employ, in consultation with the SDO, an active, appropriately trained and experienced SI-scientific diver to serve as the DO for their respective research units. A Diving Supervisor for specific scientific diving activities may be appointed by the SDO. The research unit Directors shall ensure through the appropriate supervisors that the responsibilities of all SDCB members are acknowledged in their performance plans during their tenure on the SDCB. The research unit Directors shall ensure proper and effective resources for these activities at the research unit level, including possible full-time employment of a DO, if necessary. The duties of the DO's shall be written into their official job description and annual performance plans

### **1.62. Policy Administration**

The policy administration of the SDP will reside with the SDCB under the delegated authority from the Under Secretary for Science.

### **1.63. The SI-Scientific Diving Control Board (SDCB)**

The SDCB, a formally constituted body of scientific divers, has responsibility for diver certification, diving policy and operations and, with the Under Secretary for Science, the oversight and administration of the SDP.

The SDCB is composed of 11 voting members. The voting members are the SDO, and ten SDCB members who shall be appointed by their respective Research unit Directors to include the unit DOs (Smithsonian Environmental Research Center-2, National Museum of American History-1, National Zoological Park-1, National Museum of Natural History-2, Smithsonian Tropical Research Institute-2, Smithsonian Marine Station at Fort Pierce-2) for renewable three-year terms. Research unit Directors will ensure that the duties, responsibilities and scientific diving activities of the Diving Officers, Dive Masters, as well as their supervisors, are enumerated as important elements in their annual performance plans; and that performance plans for all Scientific Divers reflect the importance of adhering to the Dive Manual. The SDCB will elect its officers (Chairperson, Vice Chairperson and Secretary). The General Counsel shall appoint a non-voting legal advisor from his/her office.

The SDCB is responsible for setting policies. The SDCB duties include, but are not limited to:

1. approving and monitoring diving projects;
2. reviewing and revising SD 120;
3. assuring compliance with SD 120;
4. certifying and reviewing the depth to which a SI-Scientific Diver has been trained, and reviewing for potential approval the recommendations of the SDO for issuance, re-issuance, or revocation of SI-Scientific Diver certification following procedures set forth in this SI-Scientific Diving Safety Manual;
5. taking disciplinary action for unsafe diving activities, including suspending scientific diving programs, projects, or certifications of SI-Scientific Divers;
6. assuring compliance with the buddy diving system;
7. acting as a board of investigation to inquire into the nature and cause of all diving accidents and all reported violations of SD 120;

8. acting as a board of inquiry, whenever necessary, to consider scientific diver-related problems encountered while diving, operating under or complying with the SDP, its policies, or the standards and requirements of SD 120;
9. reviewing, at least yearly, both the activities of (1) the SDO, and (2) the SDP, and submit reports thereon to the Under Secretary for Science, or more frequently at the request of the Under Secretary for Science;
10. meeting at least annually, or upon specific request of the Under Secretary for Science, or any SDCB member, and record and distribute minutes of all meetings;
11. promoting safe diving by making available or establishing training/refresher programs on diving, diving medicine and first aid;
12. establishing criteria for equipment selection and use, and recommending new equipment or techniques;
13. establishing criteria for the inspection and maintenance of diving equipment; and,
14. ensuring that the SI-owned air and or mixed gas station(s) meet air or mixed gas quality standards as described in Secs. 4.30 and 5.45.

**1.64. The SI-Scientific Diving Officer (SDO)**

The SDO shall have full responsibility and accountability to the SDCB and the Under Secretary for Science in all operational, diving and safety matters. In addition, the SDO reports to the Under Secretary for Science regarding administrative matters. The SDO shall:

1. be appointed by the Under Secretary for Science with the advice, counsel and recommendation of the SDCB;
2. be a certified SI-Scientific Diver;
3. be certified by a nationally recognized scuba certification agency to teach basic and advanced scuba diving courses; and,
4. be responsible, through the SDCB, and to the Under Secretary for Science, for the conduct of the SDP.
5. The operational authority for this program rests with the SDO, including:
  - A. training and certification (unless delegated to a DO)
  - B. authorization of dive plans where the SDO is not a Lead Diver
  - C. operations
  - D. maintenance of diving certification records
  - E. working directly with Diving Officers (DO's)
6. As a SDCB member and with the SDCB, the SDO is responsible for enforcement of scientific diving policies, regulations and procedures, as well as compliance with SD 120;
7. annually submit an evaluation report of the DO's activities to his/her supervisor; and,
8. designate an alternate authority to perform these duties when the SDO is not available.

**1.65. Diving Officer (DO)**

The DO shall have full responsibility and accountability to the SDO in all operational, diving and safety matters. The DO's for specific research units shall:

1. maintain a current SI-Scientific Diver certification;
2. oversee scientific diving activities conducted in their research unit or areas of responsibilities;
3. ensure compliance with all SI policies, requirements and procedures established and set forth in this SI-Scientific Diving Safety Manual;
4. be responsible for maintaining diver and medical certification records, and dive logs of all SI-Scientific Divers in their research unit and those diving under the auspices of the SI through their research unit's scientific research, collection or educational activities, and, as requested, make these records available in a timely manner to appropriate institutional requesters;
5. be responsible for performing (NMNH, STRI) or documenting (SERC, SMSFP, NMAH, NZP) equipment maintenance through the SDP standardized equipment program;
6. have the unilateral authority to suspend diving operations or Scientific Divers whose diving activities they consider unsafe or unwise and report such actions immediately to the SDO; and,
7. submit reports on diving activities and diver certification statuses in a timely fashion to SDO.

**1.66. Policy Implementation**

Implementation of policies shall be conducted by the SDO and DO's, who shall meet on a regular basis and at any time as deemed necessary.

**1.67. The SI-Office of the General Counsel (OGC)**

The OGC, or its designated representative, shall serve as the advisor to the SDCB and the Under Secretary for Science on all legal matters relevant to the SDP, including, but not restricted to, continued compliance of the Smithsonian Institution with applicable OSHA regulations.

**1.68. The SI-Office of Risk and Asset Management (ORAM)**

The ORAM shall support the SDP.

**1.69. Individual Scientific Diver's Responsibilities**

1. Submit a completed SI-Scientific Diver Application (in DECOSTOP, the SDP') to the DO;
2. Obtain a SI-Scientific Diver medical certification (Sec. 6.00);
3. Maintain good physical condition and a high level of diving proficiency commensurate with the frequency, scope, and type of diving activity being undertaken;
4. Refuse to dive if:
  - a. in his/her judgment, conditions are unsafe or unfavorable for the type of diving operations planned;
  - b. for any reason he/she believes his/her diving participation might jeopardize human life;
  - c. he/she is not in proper physical or mental condition; and/or
  - d. he/she believes the scuba equipment to be used is in faulty condition.
5. Provide proof of current diver first aid training (Sec. 3.74);
6. Have an annual scuba equipment inspection and maintenance performed;
7. Bear ultimate responsibility for personal safety and compliance with SD 120 regarding a planned diving operation;
8. Notify his/her assigned DO, through submission of an SI-Dive Plan (in DECOSTOP) for approval by the SDO, prior to engaging in any diving activity; and,
9. Submit Zoop computers for download (in DECOSTOP) after each expedition or quarterly at the latest.

**1.70. CONSEQUENCE OF NONCOMPLIANCE WITH SI-SCIENTIFIC DIVING POLICIES**

1. A DO shall immediately notify the SDO whenever he/she believes his/her advice regarding a specific diving activity is being ignored by a diver with probable dangerous consequences;
2. The SDO shall immediately notify the SDCB and diver's immediate supervisor whenever he/she finds that a diving operation will take place contrary to his/her diving authorization and will present an unacceptable risk to human life or property; and/or, constitutes a scientific diving policy violation;
3. An individual SDCB member may stop a sufficiently dangerous and time-critical diving operation until two-thirds of the Board's voting membership agrees upon a proper resolution of the issues;
4. The SDCB will review, evaluate, make findings and, where appropriate, require remedial actions in all SI-scientific diving policy violations properly submitted to it. (See Section 3.80 regarding revocation of SI-Scientific Diver certification). Findings and remedial actions shall be:
  - a. approved by at least a two-thirds vote of the SDCB; and,
  - b. submitted in written form to the Under Secretary for Science within twenty-one calendar days after the matter is received by the SDCB for consideration.

**1.71. SI-Scientific Diver Appeals**

Any SI-Scientific Diver (employee or non-employee) has the right to appeal if adversely affected by a finding or remedial action required by the SDCB. The appeal procedures are as follows:

1. all appeals must be submitted in writing to the research unit Director within ten working days of the SDCB action or decision;
2. the research unit Director, through the Under Secretary for Science, will render a final written decision within ten working days after receipt of the appeal.

**1.80. INSTRUCTIONAL PERSONNEL**

**1.81. Qualifications**

All personnel involved in diving instruction under the auspices of the Smithsonian Institution shall be approved by the SDO for the type of instruction being given.



**1.82. Selection**

Additional instructional personnel will be selected by the DO, and approved by the SDO.

**1.83. SI-Scuba Course Approval**

All proposed SI-scuba courses require approval by the SDO to be accepted to meet SI diving training standards.

**1.90. MEDICAL EXAMINATION**

All scientific divers shall pass an initial and appropriate interval diving medical examination and authorize the release of this diving-related medical information to the SDO. After each illness or injury requiring hospitalization, or after an episode of unconsciousness related to diving activity, or after treatment in a hyperbaric chamber following a diving accident or other serious illness, divers shall submit to a medical examination appropriate to the nature and extent of the injury or illness before resuming diving activities.

**SECTION 2.00  
DIVING REGULATIONS**

**2.10. GENERAL POLICY**

Scientific diving shall be in compliance with the standards and regulations set forth in this SI-Scientific Diving Safety Manual. The ultimate responsibility for 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 if he/she would be violating the precepts of his/her training, or the regulations in this SI-Scientific Diving Safety Manual.

**2.20. DIVING PROCEDURE**

**2.21. Solo Diving Prohibition**

All diving conducted under the auspices of the Smithsonian Institution shall be planned and executed in such a manner as to ensure that every diver maintains constant, effective communication with at least one other comparably equipped, certified scientific diver in the water (see Section 5.20 for buddy requirements for aquarium dives). This buddy 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, all divers shall surface and re-establish contact.

**2.22. Emergency Procedures**

Scientific diving shall not be conducted unless the emergency plan information is complete and the dive plan has been reviewed by the DO and approved by the SDO. The Lead Diver must ensure that first aid, emergency and oxygen administration equipment is in working order and present at the dive location. A radio and/or cellular phone must also be present.

**2.23. Enclosed or Confined Spaces**

Where an enclosed or confined space is not large enough for two divers, a diver shall be stationed at the underwater point of entry and an orientation line shall be used. Specialty training is required before diving in overhead environments.

**2.24. Dive Flags**

A dive flag shall be displayed prominently over the dive site whenever diving is conducted.

**2.25. Dive Computers and Dive Tables**

The use of dive computers, versus dive tables, as a means of determining decompression status is required for all dives conducted under the auspices of the Smithsonian Institution. The dive computer must have a downloadable dive log capability and an ascent rate monitor. All divers will be issued an SI dive computer for dive log tracking purposes. See appendix F for more information on rules and regulations of using dive computers.

**2.26. Depth Limits**

Each scientific diver shall be certified to a specific depth limit by the SDO.

1. A scientific diver diving under the auspices of the Smithsonian Institution shall not exceed his/her depth certification, unless accompanied by a diver certified to a greater depth. Under these circumstances the diver may not exceed his/her depth limit by more than one step;
2. Dives between 0-130 feet in depth must be in conformance with Sec. 3.61-3.63;
3. Dives exceeding 130 feet in depth must be in accordance with Sec. 3.64; and,
4. Diving with compressed air is not permitted beyond a depth of 190 feet.

**2.27. Refusal to Dive**

The decision to dive is solely that of each diver. A diver may refuse to dive, without fear of penalty or reprisal, whenever he/she feels it is unsafe to make the dive (see Sec. 1.69.4 and Sec. 2.33.1b).

**2.28. Termination of the Dive**

1. It is the responsibility of the diver to terminate the dive, without fear of penalty or reprisal, whenever he/she feels it is unsafe to continue the dive, unless it compromises the safety of another diver already in the water.
2. The dive shall be terminated while there is still sufficient cylinder pressure to permit the diver to reach the surface safely, including a stop, or to safely reach an additional air source at the decompression station.

**2.29. Shipboard Scientific Diving Safety**

All scientific diving activities carried out from Smithsonian research vessels shall conform to this manual, the R/V cruise manual and those of the UNOLS (University-National Oceanographic Laboratory System). The on-board Diving Supervisor shall be designated by the SDO for each cruise.

**2.30. SCIENTIFIC DIVING OPERATIONS**

**2.31. Lead Diver**

For each dive, one individual shall be designated as the Lead Diver. This person shall be at the dive location during the entire diving operation. The Lead Diver shall be responsible for:

1. **Coordination.** Diving shall be coordinated with other known activities in the vicinity which are likely to affect diving operations. The Lead Diver is also responsible for suspending diving operations if in his/her opinion conditions are not safe.
2. **Briefing.** The dive team members shall be briefed on:
  - a. dive objectives;
  - b. unusual hazards or environmental conditions likely to affect the safety of the diving operation;
  - c. modifications to diving or emergency procedures necessitated by the specific diving operation; and,
  - d. reporting any physical problems or adverse physiological effects, including symptoms of pressure-related injuries.
3. **Dive Planning.** Planning of a diving operation shall include considerations of the safety and health aspects of the
  - a. diving mode;
  - b. surface and underwater conditions and hazards;
  - c. breathing gas supply;
  - d. thermal protection;
  - e. diving equipment;
  - f. dive team assignments;
  - g. residual inert gas status of dive team members;
  - h. decompression schedules and altitude corrections; and,
  - i. emergency procedures.
4. **Emergency Equipment.** The Lead Diver must ensure that emergency equipment is present.

### 2.32. Dive Plans

Dives should be planned around the competency of the least experienced diver. Before conducting any diving operations under the auspices of the Smithsonian Institution, the Lead Diver for a proposed project shall submit, 6 weeks in advance, through the DO to the SDO, a dive plan for approval. When the SDO is the Lead Diver, the dive plan must be submitted through the DO to the Chair of the SDCB for approval.

For complicated, irregular, or unusual dive plans, especially but not limited to any diving activity that is in exception to the SI-Scientific Diving Safety Manual, the SDO should consult with the Chair of the SDCB to review the plans and recommendations before approval. The SDO and Chair of the SDCB are expected to consult with appropriate members of the DCB and/or external advisors before approval. The review process, consultation and recommendations should be documented in the Dive Programs records.

### 2.33. Pre-Dive Safety Checks

#### 1. Diver's Responsibility.

- a. Each scientific diver shall conduct a functional check of his/her diving equipment in the presence of the diving buddy or tender;
- b. it is the diver's responsibility and duty to refuse to dive if, in his/her judgment, conditions are unfavorable, or if he/she would be violating the precepts of his/her training, or applicable provisions of this SI-Scientific Diving Safety Manual;
- c. no dive team member shall be required to be exposed to hyperbaric conditions against his/her will, except when necessary to prevent or treat a pressure-related injury;
- d. no dive team member shall be permitted to dive for the duration of any known condition which is likely to adversely affect the safety and health of the diver or other dive members; and,
- e. the diver shall terminate the dive while there is still sufficient tank pressure to permit the diver to safely reach the surface including decompression.

#### 2. Equipment Evaluations.

- a. Each diver should perform a check of the submersible pressure gauge, timing device, depth gauge and/or dive computer;
- b. each diver shall have the capability of achieving and maintaining positive buoyancy;
- c. if mixed gas is used as the breathing medium, appropriate dive tables shall be used; and,
- d. each diver should perform an equipment check for all dives on closed and semi-closed circuit rebreathers (See Sec. 3.55).

#### 3. Diver's Qualifications.

Each diver shall possess current scientific diving certification and be trained and qualified for the diving mode being used, and each dive team member shall have experience or current training in the following:

- a. The use of the instruments and equipment appropriate to the diving activity to be conducted;
- b. dive planning and emergency procedures;
- c. current diver first aid training (Sec. 3.74); and,
- d. diving-related physics and physiology, recognition of pressure related injuries, and the appropriate emergency treatments.

### 2.34. Post-Dive Safety Checks

1. After the completion of a dive, each diver shall report any physical problems, symptoms of decompression sickness, or equipment malfunctions.
2. When diving outside the no-decompression limits, the divers should remain awake for at least one hour after diving and in the company of a dive team member who is prepared to transport him/her to a hyperbaric chamber, if necessary.
3. **Flying after diving or Ascending to Altitude (Over 1000 feet MSL):**  
Following a Single No-Decompression Dive: Divers should have a minimum preflight surface interval of 12 hours. Following Multiple Dives per Day or Multiple Days of Diving: Divers should have a minimum preflight surface interval of 18 hours. Following Dives Requiring Decompression Stops: Divers should have a minimum preflight surface interval of 24 hours. Before ascending to Altitude above 1000 feet by Land Transport: Divers should follow the appropriate guideline for preflight surface intervals unless the decompression procedure used has accounted for the increase in elevation.

**2.35. Emergencies and Deviations from Regulations**

Any diver may deviate from the requirements of this SI-Scientific Diving Safety Manual to the extent necessary to prevent or minimize a situation which is likely to cause death, serious physical harm, or major environmental damage. A written report of such actions must be submitted to the SDO explaining the circumstances and justifications.

**2.36. Consequence of Violation of Regulations by Scientific Divers**

Failure to comply with the regulations of the SI-Scientific Diving Manual may be cause for the immediate cessation of diving activities by action of a DO, pending review by the SDO and SDCB, and revocation or restriction of an individual's scientific diver authorization by action of the SDCB.

**2.40. RECORD KEEPING AND REQUIREMENTS**

**2.41. Personal Diving Log**

1. Each SI-Scientific Diver shall log every dive made under the auspices of the SDP with the SI-issued dive computer. These logs will be submitted through DECOSTOP's dive log upload system. The SI-diving log includes at least:
  - a. scientific diver's name, Smithsonian research unit and depth authorized;
  - b. dive plan authorization number;
  - c. name of buddy diver and location;
  - d. date;
  - e. maximum depth, dive time, required safety stops and surface interval;
  - g. remarks (*e.g.* environmental conditions or equipment notes);
  - h. total activity (dive times and depths); and,
  - i. a detailed report of any accidents or potentially dangerous situations.
2. If pressure-related injuries are suspected, or if symptoms are evident, the following additional information shall be recorded and retained by the SDO, with the record of the dive, for a period of 5 years:
  - a. complete accident report;
  - b. description of symptoms, including depth and time of onset; and,
  - c. description and results of treatment.

**2.42. Record Maintenance**

The SDO or his/her designee shall maintain permanent records for each individual SI-Scientific Diver certified. The file shall include evidence of certification, log sheets, record of current medical certification, waiver, reports of disciplinary actions by the SDCB and other pertinent information deemed necessary.

**2.43. Availability of Records**

1. Medical records shall be available to the attending physician of a diver or former diver upon written request by the diver, and,
2. Records and documents required by this standard shall be retained by the SDO for the following periods:
  - a. scientific diver medical certifications for 5 years;
  - b. SI-Scientific Diving Safety Manual: current document only;
  - c. records of dives: 1 year, except 5 years where there has been an incident of pressure-related injury;
  - d. pressure-related injury assessment: 5 years; and,
  - e. equipment inspection and testing records: current entry or tag, or until equipment is withdrawn from service.

**2.44. Required Accident Reporting**

All diving accidents requiring recompression or resulting in moderate or serious injury shall be reported to the SDO. The SDO will then report all diving accidents to the SDCB and the Under Secretary for Science. Additional information must meet the following reporting requirements:

1. the SDCB shall record and report occupational injuries and illnesses in accordance with the applicable requirements established by OSHA; and,

2. the SDCB shall record the occurrence of any diving-related injury or illness which requires any dive team member to be hospitalized, or after an episode of unconsciousness related to diving activity, or after treatment in a recompression chamber following a diving accident. The report will specify the circumstances of the incident and the extent of any injuries or illnesses.

### **SECTION 3.00 SCIENTIFIC DIVER TRAINING REQUIREMENTS**

#### **3.10. GENERAL POLICY**

Set forth below are the SDCB standards for SI-Scientific Diver certification. No person shall engage in scientific diving activities under the auspices of the Smithsonian Institution until the SDO, acting on behalf of the SDCB, has issued a scientific diving authorization and approved a submitted SI-Dive Plan.

Submission of documents and participation in aptitude examinations does not automatically result in certification. The applicant must convince the SDO that he/she is sufficiently skilled and proficient to be certified by the SDCB. Any applicant who does not possess the necessary judgment, under diving conditions, for the safety of the diver and his/her partner, may be denied SI-Scientific Diver privileges.

#### **3.20. PREREQUISITES**

##### **3.21. Eligibility**

Only a person diving under the auspices of the Smithsonian Institution is eligible for SI-Scientific Diver certification. The Smithsonian Institution does not provide recreational diver training and therefore limits course enrollment to Smithsonian personnel (including but not limited to: volunteers, fellows, intern, visiting scientists, and research associates as well as employees) who require the use of scuba for research activities. The use of scientific diving methods shall be acknowledged by the supervisor in the employee's job description and performance plan.

##### **3.22. Application**

Application for certification shall be made through DECOSTOP, the SDP's online virtual dive office.

##### **3.23. Medical Examination**

Each applicant for SI-Scientific Diver certification shall be medically certified (Appendix A) for diving by a licensed physician, according to the Smithsonian diver medical standards (Sec. 6.00) before proceeding with scuba training as described in Sec. 3.30.

##### **3.24. Swimming Evaluation**

The applicant for training shall successfully perform the following tests in the presence of the SDO, or designated representative:

1. swim underwater without swim aids for a distance of 25 yards without surfacing;
2. swim 400 yards in less than 12 minutes without swim aids;
3. tread water for 10 minutes, or 2 minutes without the use of hands, without swim aids; and,
4. without the use of swim aids, transport another person of equal size a distance of 25 yards in the water.

#### **3.30. TRAINING**

The diver must complete theoretical and practical training for a minimum cumulative time of 100 hours.

##### **3.31. Theoretical Training**

Required topics include, but are not limited to: scientific dive planning; diver first aid training; physics and physiology of diving; function, care, use, and maintenance of diving equipment; oceanography and underwater environment; night and limited visibility diving; decompression theory; diving safety; dive computer use; scientific diving regulations and history; the SI-Scientific Diving Safety Manual; scientific methods; data gathering techniques; diving from small boats and research vessels; and, training for transportation of compressed gas cylinders (incorporated with DFA training) and compressor safety. Suggested topics include diving specialties (See Sec. 3.55).

**3.32. Practical Training – Confined Water**

At the completion of confined water training, the trainee must satisfactorily demonstrate:

1. ability to surface dive to a depth of 10 feet in water without scuba;
2. a buddy check;
3. water entry with full scuba equipment;
4. ability to alternate between snorkel and scuba while kicking;
5. clearing of mask and regulator while submerged;
6. ability to remove and replace scuba equipment while submerged; and,
7. understanding of underwater signs and signals;
8. ability to achieve and maintain neutral buoyancy while submerged;
9. proficiency in air sharing, including both buddy breathing and the use of an alternate air source, as both donor and recipient, with and without a face mask;
10. a simulated emergency swimming ascent;
11. diver rescue and transport of a passive simulated victim of an accident;
12. simulated in-water mouth-to-mouth resuscitation;
13. techniques of self-rescue; and,
14. an in-water level of competence that is acceptable to the SDO.

**3.33. Practical Training - Open Water**

At least 12 supervised open water training dives must be performed in a variety of dive sites and conditions for a minimum cumulative bottom time of 6 hours. One of these dives must be a check-out dive with the SDO, DO, or designee. In addition to the scuba skills listed in Sec. 3.32, the trainee must satisfactorily demonstrate:

1. planning and performing a dive with a buddy;
2. entry and exit of open water, surf, or a diving vessel, while wearing scuba equipment;
3. kicking on the surface (400 yards) while wearing scuba equipment, without breathing from the scuba unit;
4. navigating under water;
5. ability to maneuver efficiently in the environment, at and below the surface;
6. ability to ascend at a rate not to exceed 30 fsw/min;
7. ability to perform a safety stop for 3-5 mins at 15 fsw; and,
8. judgment adequate for safe diving.

**3.40. EXAMINATIONS**

1. SI-Scientific Diver written examination based on theoretical and practical training in this section;
2. Examination and approval of scuba equipment by SDO or DO.
3. Open water check-out dive(s) to appropriate depths (Appendix E).

**3.50. SI-DIVER AUTHORIZATIONS**

**3.51. Diver-In-Training Authorization**

This authorization signifies that the trainee is currently participating in a scientific diving program course.

**3.52. Scientific Diver Certification**

This certification is a permit to dive for the use of compressed air within no-decompression limits. The diver has completed scientific diver certification requirements as outlined in this section. This permit is valid only while it is current and for the depth and specialty intended.

**3.53. Scientific Diving Reciprocity Authorization**

This authorization is issued by the SDO for a certified scientific diver from an organization that operates, at a minimum, under scientific diving regulations that meet or exceed AAUS scientific diving regulations. The visiting diver must, at a minimum, adhere to the requirements of this SI-Scientific Diving Safety Manual. Prior to arrival, the Smithsonian diving reciprocity form must be completed and forwarded to the SDO for approval. Upon arrival at the Smithsonian Institution, the visiting scientific diver will receive a brief orientation to the local SI safety procedures, and perform a check-out dive with the SDO, DO, or authorized designee.

### 3.54. Temporary Diver Authorization

This authorization is issued only following a demonstration of the required proficiency in diving and if the person in question can contribute measurably to a planned dive. It is granted by the SDO and is valid only for a specified time. Temporary diver authorization shall be restricted to the planned diving operation under Smithsonian Institution auspices and shall comply with all other policies, regulations and standards of this SI-Scientific Diving Safety Manual, including medical requirements.

### 3.55. Specialties

The following specialties require additional training, proficiency, equipment, and approval by the SDO, and must follow AAUS regulations. SI-Scientific Diver certification is a prerequisite before engaging in the following specialties.

1. **Decompression diving:** Any diving during which the divers cannot perform a direct ascent to the surface without performing a mandatory decompression stop.
2. **Surface-supplied diving:** A diving mode in which the tethered diver is supplied compressed gas from the surface by means of an air delivery system (e.g., Hookah). The diver is tended by a surface safety person and usually employs a full-face mask.
3. **Mixed-gas scuba diving:** A diving mode in which the diver is supplied in the water with a breathing gas other than air.
4. **Rebreathers:** Closed or semi-closed recirculating underwater breathing apparatuses.
5. **Blue-water diving:** A diving technique over deep, open ocean where visual references are limited, requiring use of a tether system with a safety diver.
6. **Dry suit diving:** A diving mode utilizing trilaminate, vulcanized rubber, or crushed neoprene water-tight suits.
7. **Ice diving, cave diving and wreck diving:** A diving technique in overhead environments where direct access to the surface is obstructed.
8. **Altitude diving:** A diving environment above sea level that requires the setting of altitude functions in dive computers or the use of special altitude dive tables.

### 3.60. DEPTH CERTIFICATION

The SI-Scientific Diver certification will authorize the holder to dive to the depth indicated on the authorized dive plan. A diver shall not exceed his/her depth certification, unless accompanied by a diver certified to a greater depth. Under these circumstances, the diver may not exceed his/her depth limit by more than one step. Diving is not permitted beyond a depth of 190 feet.

#### 3.61. Certification to 30 Foot Depth

This is the initial certification, approved upon the successful completion of training listed in Sec. 3.00.

#### 3.62. Certification to 60 Foot Depth

A diver holding a 30 foot certification card may be certified to a depth of 60 feet after successfully completing, under supervision of a SI-Scientific Diver certified to that depth or greater, 12 logged training dives to depths between 31 and 60 feet, for a minimum total time of 4 hours.

#### 3.63. Certification to 100 and 130 Foot Depths

A diver holding a 60 foot certification may be certified to depths of 100 and 130 feet respectively, by logging four dives near the maximum depth, and successful completion of a check-out dive approved by the SDO.

#### 3.64. Certification to Depths Over 130 Feet

A diver may be certified to depths of 150 and 190 feet, provided there is a scientific need, by logging four dives near each depth, and successful completion of a check-out dive approved by the SDO. Dives shall be planned and executed under close supervision of a SI-Scientific Diver certified to this depth. The diver must demonstrate knowledge of the special problems of deep diving and of special safety requirements, as explained in AAUS standards.

### **3.70. CONTINUATION OF CERTIFICATION**

#### **3.71. Minimum Activity to Maintain Certification**

During any 12 month period, each certified SI-Scientific Diver must log a minimum of 12 dives, two of which shall be within the certified depth range. Divers certified to 150 feet or deeper may satisfy these requirements with dives to 130 feet or over. If no dive is made for a 6 month period, an orientation dive or check-out dive must be made with the SDO, DO, or approved designee.

#### **3.72. Requalification of Depth Certification**

Once the initial certification requirements are met, divers whose depth certification has lapsed due to lack of activity may be re-qualified by satisfactorily performing a check-out dive with the SDO, DO, or approved designee.

#### **3.73. Medical Examination**

All SI-Scientific Divers shall pass a medical examination as specified in Sec. 6.00. After each major illness or injury, as described in Sec. 6.12, the individual shall submit to a medical examination before resuming diving activities; if the injury or illness is pressure-related, then the clearance to return to diving must be performed by a physician trained in diving/undersea medicine.

#### **3.74. Diver First Aid Training**

1. cardiopulmonary resuscitation (CPR) – within 12 months;
2. emergency oxygen administration – within 12 months;
3. field neurological examination, and,
4. dive rescue and first aid for diving accidents.
5. training for handling compressed gas cylinders.

#### **3.75. Diving Equipment Maintenance**

All SI-Scientific Divers shall have their scuba equipment inspected and serviced annually in compliance with Sec. 4.10.

### **3.80. REVOCATION OF CERTIFICATION**

A diving certification may be revoked or restricted by the SDO, pursuant to the consequences process outlined in Sec. 1.70, for cause, such as violations of regulations set forth in this SI-Scientific Diving Safety Manual. The SDO shall inform the diver in writing of the reason(s) for revocation. The diver will be given the opportunity to present his/her case in writing to the SDCB for reconsideration and/or recertification, pursuant to the appeals process outlined in Sec. 1.71. All such written statements and requests, as identified in this section, are formal documents that will become part of the diver's file.

### **3.90. RECERTIFICATION**

If a SI-Scientific Diver's certification expires, or is suspended or revoked, he/she may be recertified after complying with such conditions as the SDO or the SDCB may impose. The diver shall be given an opportunity to present his/her case to the SDCB before conditions for recertification are stipulated.

## **SECTION 4.00 DIVING EQUIPMENT**

### **4.10. GENERAL POLICY**

All equipment shall meet standards as determined by the SDCB and shall be inspected and tested in accordance with manufacturer's specifications prior to first use and annually thereafter. Equipment that is subjected to extreme usage under adverse conditions should require more frequent testing and maintenance. Each diver shall regularly perform a functional check of his/her scuba equipment prior to diving. The Smithsonian operates a Standardized Equipment Program (SEP) that provides for:



1. dive computer and regulator specifications and approval;
2. diving equipment for SI training courses;
3. periodic bulk equipment purchases; and,
4. in-house equipment maintenance and quality control.

#### **4.20. EQUIPMENT**

##### **4.21. Required Equipment**

Each SI-Scientific Diver shall wear the following equipment:

1. mask and fins;
2. regulator and alternate breathing source approved by the SDCB;
3. scuba cylinder;
4. submersible pressure gauge;
4. dive computer (SDCB approved);
5. buoyancy compensator (designed for scuba diving and equipped with a low pressure power inflator);
6. dive knife (sharp enough to cut through monofilament line);
7. weight system (with quick release device), and,
8. appropriate thermal insulation.

##### **4.22. Dive Site Equipment**

A first aid kit, oxygen resuscitation unit with demand valve, radio and/or cell phone shall be present at the dive location. A dive flag must be flown over the dive site.

##### **4.23. Scuba Cylinders**

Scuba cylinders shall be designed, constructed, and maintained in accordance with the applicable provisions of the Unfired Pressure Vessel Safety Orders promulgated for the U.S. Department of Transportation (DOT) by the American Society of Mechanical Engineers (A.S.M.E.). Scuba cylinders must:

1. be hydrostatically tested every 5 years;.
2. have an annual internal visual inspection; and,
3. have a annual functional test of valves.

##### **4.24. Record Keeping**

Each equipment modification, repair, test, calibration, or maintenance service shall be logged, including the date and nature of work performed, serial number of the item, and the name of the person performing the work for the following equipment:

1. regulators and alternate breathing sources;
2. submersible pressure gauges;
3. depth gauges;
4. buoyancy compensators;
5. scuba cylinders;
6. cylinder valves;
7. diving helmets;
8. full-face masks;
9. compressors;
10. gas control panels;
11. air storage cylinders;
12. air filtration systems;
13. analytical instruments;
14. dive computers; and,
15. dry suits.

#### **4.30. AIR QUALITY STANDARDS**

Breathing air for scuba shall meet the following specifications as set forth by the Compressed Gas Association (CGA Pamphlet G-7.1) and referenced in OSHA 29 CFR 1910.134 (or its most recent version):

CGA Grade E	
Component	Maximum
Oxygen	20 - 22%/v
Carbon Monoxide	10 PPM/v
Carbon Dioxide	1000 PPM/v
Condensed Hydrocarbons	5 mg/m <sup>3</sup>
Total Hydrocarbons as Methane	25 PPM/v
Water Vapor ppm	(2)
Objectionable Odors	None

For breathing air used in conjunction with self-contained breathing apparatus in extreme cold where moisture can condense and freeze, causing the breathing apparatus to malfunction, a dew point not to exceed -50°F (63 pm v/v) or 10 degrees lower than the coldest temperature expected in the area is required.

**4.40. COMPRESSOR SYSTEMS - SMITHSONIAN CONTROLLED**

**4.41. Design and Location of Compressor**

1. Low pressure compressors used to supply air to the diver shall be equipped with a volume tank with a check valve on the inlet side, a pressure gauge, a relief valve, and a drain valve.
2. Compressed air systems over 500 psig shall have slow-opening shut-off valves.
3. All air compressor intakes shall be located away from areas containing exhaust fumes or other contaminants.
4. Compressors shall be operated and maintained following manufacturer's specifications.

**4.42. Compressor Operation and Air Test Records**

1. Gas analyses and air tests shall be performed on each breathing air compressor at regular intervals of no more than six months. The results of these tests shall be entered in a formal log and maintained by the appropriate DO.
2. Persons operating breathing air compressors must receive training in the proper operating procedures.
3. A log shall be maintained showing operation, repair, overhaul, filter maintenance and temperature adjustment for each compressor as well as training verification of air compressor operators

**4.50. OXYGEN SYSTEMS**

1. Equipment used with oxygen or mixtures containing over forty percent (40%) by volume oxygen shall be designed, dedicated and maintained for oxygen service according to the highest prevailing standards for such use.
2. Components exposed to oxygen or mixtures containing over forty percent (40%) by volume oxygen shall be cleaned of flammable materials before being placed into service.
3. Oxygen systems over 125 psig shall have slow-opening shut-off valves.

**SECTION 5.00  
OTHER DIVING ACTIVITIES**

**5.10. CLOSED AND SEMI-CLOSED CIRCUIT SCUBA**

Closed and semi-closed circuit scuba (rebreathers) shall meet the following requirements:

1. oxygen partial pressure in the breathing gas shall not exceed values approved by the SDCB (the generally accepted maximum value is 1.5 atmospheres PO<sub>2</sub> at depths greater than 25 fsw/7.6 msw);
2. chemicals used for the absorption of carbon dioxide shall be kept in a cool, dry location in a sealed container until required for use;
3. the designated person-in-charge shall determine that the carbon dioxide absorption canister is used in accordance with the manufacturer's instructions; and,

4. closed and semi-closed diving equipment will not be used at a depth greater than that recommended by the manufacturer of the equipment, and shall be operated and maintained in accordance with manufacturer's specifications and requirements.

#### **5.20. HOOKAH DIVING**

Hookah divers shall comply with all scuba diving procedures in this manual.

1. Divers using hookah shall be equipped with a diver-carried independent reserve breathing gas supply.
2. Each hookah diver shall be hose-tended by a separate dive team member while in the water.
3. The hookah breathing gas supply shall be sufficient to support all hookah divers in the water for the duration of the planned dive, including decompression.

#### **5.30. SURFACE SUPPLIED DIVING**

Surface supplied divers shall comply with all scuba diving procedures in this manual (except Sec. 2.21). Surface supplied diving shall not be conducted at depths greater than 190 fsw (58 msw).

1. Divers using the surface supplied mode shall be equipped with a diver-carried, independent reserve breathing gas supply.
2. Each surface supplied diver shall be hose-tended by a separate dive team member while in the water.
3. Divers using the surface supplied mode shall maintain voice communication with the surface tender.
4. The surface supplied breathing gas supply shall be sufficient to support all surface-supplied divers in the water for the duration of the planned dive, including decompression.
5. During surface supplied diving operations, when only one diver is in the water, there must be a standby diver in attendance at the dive location.

#### **5.40. NITROX – Oxygen Enriched Air**

##### **5.41. Theoretical and Practical Training**

Topics include, but are not limited to: function, care, use and maintenance of equipment cleaned for nitrox use; physical and physiological considerations of nitrox diving; calculations of:

1. Equivalent air depth (EAD) for a given  $fO_2$  and actual depth
2.  $PO_2$  exposure for a given  $fO_2$  and depth
3. Optimal nitrox mixture for a given  $PO_2$  exposure limit and planned depth;
4. Maximum operational depth (MOD) for a given mix and  $PO_2$  exposure limit;
5. For nitrox production purposes, percentages/psi of oxygen present in a given mixture, and psi of each gas required to produce a  $fO_2$  by partial pressure mixing.
6. Decompression table and dive computer selection and usage;
7. Nitrox production methods and considerations;
8. Oxygen analysis; and,
9. Nitrox operation guidelines, dive planning and dive station components.

##### **5.42. Written Examination**

Before completion of training, diver must pass written nitrox diving examination.

##### **5.43. Nitrox Dive Parameters**

Oxygen Exposure Limits:

1. The maximum  $PO_2$  experienced at depth shall not exceed 1.6 atm.
2. The maximum allowable exposure limit should be reduced in cases where cold or strenuous dive conditions, or extended exposure times are expected.
3. If using the equivalent air depth (EAD) method the maximum depth of a dive should be based on the oxygen partial pressure for the specific nitrox breathing mix to be used.

Bottom Time Limits:

1. Bottom time for a single dive should not exceed the NOAA maximum allowable "Single Exposure Limit" for a given oxygen partial pressure.

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

**5.44. Nitrox Dive Equipment**

Equipment standards (Sec. 4.00) apply to nitrox diving operations. Additional nitrox equipment considerations include:

1. Dive computers must be adjusted for  $fO_2$  and  $PO_2$  limits by the diver prior to the start of each dive;
2. All equipment that during the cylinder filling process or dive is exposed to concentrations of oxygen greater than 40% must be cleaned and maintained for oxygen service; and,
3. Dedicated oxygen-clean “NITROX”-labeled scuba cylinders must be used.

**5.45. Gas Purity**

CGA Grade E (Sec. 4.30) and a Hydrocarbon Contaminants content no greater than 0.1 mg/m<sup>3</sup>.

**5.46. Gas Analysis**

Oxygen analysis of the breathing gas should be performed by the blender and/or dispenser and verified by the end user. The analyzer should be capable of reading a scale of 0 to 100% oxygen, within 1% accuracy. Each cylinder’s  $fO_2$ , MOD, cylinder pressure, date of analysis, and user’s name must be recorded. Dive logs must reflect this information.

**5.50. AQUARIUM DIVING**

**5.51. General Policy**

Definition - A scientific aquarium diver is an SI certified scientific diver. An aquarium is a shallow, confined body of water, which is operated by or under the control of NZP and is used for the purposes of specimen exhibit, education, husbandry, or research.

Note: All of the standards set forth in other sections of this standard shall apply, except as otherwise provided in this section.

**5.52. The Buddy System in Scientific Aquarium Diving**

All scuba diving activities in the confined environment of an aquarium shall be conducted in accordance with the buddy system, whereby both divers, or a diver and a tender as provided below, are always in visual contact with one another, can always communicate with one another, and can always render prompt and effective assistance either in response to an emergency or to prevent an emergency.

A diver and tender comprise a buddy team in the confined environment of an aquarium only when the maximum depth does not exceed 30 feet, and there are no overhead obstructions or entanglement hazards for the diver, and the tender is equipped, ready and able to conduct or direct a prompt and effective in-water retrieval of the diver at all times during the dive.

**5.53. Diving Equipment**

Section 4.21 of the SI Scientific Diving Safety Manual is modified to read as follows:

- Each Diver must be equipped with an SI Zoop dive computer.
- The maximum obtainable depth of the aquarium shall be used as the diving depth.

**5.54. Scientific Aquarium Diver Certification**

All of the standards set forth in sections 3.00 and 4.00 of the SI-Scientific Diving Safety Manual shall apply.

**5.55. Annual Safety Drills**

Scientific Aquarium Divers are required to have annual rescue skills training in accordance with the Association of Zoos and Aquariums (AZA) standards to maintain Scientific Diver Active Status.

Per section 11.7.4 of the 2012 AZA Accreditation Standards, "Institutions which utilize underwater diving with compressed air (SCUBA or surface-supplied) as a part of regular operations and/or maintenance must conduct at least one live-action emergency dive safety drill annually. These drills must be recorded and evaluated to ensure that procedures are being followed, that staff training is effective, and that what is learned is used to correct and/or improve the emergency procedures. Records of these drills must be maintained and improvements in the procedures duly noted whenever such are identified."

Explanation: at least one live-action drill is required annually. Additional practice exercises may consist of a variety of activities, including discussions, tabletop simulations, or actual drills. A drill is defined as a training exercise that physically re-creates an emergency situation and response outside the circumstances of an actual emergency. Results stemming from an actual emergency are of interest, but may not be counted as a drill for accreditation purposes.

To fulfill the AZA accreditation requirement, the National Zoo Unit Diving Officer, in conjunction with the SDO, will conduct annual live-action emergency safety drills.

**SECTION 6.00  
MEDICAL STANDARDS**

**6.10. MEDICAL REQUIREMENTS**

**6.11. General**

1. The SDCB shall verify that scientific divers have passed a current diving medical evaluation and have been certified as medically fit to engage in diving activities.
2. All medical evaluations required by this standard shall be performed by, or under the direction of, a licensed physician of the diver's choice, preferably one trained in diving/undersea medicine.
3. The diver shall be free of any acute or chronic disabling disease or condition for which restriction from diving is generally recommended.

**6.12. Frequency of Medical Evaluations**

Medical evaluation shall be completed:

1. before a diver may begin diving;
2. thereafter, at 5 year intervals up to age 40, every 3 years after the age of 40, and every 2 years after age 60; and,
3. following any major injury or illness, or any condition requiring hospitalization; if the injury or illness is pressure related, then the clearance to return to diving must be performed by a physician trained in diving medicine.

**6.13. Content of Diving Medical Evaluations**

Diving medical evaluations conducted initially and at the intervals specified in Sec. 6.12 shall consist of the following:

1. diving medical history (Appendix B);
2. diving medical examination (Sec. 6.14); and,
3. completion of "SI-Scientific Diver Medical Certification" (Appendix A) by the examining physician, forwarded to the SDO.

**6.14. Laboratory Requirements for Diving Medical Evaluations and Intervals**

**1. Initial examination under age 40:**

- a. Medical history;
- b. Complete physical examination, emphasis on neurological and otological components;
- c. Urinalysis; and,
- d. Any further tests deemed necessary by the physician.

2. **Periodic re-examination under age 40 (every 5 years):**
  - a. Medical history;
  - b. Complete physical examination, emphasis on neurological and otological components;
  - c. Urinalysis; and,
  - d. Any further tests deemed necessary by the physician.
3. **First exam over age 40:**
  - a. Medical history;
  - b. Complete physical examination, emphasis on neurological and otological components;
  - c. Detailed assessment of coronary artery disease risk factors using Multiple-Risk-Factor Assessment (age, family history, lipid profile, blood pressure, diabetic screening, smoking history) Further cardiac screening may be indicated based on risk factor assessment.
  - d. Resting EKG;
  - e. Chest X-ray;
  - f. Urinalysis;
  - g. Any further tests deemed necessary by the physician
4. **Periodic re-examination over age 40 (every 3 years); over age 60 (every two years):**
  - a. Medical history;
  - b. Complete physical exam, emphasis on neurological and otological components;
  - c. Detailed assessment of coronary artery disease risk factors using Multiple-Risk-Factor Assessment (age, family history, lipid profile, blood pressure, diabetic screening, smoking history) Further cardiac screening may be indicated based on risk factor assessment.
  - d. Resting EKG;
  - e. Urinalysis;
  - f. Any further tests deemed necessary by the physician.

**6.15. Conditions which MAY be disqualifying**

A recommended reference source is Bove, A.A. (Ed.). 1998. *Medical Examination of Sport SCUBA Divers*. Best Publishing Co., Flagstaff, Arizona.

1. Abnormalities of the tympanic membrane, such as perforation, presence of a monomeric membrane, or inability to auto inflate the middle ears.
2. Hearing loss; Vertigo including Meniere's Disease.
3. Stapedectomy or middle ear reconstructive surgery.
4. Recent ocular surgery.
5. Psychiatric disorders including claustrophobia, suicidal ideation, psychosis, anxiety states, depression.
6. Substance abuse, including alcohol.
7. Episodic loss of consciousness.
8. History of seizure.
9. History of stroke or a fixed neurological deficit.
10. Recurring neurologic disorders, including transient ischemic attacks.
11. History of intracranial aneurysm, other vascular malformation or intracranial hemorrhage.
12. History of neurological decompression illness with residual deficit.
13. Head injury.
14. Hematologic disorders including coagulopathies.
15. Risk factors or evidence of coronary artery disease.
16. Atrial septal defects.
17. Significant valvular heart disease - isolated mitral valve prolapse is not disqualifying.
18. Significant cardiac rhythm or conduction abnormalities.
19. Implanted cardiac pacemakers and cardiac defibrillators (ICD).
20. Inadequate exercise tolerance.
21. Hypertension.
22. History of pneumothorax.
23. Asthma.
24. Chronic pulmonary disease, including radiographic evidence of pulmonary blebs, bullae or cysts.
25. Diabetes mellitus.
26. Pregnancy

**6.16. Medical Certification by Physician**

The SI-Scientific Diver Medical Certification (Appendix A) required by this standard shall be submitted by the examining physician to the Dive Program representative designated by the SDO. This will be reviewed by the SDO and the DO shall make a copy available to the individual diver. The diver medical evaluation report and laboratory results shall be maintained by the examining physician consistent with all applicable federal and local regulations and guidelines for storage and release of medical records.

**SECTION 7.00  
DEFINITION OF TERMS**

**AAUS** - American Academy of Underwater Sciences is a not-for-profit organization representing scientific divers in the United States. AAUS promulgates consensual standards for the scientific diving certification and operation of scientific diving programs that the Smithsonian Institution adheres to.

**Aquarium** - A shallow, confined body of water, which is operated by or under the control of an institution and is used for the purposes of specimen exhibit, education, husbandry, or research.

**Bottom Time** - The total elapsed time measured in minutes from the time when the diver leaves the surface in descent to the time that the diver begins a direct ascent to the surface.

**Buddy Breathing** - The sharing of a single air source between divers.

**Buddy Diver** - Second member of the dive team.

**Cylinder** - A pressure vessel for the storage of gases.

**Decompression Sickness** - A condition with a variety of symptoms that 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** - Electronic, submersible, diver-carried meter based on an algorithm or dive table, which computes a diver's decompression status from time-depth inputs via a pressure sensor.

**Dive Location** - A surface or vessel from which a diving operation is conducted.

**Dive Site** - The physical location of a diver during the 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; also called dive tables.

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

**Dive Time** - The total elapsed time measured in minutes from the time when the diver leaves the surface to the time that the diver resurfaces.

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

**Diver-In-Training** - An individual gaining experience and training in additional diving activities under the supervision of a dive team member experienced in those activities.

**Diving Mode** - A type of diving requiring specific equipment, procedures, and techniques (for example, snorkel, scuba, surface supplied air, or mixed gas).

**Diving Officer** - Scientific Diver possessing current leadership certification, and authorized by SDCB to perform check out dives.

**Diving Supervisor** - Scientific Diver designated by SDO to supervise a specific scientific diving activity or research cruise.

**FSW** - Feet of seawater, or equivalent static head.

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

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

**Lead Diver** - The certified scientific diver with the experience and training to conduct the diving operation.

**MSW** - Meters of seawater or equivalent static head.

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

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

**Pressure Vessel** - See cylinder.

**Psig** – Unit of Pressure, Pounds per square inch gauge.

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

**Scientific Diving** - Scientific diving is defined (29CFR1910.402) as diving performed solely as a necessary part of a scientific, research, or educational activity by employees whose sole purpose for diving is to perform scientific research tasks.

**Scientific Diving Control Board (SDCB)** - A formally constituted body of SI-Scientific Divers with responsibility for diver certification, diving policy and operations and, with the Under Secretary for Science, the administration and oversight of the scientific diving program.

**Scientific Diving Officer (SDO)** - The individual with the operational authority, acting on behalf of the SDCB, and responsibility to the Under Secretary for Science, for the safe conduct of the scientific diving program of the Smithsonian Institution.

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

**Standby Diver** - A diver at the dive location capable of rendering assistance to a diver in the water.



**Surface Supplied Diving** - Surface Supplied: Dives where the breathing gas is supplied from the surface by means of a pressurized umbilical hose. The umbilical generally consists of a gas supply hose, strength member, pneumofathometer hose, and communication line. The umbilical supplies a helmet or full-face mask. The diver may rely on the tender at the surface to keep up with the divers' depth, time and diving profile.

**Scientific Aquarium Diver** - A scientific diver who is diving solely within an aquarium.

**Surface Supplied Diving** -- A mode of diving using open circuit, surface supplied compressed gas which is provided to the diver at the dive location and may or may not include voice communication with the surface tender.

**Swimming Ascent** - An ascent that can be done under normal or emergency conditions accomplished by simply swimming to the surface.

**UNOLS** - University-National Oceanographic Laboratory System is an association of ocean science research institutions that operate and use the U.S. academic research fleet. UNOLS publishes Research Vessel Safety Standards to which the Smithsonian Institution adheres.





# Smithsonian Institution

## Scientific Diver Medical History Form

(To Be Completed By Applicant-Diver)

Name \_\_\_\_\_ Sex \_\_\_\_ Age \_\_\_\_ Wt. \_\_\_\_ Ht. \_\_\_\_

Sponsor \_\_\_\_\_  
(Smithsonian Research Unit)

Date \_\_\_\_/\_\_\_\_/\_\_\_\_  
(Mo/Day/Yr)

### TO THE APPLICANT:

Scuba diving places considerable physical and mental demands on the diver. Certain medical and physical requirements must be met before beginning a diving or training program. Your accurate answers to the questions are more important, in many instances, in determining your fitness to dive than what the physician may see, hear or feel as part of the diving medical certification procedure. This form shall be kept confidential by the examining physician. If you believe any question amounts to invasion of your privacy, you may elect to omit an answer, provided that you shall subsequently discuss that matter with your own physician who must then indicate, in writing, that you have done so and that no health hazard exists. Should your answers indicate a condition, which might make diving hazardous, you will be asked to review the matter with your physician. In such instances, their written authorization will be required in order for further consideration to be given to your application. If your physician concludes that diving would involve undue risk for you, remember that they are concerned only with your well-being and safety.

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

	Yes	No	Please indicate whether or not the following apply to you	Comments
16			Headaches (frequent and severe)	
17			Wear dental plates	
18			Wear glasses or contact lenses	
19			Bleeding disorders	
20			Alcoholism	
21			Any problems related to diving	
22			Nervous tension or emotional problems	
23			Take tranquilizers	
24			Perforated ear drums	
25			Hay fever	
26			Frequent sinus trouble, frequent drainage from the nose, post-nasal drip, or stuffy nose	
27			Frequent earaches	
28			Drainage from the ears	
29			Difficulty with your ears in airplanes or on mountains	
30			Ear surgery	
31			Ringing in your ears	
32			Frequent dizzy spells	
33			Hearing problems	
34			Trouble equalizing pressure in your ears	
35			Asthma	
36			Wheezing attacks	
37			Cough (chronic or recurrent)	
38			Frequently raise sputum	
39			Pleurisy	
40			Collapsed lung (pneumothorax)	
41			Lung cysts	
42			Pneumonia	
43			Tuberculosis	

	Yes	No	Please indicate whether or not the following apply to you	Comments
44			Shortness of breath	
45			Lung problem or abnormality	
46			Spit blood	
47			Breathing difficulty after eating particular foods, after exposure to particular pollens or animals	
48			Are you subject to bronchitis	
49			Subcutaneous emphysema (air under the skin)	
50			Air embolism after diving	
51			Decompression sickness	
52			Rheumatic fever	
53			Scarlet fever	
54			Heart murmur	
55			Large heart	
56			High blood pressure	
57			Angina (heart pains or pressure in the chest)	
58			Heart attack	
59			Low blood pressure	
60			Recurrent or persistent swelling of the legs	
61			Pounding, rapid heartbeat or palpitations	
62			Easily fatigued or short of breath	
63			Abnormal EKG	
64			Joint problems, dislocations or arthritis	
65			Back trouble or back injuries	
66			Ruptured or slipped disk	
67			Limiting physical handicaps	
68			Muscle cramps	
69			Varicose veins	

	Yes	No	Please indicate whether or not the following apply to you	Comments
70			Amputations	
71			Head injury causing unconsciousness	
72			Paralysis	
73			Have you ever had an adverse reaction to medication?	
74			Do you smoke?	
75			Have you ever had any other medical problems not listed? If so, please list or describe below;	
76			Is there a family history of high cholesterol?	
77			Is there a family history of heart disease or stroke?	
78			Is there a family history of diabetes?	
79			Is there a family history of asthma?	
80			Date of last tetanus shot? Vaccination dates?	

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

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

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Signature

Date



Smithsonian Institution

**Diving Log Sheet**

The Scientific Diving Manual requires current scientific diver status and an approved dive plan on file with the Scientific Diving Officer prior to engaging in official diving activities.

Diver: \_\_\_\_\_ Research Unit: \_\_\_\_\_ Depth qualified: \_\_\_\_\_ Month: \_\_\_\_\_ Year: \_\_\_\_\_

Diver's signature: \_\_\_\_\_ Dive Plan Authorization Number: \_\_\_\_\_

#	Date	Dive Buddy	Location	Depth (ft)	Dive Time	Repet Group	Surface Interval	Repet Group	Stop min/ft	Remarks
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
11										
12										

Total your diving activity for scientific diving expedition or quarter below (record dive time in minutes)

Depth	0-30'	31-60'	61-100'	101-130'	131'+	Totals	Tables or Dive Computers used
# Dives							
Dive Time (mins.)							



# Smithsonian Institution

## Diving Accident Management Procedures

### Introduction

A diving accident victim could be any person who has been breathing air under water regardless of depth. It is essential that emergency procedures are predetermined on the Smithsonian Dive Plan in DECOSTOP and that medical treatment is initiated as soon as possible. It is the responsibility of the Lead Diver and DO to develop procedures for diving emergencies including evacuation and medical treatment for each dive location.

### General Procedures

Depending on the nature of the diving accident, stabilize the patient, administer 100% oxygen, contact local Emergency Medical System (EMS) for transport to medical facility, contact DO and SDO, as soon as appropriate. Explain the circumstances of the dive incident to the evacuation teams, medics and physicians. Do not assume that they understand why 100% oxygen may be required for the diving accident victim or that recompression treatment may be necessary.

1. Make appropriate contact with victim or rescue as required, followed by victim assessment.
2. Establish (C)irculation, (A)irway, (B)reathing, as required.
3. Administer 100% oxygen.
4. Activate Emergency Plan for that dive location to transport victim to nearest medical treatment facility.
5. Call appropriate Diving Officer for contact with diving physician and recompression chamber.
6. Notify SDO or designee according to the Emergency Plan of the facility.
7. Secure diving victim's scuba equipment.
8. Complete and submit Accident Report through the DO to the SDO.

### List of Emergency Contact Numbers Appropriate For Dive Location:

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### Emergency Contact Numbers:

Divers Alert Network Emergency: (919) 684-9111  
Smithsonian Diving Emergency: (202) 633-9111





## Smithsonian Institution

### Check-out Dive Procedure

Smithsonian authorized scientific diving may only be conducted by active status scientific divers, pending submission of a dive plan through their Unit's Diving Officer (DO) for approval by the SI-Scientific Diving Officer (SDO) and performance of a check-out dive with the SDO or designee.

- Pre-dive planning, briefing, site orientation;
- Buddy check (S.E.A.B.A.G.);
- Functional scuba equipment check;
- Proper dive buddy contact;
- Monitor cylinder pressure, depth and bottom time;
- Swimming skills:
  - surface dive;
  - demonstrate acceptable level of comfort in water;
  - surface swim without swim aids (400 yards < 12 mins.);
  - underwater swim without swim aids on one breath (25 yards);
  - tread water without swim aids (10 mins.) or without hands (2 mins.);
  - surface transport of a diver without swim aids (25 yards);
- Water entry and exit;
- Buoyancy check;
- Descent/ascent at appropriate ascent rate;
- Mask clearing with and without regulator in mouth;
- Regulator removal, retrieval and clearing;
- Demonstrate neutral buoyancy during dive and at safety stop;
- Remove and replace weight belt while submerged and at surface;
- Remove and replace scuba unit while submerged and at surface;
- Doff and don scuba gear;
- Buddy breathing with and without mask as donor and recipient;
- Alternate air sharing with and without mask as donor and recipient;
- Simulated emergency swimming ascent;
- Simulated safety stop;
- Dive rescue procedures:
  - Self rescue techniques;
  - Rescue of submerged, non-breathing diver (include equipment removal, ascent, simulated rescue breathing, towing and extraction).

Depth certification: \_\_\_\_\_

\_\_\_\_\_  
Scientific diver

\_\_\_\_\_  
Date

\_\_\_\_\_  
Diving Officer



## Smithsonian Institution

### Diving Safety Regulations

It has long been the position of the Smithsonian Institution that the ultimate responsibility for safety rests with the individual diver. Buoyancy compensation is critical in slowing ascent rates and fundamental to safe diving practices.

#### A. Dive Computers

1. Only those makes and models of dive computers specifically approved by the SDCB may be used. In 2004, the SDCB has approved Suunto, Uwatec, and Orca Industries models.
2. Each diver relying on a dive computer to plan dives and indicate or determine decompression status must have his/her own unit and be proficient in its use. It is strongly recommended that each diver also dive with a back-up dive computer.
3. A diver should not dive for 18 hours before activating a dive computer to use it to control his/her diving. Once the dive computer is in use, it must not be switched off until it indicates complete off-gassing has occurred or 18 hours have elapsed, whichever comes first. Only 1 dive on the dive computer in which the NDL of the dive computer has been exceeded may be made in any 18 hour period.
4. On any given dive, both divers in the buddy pair must follow the most conservative dive computer.
5. If the dive computer fails at any time during the dive, the dive must be terminated and appropriate surfacing procedures should be initiated immediately.
6. Breathing 100% oxygen above water is preferred to in-water air procedures for omitted decompression.

#### B. Ascent Rates

7. Ascent rates shall be controlled at 30 fsw/min from 60' and not exceed 60 fsw/min from depth.
8. A stop in the 10-30 fsw zone for 3-5 min is required on every dive.
9. Dry suits shall have a hands-free exhaust valve.
10. A buoyancy compensator is required with dry suit use for ascent control and emergency flotation. BCs shall have a reliable rapid exhaust valve which can be operated in a horizontal swimming position.

#### C. Dive Profiles

11. Multi-day repetitive diving requires that a non-diving day be scheduled after 6 consecutive diving days.
12. Reverse dive profiles are not prohibited for no-decompression dives less than 130 fsw (40 msw) with depth differentials less than 40 fsw (12 msw).

#### D. Nitrox

13. A PO<sub>2</sub> of 1.6 atm is the maximum limit for nitrox use
14. Standard scuba equipment is approved for use with nitrox up to 40% oxygen content.
15. Oxygen analysis of the breathing gas is to be performed by the blender and/or dispenser and verified by the diver using a controlled-flow sampling device.

#### References:

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