

# NOAA DIVING

## Standards & Safety Manual



N D S S M

Effective Date: 16 March 2023

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- 05 April 2017: NDSSM signed into policy.
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## **FOREWORD, ACKNOWLEDGEMENTS, and KEY TERMS**

### FOREWORD

This document represents the minimum safety standards for diving under the auspices of the National Oceanic and Atmospheric Administration (NOAA) as of the approval date of this manual. As best practices in the diving industry evolve, so shall this standard and it is the responsibility of every NOAA diver to ensure that it continues to reflect the latest information on safe diving.

### ACKNOWLEDGEMENTS

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### KEY TERMS

The NOAA Diving Program utilizes unique key terms throughout this manual that differ from the American Academy of Underwater Sciences (AAUS) diving community. The NOAA terms and their counterparts are as follows:

1. NOAA Diving Control and Safety Board (NDCSB) is equivalent to a Diving Control Board (DCB).
2. NOAA Diving Program Manager (NDPM) is equivalent to a Diving Safety Officer (DSO).
3. The NOAA Diving Safety Officer (NDSO) serves a role that is primarily related to the inspection of diving units and equipment and offers advice on general diving safety and supports the investigation of diving incidents.

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## Section 1: ADMINISTRATION

### 1.1 General Provisions

#### 1.1.1 Purpose.

- A. The purpose of the NOAA Diving Standards and Safety Manual (“Manual”) is to ensure all NOAA diving is conducted in a manner that will maximize protection of divers from accidental injury and/or illness, and to set forth standards for training and certification that will allow reciprocity with other diving programs. Fulfillment of this purpose shall be consistent with either the Occupational Safety and Health Administration (OSHA) commercial diving standards or will contribute to the furtherance of scientific research and safety under the Scientific Exemption to the OSHA commercial diving standards.
- B. This Manual sets minimum standards for the National Oceanic and Atmospheric Administration (NOAA) diving operations, describes the organization for the conduct of NOAA diving, and the basic standards and procedures for safety in NOAA diving operations. It also establishes a framework for reciprocity between NOAA, AAUS, and other organizations that adhere to these or equivalent standards.
- C. This manual contains information specific to the OSHA commercial diving standards (a.k.a. “working dives”) found in 29 CFR 1910, Subpart T and the Scientific Exemption to those standards (a.k.a. “scientific dives”); there are differences in how the dives can be conducted, to whom they apply, the gasses and equipment that are to be used and the personnel levels required to conduct the dives. All NOAA divers are to make themselves aware of the differences between the standards for commercial and scientific diving.

#### 1.1.2 Definition of Scientist and Scientist-In-Training.

For the purposes of performing operational dives which qualify under the Scientific Exemption to OSHA or scientific training and proficiency dives consistent with those sections of this Manual, divers must be one of the following:

- A. Scientist. An individual who dives to conduct scientific operations which require specific knowledge and expertise in which the individual is fully qualified, as determined by the on-site Divemaster (DM)/Lead Diver (LD) and Chief Scientist.
- B. Scientist-In-Training. An individual who dives to conduct scientific operations which require specific knowledge and expertise, but whose science activities and diving are conducted under the direct or indirect supervision of a Scientist and with the approval of the on-site DM or LD.

#### 1.1.3 OSHA Scientific Diving Exemption.

- A. In 1982, The Occupational Safety and Health Administration (OSHA) exempted scientific diving from commercial diving regulations (Code of Federal Regulations, 29 CFR 1910, Subpart T) under certain conditions that are outlined below. The final guidelines for the exemption became effective in 1985 (Federal Register, Vol. 50, No.6, p.1046). NOTE: The term “working dive” in this manual shall mean the same as “commercial dive” for the purposes of all regulations.
  - B. Per 29 CFR 1910, Subpart T, “Scientific diving means 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 does not include performing any tasks usually associated with commercial diving such as: Placing or removing heavy objects underwater; inspection of pipelines and similar objects; construction; demolition; cutting or welding; or the use of explosives.”
- 1) The two elements that a diving program must contain as defined by OSHA in 29 CFR 1910 Subpart T 1910.401(a)(2)(iv) are:
    - a. Diving safety manual, which includes at a minimum: Procedures covering all diving operations specific to the program; procedures for emergency care, including recompression and evacuation; and criteria for diver training and certification.
    - b. Diving control (safety) board, with the majority of its members being active divers, which must 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 depths to which a diver has been trained; take disciplinary action for unsafe practices; and, assure adherence to the buddy system (a diver is accompanied by and is in continuous contact with another diver in the water) for SCUBA diving.
  - 2) OSHA has granted an exemption for scientific diving from commercial diving regulations under the following guidelines (29 CFR 1910 Subpart T):
    - a. The Diving Control Board consists of a majority of active scientific divers and has autonomous and absolute authority over the scientific diving program’s operation.
    - b. The purpose of the project using scientific diving is the advancement of science; therefore, information and data resulting from the project are non-proprietary.
    - c. The tasks of a scientific diver are those of an observer and data gatherer. Construction and trouble-shooting tasks traditionally associated with commercial diving are not included within scientific diving.
    - d. Scientific divers, based on the nature of their activities, must use scientific expertise in studying the underwater environment and therefore, are scientists or scientists-in-training.

- C. Tasks that cannot be conducted under the scientific exemption include, but are not limited to: those involving ship husbandry (e.g., cleaning hulls, sea strainers, replacing zincs, un-fouling a ship’s propeller); use of heavy power tools powered by pneumatics or hydraulics from the surface; lifting, positioning and retrieving heavy objects (≥100 pounds underwater); construction, underwater cutting or welding using exothermic cutting lances, and use of explosives.

1.1.4 Scope and Application.

- A. The policies and procedures in this Manual apply to:
  - 1) All NOAA diving operations – NOAA diving operations include any diving operation in which NOAA is connected because of ownership of life support equipment used, locations selected, or relationship with the individual(s) concerned
  - 2) All NOAA employees engaged in diving activities during official duty hours (i.e., when receiving financial compensation for work performed) where compressed gas is breathed in a hyperbaric environment (when using NOAA-owned equipment off-duty this manual may apply as detailed in Section 5.4.14; and
  - 3) Non-NOAA personnel performing dives under the direct supervision of a NOAA DM or LD. For the purposes of this Manual, NOAA employees and non-NOAA personnel diving under the auspices of NOAA shall be collectively referred to as “NOAA divers.”
- B. Working versus Scientific dives. Unit Diving Supervisors (UDS) or designee shall be responsible for determining whether dive operations are to be conducted as OSHA subject (working dives) or OSHA exempt (scientific dives), based on review of the dive plan. Criteria to be used to distinguish between a working and scientific dive are presented at [www.osha.gov](http://www.osha.gov) and in the list below. A negative answer to any of the following questions would require the task to be conducted as a working dive following the standards outlined in this Manual.

Can the tasks be accomplished using simple hand tools (e.g., small hammers, pliers, chisels, wrenches, cameras, measuring tapes, nets, collection jars) weighing 25 pounds or less underwater?
Do the tasks require the expertise of a scientist or scientist-in-training?
Are the tasks limited solely to the observation of natural phenomena or responses of natural systems and/or gathering of data for scientific analysis?
If any object is to be lifted or moved, is its weight underwater <100 pounds?
Will the tasks result in the advancement of science?

- C. When conducting mixed operations (i.e., dives involving both scientific and working tasks), or when in doubt as to the nature of the dive, the dive shall be conducted as a working dive.

#### 1.1.5 Obligations, Restrictions, and Conditions.

- A. The NOAA Diving Program (NDP) ensures all NOAA divers are in compliance with:
  - 1) All standards of general applicability outlined in 29 CFR Part 1910, Subpart T; and
  - 2) All policies and procedures outlined in this Manual.
- B. The NOAA Diving Control and Safety Board (NDCSB) may elect to implement and enforce more stringent diving standards and procedures than those stated herein. Such changes will be promulgated in writing to all affected employees and supervisors prior to implementation and will be included in the next revision to this Manual.
- C. Failure to comply with the standards outlined in this Manual may be cause for the revocation or restriction of the diver's authorization by action of the NDCSB.
- D. No person shall engage in diving operations under the auspices of the NDP unless they hold a current authorization issued pursuant to the provisions of this Manual.
- E. No dive team member shall be exposed to hyperbaric conditions against their will.
- F. No dive team member shall be permitted to dive with any documented medical condition that is likely to adversely affect the safety and health of the diver or other dive team members and/or constitutes a direct threat towards the diver and/or others.

#### 1.1.6 Substitutions for Required Equipment, Materials, Apparatuses, Arrangements, Procedures, or Tests.

- A. Where it is demonstrated to the satisfaction of the NDCSB that the use of any particular equipment, material, apparatus, arrangement, procedure, or test is unreasonable or impracticable, the NDCSB may permit the use of alternate equipment, material, apparatus, arrangement, procedure, or test to such an extent and upon such condition that insures, to the satisfaction of the NDCSB, a degree of safety consistent with the minimum standards set forth in this Manual and remaining in compliance with 29 CFR 1910 Subpart T.
- B. Such changes will be codified in future revisions of this Manual and disseminated to all NOAA divers with an effective date of implementation.

#### 1.1.7 Deviations in Emergencies.

- A. NOAA divers may deviate from the requirements of this Manual provided that:
  - 1) The deviation is necessary to prevent or minimize a situation which is likely to cause imminent death, serious physical harm, or major environmental damage; and
  - 2) The DM or LD notifies the NOAA Diving Program Manager (NDPM), UDS, and Line Office Diving Officers (LODO) of the deviation within 24 hours of the onset of the emergency situation, with a written report fully supporting the rationale for deviation to follow within 30 days.
  - 3) A diver found to be inappropriately deviating from applicable legal standards shall be suspended from diving until the NDCSB approves reauthorization.
- B. The NDPM will in turn notify the Director, Office of Marine and Aviation Operations (OMAO), within 48 hours of the onset of the emergency situation indicating the nature of the emergency and extent of the deviation from the prescribed regulations.

#### 1.1.8 Manual Revisions.

- A. The NDCSB shall review this Manual at a minimum of every two (2) years.
- B. This Manual shall be:
  - 1) Issued, updated, and maintained by the NDP; and
  - 2) Distributed in paper or electronic form.

#### 1.1.9 Reference Material.

- A. This Manual can be viewed and downloaded from the [NOAA Diving Program \(NDP\) internal website](https://sites.google.com/noaa.gov/ndp/resources/ndssm) at <https://sites.google.com/noaa.gov/ndp/resources/ndssm>.
- B. Each NOAA diver, who is either NOAA-trained or granted equivalency by the NDPM, shall have access to a copy of this document.

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## 1.2 Program Mission, Goals, Core Products, Services and Management

### 1.2.1 Program Mission.

The mission of the NDP is to “To train, certify, authorize, and equip scientists, engineers, and technicians, while promoting innovation of effective diving technologies and safely performing underwater operations.”

### 1.2.2 Goals, Core Products, and Services of the NDP.

- A. Support and enable critical NOAA scientific research, stewardship activities and observations of natural phenomena.

- B. Establish standards and implement policies and procedures for conducting safe NOAA diving operations.
- C. Train, certify, and authorize scientists, engineers, and technicians in diving and diving medicine-related subjects.
- D. Provide NOAA divers with safe, technologically advanced, and well-maintained dive equipment.
- E. Provide guidance and expertise to the NOAA diving community.
- F. Investigate and implement new diving technologies and techniques for NOAA divers.
- G. Provide routine and emergency diving services to the NOAA fleet through ship and shore-based dive teams.
- H. Provide equipment, personnel, and expertise to NOAA field operations, as needed.
- I. Promote NOAA and the NDP through education and outreach.
- J. Investigate diving mishaps, incidents, and accidents consistent with applicable NOAA NAOs to foster refinements of NDP policies and procedures in order to prevent recurrences.

### 1.2.3 Management.

- A. The OMAO Director bears the overall responsibility for the safety of all NOAA divers.
- B. Management of the diving program is delegated from the OMAO Director to the NDPM.
- C. The NDCSB reviews and establishes diving regulations, policies, and procedures deemed necessary to ensure a safe and efficient diving program.
- D. Except as specified under 29 CFR 1910, Subpart T, and NAO 209-123, the NDCSB has absolute and autonomous authority over all NOAA diving operations.

## Section 2: PERSONNEL

Duties and responsibilities delegated herein to specific roles and positions may not be further re-delegated unless specifically authorized in this Manual.

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### 2.1 Director, Office of Marine and Aviation Operations

#### 2.1.1 General.

- A. The Director, OMAO broadly administers NOAA's diving activities.
- B. Responsibility for the day-to-day management of the NDP is delegated to the NOAA Diving Program Manager (NDPM).

#### 2.1.2 Responsibilities.

- A. Overall responsibility for the NDP and its policies and procedures.
  - B. Reviews issues raised by members of the NDCSB with dissenting opinions.
  - C. Receives briefings from the NDPM and Chair, NDCSB on NDP activities and provides guidance as needed.
  - D. Approves candidates for the membership on the NOAA Diving Medical Review Board and Technical Advisory Board.
  - E. Considers appeals from divers whose dive certifications are revoked.
- 

### 2.2 NOAA Diving Control and Safety Board

#### 2.2.1 General.

- A. The NDCSB is an appointed board of representatives from NOAA's Line Offices (LO) who report to the Director, Office of Marine and Aviation Operations (OMAO), and are responsible for the safety and effectiveness of the NDP.
- B. Although the NDCSB reports to the Director, OMAO, per 29 CFR 1910, Subpart T, the NDCSB exercises autonomous and absolute authority over operations of the NDP for both working and scientific dives.
- C. The NDCSB may grant waivers or variances to any part of this manual such as specific requirements of training, examinations, depth authorizations, and minimum activity to



maintain authorizations. Applicable legal standards and medical standards shall not be waived.

- D. The NDCSB shall meet annually in person and should meet monthly via teleconference, unless special meetings are required to address time sensitive issues.

### 2.2.2 Responsibilities.

#### A. General.

- 1) Exercises autonomous and absolute authority over and promotes the safe and effective operations of the NDP.
- 2) Acts as the official representative of NOAA in matters concerning the scientific diving program.
- 3) Establishes processes and program structure necessary to effectively approve and monitor diving projects across NOAA's geographically dispersed diving program.
- 4) Reviews and approves all diving operations involving more than one (1) of the following; equipment other than open-circuit scuba, breathing mixtures other than air or Nitrox, depths greater than 130 fsw or bottom times beyond the U.S. Navy no-decompression limits. The sole exception to these requirements for NDCSB approval is the Light Decompression program in which authorization is not needed after a Dive Unit has completed the probationary period.
- 5) Ensures that all personnel involved in diving instruction under NOAA are approved and authorized.
- 6) Delegates authority to Unit Diving Supervisors (UDS) to review and approve routine dive operations conducted at the unit level.

#### B. Safety.

- 1) Ensures sufficient oversight for safety exists within NDP.
- 2) Participates in safety assessments as necessary.
- 3) Advises the Director, OMAO of circumstances adversely impacting safety and/or efficiency of the NDP.
- 4) Instructs and reminds divers, LDs, DMs, and UDSs to adhere to all NDP diving regulations, standards, policies, and procedures.
- 5) Reviews dive operations and diving emergency assistance plans from non-NOAA diving partners who request to utilize NOAA-owned or contracted vessels to conduct diving operations following standards other than those promulgated by the NDP.
- 6) Holds the responsibility to conduct an evaluation and the authority to stand a unit back up after it has been suspended.

### C. Incident Review and Action.

- 1) If not superseded by other NOAA policy, serves as a board of review for inquiries into the nature and cause of diving incidents (including near-misses) as well as violations of NOAA or other applicable policies and standards, and reports the results to the Director, OMAO.
- 2) In accordance with NOAA Safety Policy NAO 209-1, SECO (Safety and Environmental Compliance Office) is responsible for investigating Class 'A' incidents involving a fatality or severe injury, or other cases constituting a "serious incident".
- 3) Institutes appropriate measures to mitigate the reoccurrence of dive incidents.
- 4) Prescribes action for unsafe or noncompliant practices or actions.

### D. Manuals and Procedures.

- 1) Develops and promulgates standards and safety manuals, and reviews and revises them as necessary.
- 2) Monitors compliance with standards and safety manuals, including establishing such compliance inspection and authorization programs as necessary, and reports non-compliance to the NDPM for action.
- 3) Reviews and makes changes in other NOAA diving regulations, standards, policies, and operational procedures.
- 4) As an Organizational Member of the American Academy of Underwater Sciences, the NDCSB will recommend changes in policy and amendments to the AAUS diving safety manual as the need arises.

### E. Training, Certification and Authorization.

- 1) Establishes and/or approves training, certification, and authorization programs for both NOAA divers and non-NOAA divers participating in NOAA-controlled dive projects.
- 2) Reviews, adopts, and enforces medical standards required to promote diver safety.
- 3) Recommends to the NDPM the revocation of diving authorizations.
- 4) Determines equivalency of potential diving partner organizations with that of the NDP for diving reciprocity.
- 5) Considers appeals from divers whose dive authorizations are suspended.
- 6) Recommends the issue, reissue, or the revocation of diving authorizations.

### F. Awards.

- 1) Reviews and approves non-monetary, on-the-spot awards for personnel providing meritorious service to the NDP.
- 2) Awards will adhere to requirements of NAO 202-451 and will remain at or below the limits of Level B as outlined in Appendix C of NAO 202-451.
- 3) Appropriated funds may be used for these awards.

G. Standardized Equipment Program.

- 1) Considers, reviews, and makes appropriate changes in diving equipment requirements.
- 2) Reviews and approves new diving technologies and techniques for possible implementation.
- 3) Establish and/or approve facilities for inspection and maintenance of diving and associated equipment.

2.2.3 Composition and Qualifications.

A. The voting members of the NDCSB shall include the following individuals:

- 1) NDPM;
- 2) LODOs with active diving programs (Line Offices must have 15% of total NOAA diver population for a voting seat on the board. Line Offices may request a non-voting seat until they meet the population threshold); and
- 3) NOAA Deputy Line Office Diving Officers (DLODOs) with active diving programs;

B. The non-voting members of the NDCSB shall include the following individuals:

- 1) The NOAA Diving Safety Officer (NDSO)
- 2) The NOAA Diving Center Manager (NDCM)
- 3) The NOAA Diving Medical Officer (NDMO)
- 4) A representative of NOAA's Safety and Environmental Compliance Division
- 5) A representative of NOAA's Small Boat Program Safety Board

C. The NDCSB may consult individual advisors or advisory panels with subject matter expertise to provide additional information.

D. All voting Members of the NDCSB shall be NOAA certified divers with a majority being qualified, active scientific divers.

E. A separate, non-voting Executive Secretariat, appointed by the Chairperson, may be appointed to administratively assist the NDCSB.

#### 2.2.4 Selection of NDCSB Members.

- A. NDPM is selected by the Director, OMAO from a list of candidates provided by the Office of Human Capital Services (OHCS) or Office of Personnel Management (OPM) with input provided by representatives of the NDCSB and other diving professionals.
- B. LODOs are appointed by NOAA Assistant Administrators from Line Offices with active diving programs.
- C. OMAO LODO is appointed by the Director, OMAO.
- D. DLODOs are appointed by the respective LODO with concurrence of their immediate supervisors.

#### 2.2.5 Chair.

- A. The Chair shall be selected from the current LODOs and DLODOs by majority vote of all voting members.
- B. The Chair communicates directly with the Director OMAO and shall report on a regular basis to the Director, OMAO significant issues and decisions before the NDCSB.
- C. The Chair sets the agenda for the NDCSB meetings.

#### 2.2.6 Decision Making Process of the NDCSB.

- A. The Chair shall strive for consensus on all NDCSB issues and decisions, and every attempt shall be made to query each voting member of the NDCSB on all decisions.
- B. A quorum of two-thirds of the voting members must be present, in person or electronically, to conduct official business.
- C. Voting members may designate a proxy to vote in their place with the following provisions:
  - 1) Proxies must be given in writing with a copy provided to the Chair;
  - 2) Proxies may not be given to another voting member of the NDCSB;
  - 3) The majority of voting members must be active scientific divers after the designation of any proxy voting members;
  - 4) Proxy voting privileges expire thirty (30) days after designation, may be renewed up to five (5) times and may be revoked at any time by the voting member delegating their vote.
- D. Decisions will be made by majority vote with the Chair casting the deciding vote in case of a tie.

- E. Major objections to majority votes shall be made part of the meeting minutes. Any voting member of the NDCSB may request that an item be raised to the Director, OMAO via written communication from the Chair.
- F. Though not a voting member, the opinion of the NDSO shall be recorded for all decisions relating to safety in the NDP.

#### 2.2.7 Term Limits.

- A. The Chair shall serve a two (2) year term and may be re-elected.
  - B. A Chair-Elect will be elected from the eligible candidates one (1) year prior to taking office.
  - C. The NDPM, NDCM, NDMO and NDSO are non-rotating members of the NDCSB. All other members shall serve a five (5) year term and may be re-appointed.
  - D. Appointments should be scheduled so only one (1) member rotates off the NDCSB per year.
- 

### 2.3 NOAA Diving Program Manager (NDPM)

#### 2.3.1 General.

- A. Selected by the Director, OMAO from a certified list of candidates from OHCS or OPM with advice and counsel provided by representatives of the NDCSB and other diving professionals where requested.
- B. Administers and manages the NDP.
- C. Serves as a voting member of the NDCSB.
- D. As necessary, permits aspects of the NDP to be carried out by a qualified designee, with approval from NDCSB. (The NDPM may not delegate responsibility for the overall safe operation of the NDP.)

#### 2.3.2 Responsibilities.

- A. Implements all policies and decisions prescribed by the NDCSB.
- B. Responsible to the Director, OMAO for the management and administration of the NOAA Diving Program.
- C. Enacts and implements NDP programs and policies developed and adopted by the NDCSB
- D. Reviews recommendations from the NOAA Diving Safety Officer (NDSO) and takes appropriate action.
- E. Suspends diving operations considered to be unsafe or unwise.

- F. Investigates and reviews new diving technologies and techniques.
- G. Suspends diving authorizations for violations of the standards and procedures in accordance with this Manual.
- H. Revokes diving authorizations for violating the standards and procedures in accordance with this Manual as directed by the NDCSB.
- I. Advises the Director, OMAO of circumstances adversely impacting safety and/or efficiency of the NDP.

#### 2.3.3 Management and Administration.

- A. Conducts an annual review of all NOAA diving operations and submits a report to the Director, OMAO.
- B. Monitors and enforces compliance with the applicable federal regulations and the NOAA Diving Standards and Safety Manual (NDSSM).
- C. Supervises the NOAA Diving Center Manager, NOAA Diving Medical Officer and any other assigned staff.
- D. Serves as the AAUS DSO and must meet all of the reporting and participation requirements for an organizational member of AAUS.

#### 2.3.4 Training, Certification, and Authorizations.

- A. Determines completion of certification requirements and issues initial NOAA diver authorizations to dive.
- B. Signs all “Letters of Initial Authorization to Dive,” “Dive Certifications,” and “Diver ID Cards”.

#### 2.3.5 Qualifications.

- A. NOAA authorized diver or equivalent, as determined by the NDCSB.
- B. A minimum of 15 years of experience in diving or a related field.
- C. Broad technical and/or scientific expertise in research related diving (e.g., safety, regulations, equipment, procedures).
- D. Must be an active scuba instructor from an internationally recognized certifying agency.
- E. Must qualify as a Full Voting Member of AAUS as defined by AAUS bylaws.
- F. Currently certified in cardiopulmonary resuscitation (CPR), including adult Automated External Defibrillator (AED), first aid, oxygen administration and is knowledgeable in dive accident management.

## 2.4 NOAA Diving Center Manager (NDCM)

### 2.4.1 General.

- A. Selected by the NDPM from a certified list of candidates from OHCS or OPM.
- B. Administers and manages the NOAA Diving Center (NDC).
- C. Serves as an advisory member of the NDCSB.
- D. As necessary, permits aspects of the NDC to be carried out by a qualified designee. (The NDCM may not delegate responsibility for the administration, management, and operation of the NDC.)

### 2.4.2 Responsibilities.

- A. Implements all policies and decisions prescribed by the NDCSB related to NDC functions.
- B. Responsible to the NDPM for the management of the NDC.
- C. Supervises all NDC staff.
- D. Investigates and reviews new diving technologies and techniques.
- E. Supervises the training programs of the NDC.
- F. Supervises the Standardized Equipment Program.

### 2.4.3 Management and Administration.

- A. Conducts an annual review of all NDC operations and submits a report to NDPM.
- B. Prepares and executes annual budgets for all NDC activities.
- C. Initiates all personnel actions within the NDC.
- D. Serves as contracting officer for NDC purchases and acquisitions.

### 2.4.4 Training and Certification.

- A. Ensures NDC dive training courses comply with standards of the Recreational Scuba Training Council (RSTC) and the NOAA Diving Standards and Safety Manual.
- B. Ensures all NDC diving instructors maintain qualifications as advanced open water and rescue instructors in at least one (1) nationally recognized diving certification organization and documentation of qualifications is maintained.

### 2.4.5 Qualifications.

- A. NOAA authorized diver or certified equivalent, as determined by the NDCSB.

- B. A minimum of ten (10) years of experience in diving or a related field.
  - C. Broad technical and/or scientific expertise in research related diving (e.g., safety, regulations, equipment, procedures).
  - D. Currently certified in cardiopulmonary resuscitation (CPR), including adult Automated External Defibrillator (AED), first aid, oxygen administration and is knowledgeable in dive accident management.
- 

## **2.5 NOAA Diving Safety Officer (NDSO)**

### **2.5.1 General.**

- A. The NDSO is selected by the NDPM, from a certified list of candidates from OHCS or OPM. The selection committee is chaired by the NDP Manager, and must include members from the NDCSB.
- B. Reports to the NOAA Diving Program Manager.
- C. Serves as an advisory member of the NDCSB.

### **2.5.2 Responsibilities.**

- A. Provides advice to the NDCSB, NOAA managers, and divers for diving safety-related issues.
- B. Provides assistance with NOAA diving safety issues to other NOAA offices and coordinates resolution of NOAA diving safety issues as directed by NDP Manager.
- C. Coordinates Diving Unit Safety Assessments (DUSA) of all NOAA dive units.
- D. As necessary, permits portions of this program to be carried out by a qualified designee, although the NDSO may not delegate responsibility for the oversight of safety within the NDP.
- E. Investigates, subject to and consistent with the incident investigation parameters in NAO 209-1, all Class B diving mishaps and provides findings to the NDCSB, Director, OMAO, and Director, Safety and Environmental Compliance Division (SECD).
- F. Conducts, facilitates and oversees the DUSA Program of the NDP and provides reports on the results of such assessments to the Director, SECD, NDCSB, and relevant UDS and facility director, including recommendations or actions taken to strengthen the safety and effectiveness of the NDP.
- G. Suspends diving operations considered to be unsafe or unwise and immediately notifies the NDCSB.



### 2.5.3 Qualifications.

- A. NOAA DM or equivalent as determined by the NDCSB.
  - B. A minimum of ten (10) years of experience in diving.
  - C. Broad technical and/or scientific expertise in research related diving (e.g., safety, regulations, equipment, procedures).
  - D. Shall be a current or previously-certified scuba instructor from an internationally recognized certifying agency.
  - E. Currently certified in cardiopulmonary resuscitation (CPR), including adult Automated External Defibrillator (AED), first aid, oxygen administration and is knowledgeable in dive accident management.
- 

## 2.6 Line Office Diving Officers (LODO)

### 2.6.1 General.

- A. Senior representatives for diving for each of the NOAA Line Offices with active diving missions (NMFS, NOS, and OMAO).
- B. LODOs are appointed by their respective Assistant Administrators, with consultation of the NDCSB and approval of the employee's immediate supervisor.
- C. The OMAO LODO is appointed by the Director, OMAO, with consultation of the NDCSB and approval of the employee's immediate supervisor.
- D. Duties and responsibilities are included in the LODO performance plans.

### 2.6.2 Responsibilities.

- A. Safety.
  - 1) Serves as subject matter experts, as requested, for SECO and SECO-assigned investigative teams for incidents involving a fatality or severe injury, or other criteria constituting a "serious incident" under the NOAA Safety Policy (NAO 209-1). **Note:** Responsibility for conducting the investigation and tracking completion of corrective actions is retained by SECO.
  - 2) Reviews Class "B" diving accidents that occur and report findings, recommendations, and/or proposed changes to the NDCSB and the NDSO.
  - 3) Reviews Class "C" accident investigations completed by the UDS.
  - 4) Suspends divers and/or diving operations considered to be unsafe or unwise.
  - 5) Assists in administration of DUSA program.

- 6) Forwards results of annual on-site diving unit safety inspections to the NDSO by January 31 of each year.

B. Management and Administration.

- 1) Assists as needed in planning and reviewing advanced and/or remote diving operations of assigned units and ensures compliance with this Manual.
- 2) Maintains familiarity with diving activities within assigned units and submits an annual report to the NDPM by November 30 of each year for the preceding fiscal year.

C. Training.

Determines reauthorization requirements for divers whose diving authorizations have lapsed by more than six (6) months, per Section 4.5.2.

D. Standardized Equipment Program (SEP).

Verifies accuracy of annual SEP assessment charges for assigned units.

2.6.3 Qualifications.

- A. Current certified Advanced NOAA diver or equivalent.
- B. Meets the requirements for UDS in Section 2.8.3.
- C. Minimum of 10 years of experience in diving.
- D. Currently certified in cardiopulmonary resuscitation (CPR), including adult Automated External Defibrillator (AED), first aid, oxygen administration and is knowledgeable in dive accident management.

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## 2.7 Deputy Line Office Diving Officers (DLODO)

2.7.1 General.

- A. DLODOs are representatives for diving for each of the NOAA Line Offices.
- B. DLODOs are appointed by their LODOs with consultation of the NDCSB and approval of the employee's immediate supervisor.
- C. Duties and responsibilities are included in the DLODO performance plans.
- D. Term of service is two (2) years, but may be extended by the respective LODO.

2.7.2 Responsibilities.

- A. Serves as a voting member of the NDCSB.
- B. Assists LODO in the performance of assigned duties as requested.

### 2.7.3 Qualifications.

- A. Current certified Advanced NOAA diver or equivalent.
  - B. Meet the requirements for UDS in Section 2.8.3.
  - C. Minimum of seven (7) years of experience in diving.
  - D. Currently certified in cardiopulmonary resuscitation (CPR), including adult Automated External Defibrillator (AED), first aid, oxygen administration and is knowledgeable in dive accident management.
- 

## 2.8 Unit Diving Supervisors (UDS)

### 2.8.1 General.

- A. Assigned throughout the agency to provide administrative oversight of divers at the facility level within their respective diving unit.
- B. Assigned by their LODO with concurrence of the NDCSB and approval of the employee's immediate supervisor.
- C. Duties and responsibilities are included in UDS's performance plans and may be delegated as appropriate.
- D. Duties are confined to diving supervision and administration of the diving unit. Duties do not include supervisory roles in evaluating performance plans, approving pay raises and other traditional supervisory activities.
- E. The UDS may delegate the administrative responsibilities listed in this Manual, however they are accountable for all actions taken by those designees.

### 2.8.2 Responsibilities.

- A. Safety.
  - 1) Ensures all diving is planned and conducted in accordance with all prescribed NOAA diving standards, policies, and procedures listed in this Manual.
  - 2) Responsible for determining whether or not a dive can be performed under the OSHA Scientific Exemption (29 CFR § 1910.401(a)(2)(iv) based on review of the dive plan and the qualifications of the divers involved.
  - 3) Ensures competent DMs or LDs are in charge of operations at dive sites.
  - 4) Ensures all diving gear and accessory equipment is maintained in a safe operating condition.

- 5) Reports all diving-related accidents/incidents that occur within their units to their LODO and/or work supervisor as prescribed in this Manual, and consistent with NAO 209-1.
  - 6) Approves dive plans and Diving Emergency Assistance Plans (DEAP) for all routine dives using air or Nitrox as a breathing gas.
  - 7) Elevates to the NDCSB all non-routine dive plans and emergency assistance plans for approval prior to commencement of the diving operation.
  - 8) Suspends divers and/or dive operations when deemed necessary and notifies the NDPM and their respective LODO within 24 hours.
  - 9) Conducts (or designates) a check out dive(s) with all recently authorized divers or those transferring from another unit to familiarize them with local conditions, protocols, procedures, and unique hazards prior to permitting unrestricted operational diving.
  - 10) Ensures any diving conducted using specialized equipment or procedures (e.g., drysuits, full face masks, tethered or line-tended scuba) is practiced on an annual basis to maintain diver proficiency. Failure to meet these minimum standards requires work-up (refresher) dives to be conducted prior to making operational dives.
  - 11) Ensures air purity tests are completed every six (6) months and results are documented for all NOAA-owned air compressors. Takes corrective action if results are out-of-specifications.
  - 12) Assists in administration of the DUSA program.
- B. Management and Administration.
- 1) Disseminates NOAA diving standards, policies, and procedures to assigned divers.
  - 2) Maintains or delegates, to qualified personnel, the responsibility of record keeping in a Unit Log (e.g., certifications, training, and equipment) for assigned divers.
  - 3) Ensures all divers are authorized, properly trained, and fit to perform the required diving.
  - 4) Conducts or delegates Annual DUSA Self-Assessment Inspection and submits an annual report to their respective LODO by January 15 of each year.
  - 5) Submits report of unit diving activities for the preceding fiscal year to their respective LODO by October 15 of each year.
  - 6) Prepares diver training applications and submits them to NDC.
  - 7) Forwards a copy of all approved dive plans and Diving Emergency Assistance Plans (DEAP) to the appropriate DM or LD responsible for the dive operation and to [ndp.diveplans@noaa.gov](mailto:ndp.diveplans@noaa.gov).

- 8) Prepares and distributes Letters of Reciprocity (LORs) for unit divers who are diving with reciprocity partners. Submits copies of all LORs to [NDP.LOR@noaa.gov](mailto:NDP.LOR@noaa.gov).
- 9) Shall confirm on an annual basis, Points of Contact with reciprocity partners and ascertain if any significant changes have been made to the partner's program. Any changes shall be raised to the LODO for further consideration.

#### C. Training.

Conducts operational training, required annual training, and skills evaluation check-out dives as needed.

#### D. Standardized Equipment Program.

- 1) Ensures all diving equipment follows maintenance schedule protocols.
- 2) Keeps NDC apprised of changes to unit roster.
- 3) Tracks SEP equipment and ensures gear is returned to NDC when no longer needed.
- 4) Verifies accuracy of annual SEP assessment charges for assigned divers (if needed).
- 5) Helps facilitate collection of SEP fees by ensuring a local budget office has the accounting codes from divers' supervisors (if needed).

#### 2.8.3 Qualifications.

- A. Current or former NOAA authorized diver.
- B. Completes the NOAA DM training program within twelve (12) months of becoming UDS.
- C. Minimum of five (5) years of experience in diving.
- D. Demonstrated ability to conduct operational training and skills evaluation checkout dive.
- E. Currently certified in CPR, including adult AED, first aid, oxygen administration, and is knowledgeable in dive accident management.

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## 2.9 Technical Diving Supervisor (TDS)

### 2.9.1 General.

- A. Technical Diving Supervisors (TDS) shall be in charge of all aspects of diving operations at dive sites involving the use of mixed gas or decompression and shall:
  - 1) Have experience and training in the conduct of the assigned diving operation;
  - 2) Have authority over execution of on-site diving operations; and

3) Be at the dive location.

B. The TDS may dive as long as there is another qualified TDS topside, designated by the NDCSB to render assistance in an emergency.

### 2.9.2 Responsibilities.

#### A. Safety.

- 1) Ensures all diving is planned and conducted in accordance with all prescribed NOAA diving standards, policies, and procedures listed in this Manual, as well as ensure all requirements are met for the Scientific Exemption as delineated in 29 CFR 1910, Subpart T.
- 2) Develops dive plans in conjunction with the UDS and submits dive plans to the NDCSB for approval.
- 3) Prohibits any diver from diving who, in the TDS's opinion, exhibits problems of a physical or psychological nature that may compromise the safety of a diver or the dive team.
- 4) Suspends diving operations when unusual hazards or environmental conditions adversely affect the safety of the diving operation.
- 5) Ensures emergency procedures are established and clearly understood by all personnel before diving begins.
- 6) Ensures all safety and emergency equipment is in working order and at the dive site.
- 7) Ensures all divers are monitored after each dive for signs or symptoms of decompression sickness or other diving-related maladies.
- 8) Reports all diving-related accidents and incidents as prescribed in this Manual and NAO 209-1.
- 9) Coordinates with other known activities in the vicinity that are likely to interfere with diving operations.
- 10) Ensures all diver-worn equipment is properly configured in accordance with the standards outlined in this Manual.
- 11) Obtains concurrence from the vessel operator and ensures all pre-dive checklists (e.g., [NOAA Form 57-03-20 Pre-Dive Planning](#), applicable CCR Deck and Build Checklists) have been completed prior to initiating diving operations when applicable.
- 12) Conducts pre- and post-dive safety briefings.

#### B. Management and Administration.

- 1) Ensures files are maintained.
  - 2) Ensures qualified individuals are assigned to fulfill all required diving and support positions.
- C. Training.  
Conducts operational training and skills evaluation check-out dives of divers, as directed by the NDCSB.
- 2.9.3 Qualifications.
- A. Completed NOAA Divemaster Training.
  - B. Certified to the level of the operation being supervised (i.e. TDS must be capable of making the dive they are overseeing)
  - C. UDS approval, or;
  - D. NDCSB approval, and a board approved TDS Workshop.
  - E. Proficiency shall be maintained by supervising a minimum of three (3) mixed gas/decompression dive cycles per year. If lost, proficiency may be regained by supervising one (1) dive cycle under the supervision of an authorized TDS.
  - F. Lapsed proficiency may be regained by completing one of the following:
    - a. Supervising one (1) dive cycle under the supervision of an authorized TDS
    - b. Complete board approved TDS workshop, or;
    - c. NDCSB approval.

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## 2.10 Divemaster (DM) and Lead Diver (LD)

### 2.10.1 General.

- A. DMs or LDs shall be in charge of all aspects of the diving operation at the dive site and shall:
  - 1) Have experience and training in the conduct of the assigned diving operation;
  - 2) Have authority over execution of on-site diving operations; and
  - 3) Be at the dive location.
- B. DMs and LDs may dive as long as there is a qualified topside person, designated by the DM or LD, to render assistance in an emergency.
- C. Duties and responsibilities are included in the DM's performance plan.

- D. The DM or LD may delegate administrative responsibilities listed in this Manual, but they are accountable for all actions taken by those designees.

#### 2.10.2 Responsibilities.

##### A. Safety.

- 1) Ensures all diving is planned and conducted in accordance with all prescribed NOAA diving standards, policies, and procedures listed in this Manual, as well as all applicable OSHA standards outlined in 29 CFR 1910, Subpart T.
- 2) Submits dive plans to UDS for approval.
- 3) Ensures all dive team members possess current authorizations and are qualified for the type of diving operation.
- 4) Prohibits any diver from diving who, in the DM's opinion, exhibits problems of a physical or psychological nature that may compromise the safety of a diver or the dive team.
- 5) Suspends diving operations when unusual hazards or environmental conditions adversely affect the safety of the diving operation.
- 6) Ensures emergency procedures are established and clearly understood by all personnel before diving begins.
- 7) Ensures all safety and emergency equipment is in working order and at the dive site.
- 8) Ensures all divers are monitored after each dive for signs or symptoms of decompression sickness or other diving-related maladies.
- 9) Reports all diving-related accidents and incidents as prescribed in Section 13 of this Manual and NAO 209-1, which also lists chain of command notifications.
- 10) Coordinates with other known activities in the vicinity that are likely to interfere with diving operations.
- 11) Ensures all diver-worn equipment is properly configured in accordance with the standards outlined in Section 5 of this Manual.
- 12) Obtains concurrence from the vessel operator and ensures all vessel pre-dive checklists (e.g., [NOAA Form 57-03-22 Dive Operations Plan – Safe Ship](#)) have been completed prior to initiating diving operations when applicable.
- 13) Conducts pre- and post-dive safety briefings.
- 14) Assists in administration of the DUSA program.

##### B. Management and Administration.

- 1) Ensures files are maintained if delegated by the UDS.



- 2) Ensures qualified individuals are assigned to fulfill all required diving and support positions.

C. Training.

- 1) Conducts operational training and skills evaluation check-out dives of divers as directed by the UDS.
- 2) Ensures all dive team members have appropriate training and/or experience in the planned diving environment and/or conditions.

D. Standardized Equipment Program.

- 1) Ensures all equipment is in safe operating condition, and required maintenance records are maintained if delegated by their UDS.
- 2) Assists UDS in tracking SEP equipment and ensures gear is returned to NDC upon departure of divers from the unit.

### 2.10.3 Qualifications.

A. Divemaster.

- 1) Current or former NOAA authorized diver unless authorized by the LODO.
- 2) Completed the NOAA DM training program.
- 3) Assigned by the UDS.
- 4) Currently certified in CPR, including adult AED, first aid, oxygen administration and is knowledgeable in dive accident management.
- 5) Proficiency shall be maintained by controlling a minimum of one (1) dive cycle per year. If lost, proficiency may be regained by controlling one (1) dive cycle under the supervision of an authorized DM or LD.

B. Lead Diver.

- 1) Current NOAA authorized diver.
- 2) Approved by the UDS or designee after demonstrating the ability to properly plan and safely execute dive operations.
- 3) Currently certified in CPR, including adult AED, first aid and oxygen administration, and be knowledgeable in dive accident management.
- 4) Proficiency shall be maintained by controlling a minimum of one (1) dive cycle per year. If lost, proficiency may be regained by controlling one (1) dive cycle under the supervision of an authorized DM or LD.

## 2.11 Ship Diving Officer (SDO)

### 2.11.1 General.

- A. Serves as the primary communicator between the NDP and the ship.
- B. Ensures the NDP and ship's Command understand each other's needs and requirements.
- C. Supervises dive operations if currently certified as a DM by the NDP or appointed as a LD by the UDS.
- D. Reports to an assigned OMAO UDS in the diving chain of command.

### 2.11.2 Responsibilities.

- A. Administers NDP policies onboard a specific OMAO ship as delegated by the assigned shore-based UDS.
- B. Monitors dive roster and informs Command of issues affecting operational readiness (e.g., lapsing proficiency, expiring certification, diving support equipment issues, training requirements, and personnel shortages).
- C. Maintains the ship's specific instructions for dive operations and other NDP-related documents, including a Unit Log and air compressor maintenance records.
- D. Conducts air compressor testing every six (6) months in accordance with the NDP diving air compressor testing program.
- E. Submits report of unit diving activities for the preceding fiscal year to the LODO by October 15 of each year.
- F. Conducts an annual dive locker inspection and submits a report to the UDS responsible for the unit by January 15 of each year.
- G. Assists in administration of the DUSA program.
- H. Maintains a thorough passdown log within the Unit Log.
- I. Reminds arriving/departing divers of their requirement to inform NDC of new unit/address in writing.
- J. Prepares diver training applications and submits them to their UDS.

### 2.11.3 Qualifications.

- A. May be any crewmember duly appointed by the Commanding Officer.
- B. Thorough understanding of diving operations and procedures.

## 2.12 Oversight of NOAA Diving Operations by Non-NOAA Personnel

### 2.12.1 General.

- A. Non-NOAA personnel who have completed NOAA Divemaster training may oversee NOAA diving operations if a NOAA employee who is a DM or LD is physically on the dive station to ensure all NDP standards, policies, and procedures are followed. Supervision of NOAA employees is only conducted by other NOAA employees; non-NOAA personnel may only offer advice as subject matter experts.
- B. Non-NOAA personnel who have not completed NOAA Divemaster training may oversee NOAA diving operations if they are approved by the NDCSB, and if a NOAA employee who is a DM or LD is physically on the dive station to ensure all NDP standards, policies, and procedures are followed.

### 2.12.2 Responsibilities.

- A. NOAA Divers, Divemasters (DM), and Lead Divers (LD).
  - 1) Initiates requests to utilize non-NOAA personnel to oversee NOAA diving operations through their UDS.
  - 2) Requests shall include, but are not limited to, qualifications of the requested individual (e.g., diving credentials and experience), fitness of the requested individual to participate in NDP operations (e.g., medical and physical conditions), and liability and financial support requirements and considerations.
  - 3) NOAA DMs and LDs assigned to assist non-NOAA Diving Personnel on the dive station shall:
    - a. Ensure that all dive operations are conducted in accordance with this Manual;
    - b. Approve daily dive plans and grant authority to commence operations; and
    - c. Remain actively engaged in all phases of the dive operation.
  - 4) Assists non-NOAA Diving Overseers in managing emergencies as requested and ensure that all diving incidents are reported per this Manual.
  - 5) Suspends or terminates dive operations deemed unsafe or unwise.
- B. Non-NOAA Diving Personnel Overseeing NOAA Diving Operations.
  - 1) Provides information on their qualifications to oversee specific NOAA diving operations upon request.
  - 2) Oversees NOAA diving operations in accordance with the NOAA Diving Standards and Safety Manual, and shall:

- a. Include the assigned NOAA DM or LD in all phases of the dive operation including pre-dive planning;
  - b. Obtain concurrence from the NOAA DMs and LDs to commence dive operations;
  - c. Keep assigned NOAA DM or LD informed on progress of dive operations, and;
  - d. Relinquish oversight of the dive operation when so directed by the assigned NOAA DM or LD.
- C. Unit Diving Supervisors.
- 1) Reviews requests from Divers, LDs, and DMs to oversee operations and, if deemed appropriate, forward to their respective LODO.
  - 2) Informs the requesting diver of the NDCSB decision.
  - 3) Ensures a qualified NOAA employee who is a Divemaster or Lead Diver is present to monitor adherence to NOAA diving administrative requirements when a non-NOAA individual is overseeing NOAA diving operations.
- D. Line Office Diving Officer.
- 1) Reviews requests from UDSs and, if deemed appropriate, forward to the Chair of the NDCSB.
  - 2) Informs the UDS of the NDCSB decision.
- E. Chair, NOAA Diving Control and Safety Board.
- 1) Forwards requests from LODOs to the members of the NDCSB for a vote.
  - 2) Informs the members of the NDCSB on the results of the vote.
- F. Members of the NDCSB.
- 1) Review requests and vote to approve or reject requests.
  - 2) Acceptance of non-NOAA personnel for the oversight of NOAA diving operations shall be made on an individual basis dependent on the qualifications of all involved.

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## 2.13 NOAA Diver

### 2.13.1 General.

- A. Divers are assigned throughout the agency to conduct underwater tasks in support of NOAA's mission and mandates.
- B. NOAA divers must be authorized to dive by the NDP and be sufficiently trained and experienced to undertake assigned diving tasks safely and effectively.

### 2.13.2 Responsibilities.

- A. Adheres to the standards contained within this Manual when conducting dives.
- B. Refuses to dive when, in their judgment, conditions are unsafe and/or actions would be in violation of the precepts of training or the requirements in this Manual.
- C. Maintains good physical condition and a high level of diving proficiency.
- D. Reports to the DM or LD any physical or psychological changes that may adversely impact their or their buddy's fitness to dive.
- E. Terminates diving activity immediately when a physical or psychological problem develops that can compromise the safety of the diver or dive team and immediately reports this to the DM or LD.
- F. Ensures diving equipment used is maintained in a safe operating condition.
- G. Maintains accountability for NOAA-issued equipment.
- H. Ensure that non-NOAA air systems meet air quality standards before filling cylinders.
- I. Adheres to the buddy system, actively monitors buddy status, including, but not limited to, cylinder pressure, and intervenes to the maximum extent practicable to ensure the safety of the dive team.
- J. Assists in administration of DUSA program.

### 2.13.3 Qualifications.

- A. For the purpose of performing operational scientific dives, or scientific training and proficiency dives consistent with this Manual, divers must meet the definition of a scientist listed in Section 1.1.2 of this Manual.
- B. Individuals not meeting the above requirement may participate in scientific dives as a "scientist-in-training" if the individual utilizes scientific expertise to perform science dives under the direct supervision or guidance from a scientist and is appropriately briefed on the specific tasks to be performed during the dives by a scientist as defined in Section 1.1.2.
- C. Diving activities in which the participants do not meet the definitions of scientist or scientist-in-training and the tasks do not meet the requirements for operational or training scientific dives must follow the OSHA Commercial Diving Standards outlined in 29 CFR 1910, Subpart T.

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## 2.14 NOAA Advanced and Master Divers

### 2.14.1 General.

NOAA Advanced and Master Divers are assigned throughout the agency to conduct dives in support of NOAA's mission and mandate.

#### 2.14.2 Responsibilities.

- A. Adheres to the standards contained within this Manual when conducting dives.
- B. Refuses to dive when in their judgment conditions are unsafe, or if they would be violating the precepts of their training or the requirements in this manual.
- C. Maintains good physical condition and a high level of diving proficiency.
- D. Reports to the DM or LD any changes of a physical or psychological nature that may adversely impact their or their buddy's fitness to dive.
- E. Stops or does not begin a dive if problems exist of a physical or psychological nature that can compromise the safety of the diver or dive team.
- F. Ensures diving equipment used is maintained in a safe operating condition.
- G. Maintains accountability for NOAA-issued equipment.
- H. Adheres to the buddy system, actively monitors buddy status including, but not limited to, cylinder pressure, and intervenes to the maximum extent practicable to ensure the safety of the dive team.

#### 2.14.3 Qualifications.

- A. NOAA Advanced Divers, in addition to requirements for a NOAA Diver, shall:
  - 1) Complete a minimum of 150 logged dives as a NOAA Diver:
  - 2) Successfully complete a NOAA DM course;
  - 3) Complete two (2) or more checkout dives with UDS;
  - 4) Have obtained experience in a variety of diving conditions and demonstrated competent supervision of a range of diving operations; and
  - 5) Receive certification based upon review of the candidate's dive resume by the divers' UDS, LODO, and the NDPM.
- B. Master Divers, in addition to requirements listed above, shall:
  - 1) Be certified as a NOAA Advanced Diver;
  - 2) Complete a minimum of 150 logged dives as a NOAA Advanced Diver;
  - 3) Possess special expertise in several areas of diving; and
  - 4) Receive certification based upon review of the candidate's dive resume by the divers' UDS and LODO as well as one (1) other LODO, and by the NDPM.

#### 2.14.4 Equipment.

Unless otherwise authorized by the LODO, NOAA Advanced and Master Divers shall be outfitted with SEP equipment per Sections 5.2.2 and 5.4.1.

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### 2.15 Observer Diver

#### 2.15.1 General.

- A. NOAA program sites are frequently visited by representatives of other agencies, the media, and various officials for the purpose of familiarization, evaluation, or reporting on NOAA programs.
- B. The Observer Diver classification was established to allow divers not affiliated with the NDP to observe diving activities conducted by NOAA.
- C. Observer Divers diving under NOAA auspices on operational dives shall follow the standards outlined in this Manual.
- D. Once authorized, participation of Observer Divers shall be solely at the discretion of the DM or LD.

#### 2.15.2 Eligibility.

- A. The Observer Diver classification is open to both NOAA and non-NOAA personnel.
- B. This classification does not apply to NOAA employees who dive as part of their regular duties or to NOAA employees who have been previously determined to be medically unqualified to dive.

#### 2.15.3 Minimum Requirements.

- A. Persons seeking authority to participate as an Observer Diver must provide the following documents to the appropriate UDS:
  - 1) Evidence of diving certification from a recognized diver certifying organization (e.g., National Association of Underwater Instructors (NAUI), Professional Association of Diving Instructors (PADI), or the military);
  - 2) Evidence of ten (10) logged dives, one (1) of which has been conducted within the previous three (3) months, indicating the appropriate proficiencies required for the diving conditions likely to be encountered; and
  - 3) Applicants must:
    - a. Complete [NOAA Form 57-03-53 Report of Medical History – Observer Diver](#) and submit it directly to the NDMO for evaluation and approval; and if non-NOAA
    - b. Sign and submit [NOAA Form 57-03-08 Observer Diver Waiver of Liability](#).

B. The NOAA UDS or designee shall:

- 1) Inspect diver's credentials and determine whether they have evidence establishing certifications by approved organizations;
- 2) Use [NOAA Form 57-03-08 Observer Diver Waiver of Liability](#) to obtain a signed liability release from the diver (non-NOAA employees only) and complete the pre-dive checklist portion of [NOAA Form 57-03-26 Observer Diver Report](#);
- 3) Inspect diver's gear for proper operating condition and require replacement of items not considered serviceable;
- 4) Review diver's equipment maintenance records and verify the equipment has been serviced within the previous 12 months;
- 5) Obtain approval from the LODO;
- 6) Upon receiving clearance, conduct in-water evaluations of observer candidates to determine if current and overall experience levels, fitness, and diving proficiencies are adequate for the conditions likely to be encountered on the dives; and
- 7) Complete the dive log section of [NOAA Form 57-03-26 Observer Diver Report](#) immediately following the diving operation and forward to the NDC.

C. The LODO shall:

- 1) Receive a request from the UDS;
- 2) Receive medical clearance from NDMO;
- 3) Make the final decision on whether to authorize; and
- 4) Inform the UDS of the decision.

#### 2.15.4 Limitations.

- A. Tasks of Observer Divers are limited to observation, photography, and/or videography.
- B. Observer Divers may participate in up to six (6) dives per year unless otherwise authorized by the LODO.

#### 2.15.5 Personnel Requirements.

A. Escort Divers.

- 1) Observer Divers must be accompanied by a minimum of two (2) UDS-approved authorized NOAA divers whose sole responsibilities are to monitor the observer in order to ensure their safety.
- 2) A buddy team of NOAA escort divers may accompany up to two (2) observer divers.



- 3) Additional observer divers require additional NOAA escort divers in a ratio of one to one (1:1) (See table below).
- B. Standby Divers. A team of standby divers, or a line-tended standby diver, shall be available topside and ready to enter the water within one (1) minute of notification if required by the LD, DM, UDS, or LODO.
- C. A Designated Person In-Charge (DPIC) who is assigned by the DM or LD and stationed topside at the dive location, shall be in charge of all aspects of the dive operation affecting the safety and health of the dive team members.

Observer Divers	Escort Divers	Standby Divers <sup>1</sup>	DPIC
1	2	1 or 2	1
2	2	1 or 2	1
3	3	1 or 2	1
4	4	1 or 2	1

Note <sup>1</sup>: See Section 2.15.5 B above.

#### 2.15.6 Equipment.

- A. Unless authorized by the LODO, Observer Divers shall be outfitted with personally-supplied diving equipment equivalent to that of Section 5.4.1.
- B. Each NOAA escort and standby diver shall carry a RASS.

## 2.16 Reciprocity Diver

### 2.16.1 General.

- A. Non-NOAA divers may participate in NOAA diving activities, and NOAA divers may participate in non-NOAA diving activities through reciprocity agreements.
- B. Scientific reciprocity divers under NOAA auspices shall follow the standards outlined in this Manual.
- C. A reciprocity diver may be asked to demonstrate their knowledge and skills for the planned dive.
- D. NOAA reciprocity agreements:
- 1) Allow non-NOAA divers to participate in NOAA diving activities, and vice-versa with minimal administrative requirements;
  - 2) Are established with other organizations only after it is determined their diving programs are equivalent to NOAA's;

- 3) Are only applicable to personnel employed and covered for medical treatment, Workers Compensation, and liability claims by reciprocity organizations;
  - 4) Are not transferable to other agencies or institutions with whom NOAA's reciprocity partners have separate reciprocity agreements; and
  - 5) Expire on December 31 ten years after the date they were established; they must be re-established every ten years.
- E. Reciprocity divers in good standing with their organizations, who are not employees and are not covered for medical treatment, Workers Compensation and liability (e.g., students), can only be accepted as volunteers if permitted by statutory authority (Section 2.17).
- 2.16.2 Request for Reciprocity with a Non-NOAA Organization.
- A. A NOAA UDS may request formal diving reciprocity be established with non-NOAA organizations when no such agreement exists.
  - B. Such requests, along with a copy of the candidate organization's diving standards and safety manual, must be forwarded through the appropriate LODO to the NDCSB for review.
  - C. If deemed equivalent to NOAA's diving standards, reciprocity may be established.
  - D. The UDS shall confirm on an annual basis, Points of Contact with reciprocity partners and ascertain if any significant changes have been made to the partner's program. Any changes will be raised to the LODO for further consideration.
  - E. A list of current reciprocity agreements is maintained on the website at <https://sites.google.com/noaa.gov/ndp/unit-admin/reciprocity>.
- 2.16.3 Letters of Reciprocity for NOAA Divers.
- A. Per the terms of the reciprocity agreements, any NOAA diver wanting to dive with a reciprocity organization must request a LOR be sent to the DSO of the receiving organization verifying they are an authorized NOAA Diver. The UDS is authorized to provide the LOR or they may request that NDC provide the LOR. All LOR requests must be issued within seven (7) days and LORs should be issued within three (3) days.
  - B. LOR forms can be generated by the UDS and must [use the Letter of Reciprocity Form](#), available on the NDC website. If NDC is needed to generate the form send request to [support.ndc@noaa.gov](mailto:support.ndc@noaa.gov). LORs generated and signed by NDC will be forwarded to the receiving DSO with copies sent to the NOAA diver and UDS. LORs includes the following information:
    - 1) Dates of original diving authorization, written scientific diving exam completion, and last diving medical exam with expiration

- 2) Dives: most recent checkout dive, depth of last dive, number of dives in the last 12 months, total career dives
  - 3) Depth Authorization
  - 4) Agency and dates of last training of CPR, First Aid, and Oxygen Administration Certification.
  - 5) Waivers or requirements
  - 6) Pertinent authorizations or training
  - 7) Emergency contact information
- C. LORs generated and signed by the UDS will be forwarded to the receiving DSO with copies sent to the NOAA diver and NDC. The copy for NDC should be sent to: [NDP.LOR@noaa.gov](mailto:NDP.LOR@noaa.gov) within 24 hours.
- D. LORs will only be sent if the NOAA diver is in an authorized diving status.
- E. Liability Information.
- 1) LORs for NOAA federal full-time employees will state the diver is covered under the Federal Employee Compensation Act, United States Code (USC) 5 USC § 8101 et seq., for injuries that may be sustained as the result of an accident occurring during the scope of any official dive; as well as by the provisions of the Federal Tort Claims Act, 28 USC §§ 1346, 2671 et seq.
  - 2) LORs for NOAA contract employees will state the diver is not a federal employee and, therefore, not covered by NOAA for injuries that may be sustained as the result of an accident occurring during the scope of any official dive; however, they are covered by their contract employer.
- F. LORs only address a diver's credentials and status within the NDP. It is up to the Line Office's Program Office to which the diver belongs to determine if the specific work to be performed with a reciprocity partner is authorized from a programmatic standpoint.
- #### 2.16.4 Letters of Reciprocity for Non-NOAA Divers.
- A. Reciprocity divers wanting to dive with NOAA must present a signed LOR from their organization's DSO to the appropriate UDS (or designee) verifying that the diver is in an authorized status with their organization.
  - B. The LOR must indicate the diver is covered for medical treatment, included in their organization's Workers Compensation policy, and covered for liability claims.
  - C. Must be received from the DSO at an institution with whom NOAA currently has reciprocity.

- D. If denied permission to dive, NOAA must notify the reciprocity diver and their DCB with an explanation of all reasons for the denial.

#### 2.16.5 Equipment.

- A. Reciprocity divers shall be outfitted with personally-supplied diving equipment equivalent to that of Section 5.4.1 as determined by the on-site DM or LD.
- B. A UDS (or designee) will inspect the Reciprocity Diver's non-NOAA diving equipment for proper operating condition and replace items not considered serviceable with other equipment provided by the diver or NOAA.
- C. When not provided by the Reciprocity Diver and with verification of the appropriate training, NOAA shall provide (when required) a diver-carried reserve breathing gas supply, or other appropriate gear, to the diver.

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## 2.17 Volunteer Diver

### 2.17.1 General.

- A. The Federal Government may only accept voluntary services as provided for by statute. The law that allows NOAA to accept volunteer services for certain activities is the Fish and Wildlife Improvement Act of 1978 (16 USC 742f). The Act authorizes Secretaries of the Interior and Commerce (inclusive of NOAA) to accept voluntary services in accordance with the provisions of that law. The Act also authorizes provision of incidental expenses such as transportation, lodging, awards, and subsistence to volunteers without regard to their place of residence.
- B. NOAA Volunteer Divers conducting work as authorized by the Fish and Wildlife Act, as amended, or the National Marine Sanctuaries Act, as amended, or other applicable statutes will, in most circumstances, be considered federal employees for purposes of claims under the Federal Tort Claims Act and for purposes of the Federal Employees' Compensation Act.
- C. Volunteers must submit proof of training and experience to the appropriate NOAA UDS for review. The UDS will forward documentation, along with their recommendation, to their LODO. The LODO shall forward documentation, along with their recommendation, to the NDPM. The NDPM shall review the documentation and recommendations from the UDS and LODO, and determine if the individual meets the criteria for certification. If qualified, the NDPM shall issue a letter of initial authorization to dive as a Volunteer under NOAA auspices. The NDPM will notify the LODO and UDS of their decision.

### 2.17.2 Eligibility.

- A. NOAA Volunteer Divers must be sponsored by a NOAA program or office. An Appointing Officer (someone with hiring authority) from that program or office is responsible for meeting all federal requirements for administering and managing the work of the volunteer and serves as the point of contact to the NDPM.
- B. Divers in good standing with organizations with whom NOAA has an active diving Reciprocity Agreement, and who meet the requirements of Section 2.17.4, may be accepted as volunteers based on their diving credentials as reciprocity divers.
- C. If a person is not an employee of an organization with whom NOAA has reciprocity, then that person must become a NOAA-certified diver consistent with the requirements and procedures prescribed in the NOAA Diving Standards and Safety Manual.
- D. Individuals not meeting the above requirements must comply with all diving regulations, policies, and procedures prescribed in this Manual for NOAA certified divers.

#### 2.17.3 Authority for Accepting Volunteers.

- A. Authority for accepting volunteers for liability rests with the specific NOAA office/program hiring official receiving the services of the volunteer.
- B. Final authority for certifying volunteers as NOAA divers rests with the NDPM.

#### 2.17.4 Minimum Requirements.

- A. Successful completion of a medical examination equivalent to those standards outlined in the [NOAA Diving Medical Standards and Procedures Manual](#).
- B. Proof of training and/or experience equivalent to a NOAA Diver as determined by the NDCSB and verified by the UDS.
- C. Minimum of 30 logged dives if the Volunteer Diver will be conducting OSHA-exempt dives.
- D. Minimum of 100 logged dives if the Volunteer Diver will be conducting OSHA-subject dives.
- E. Current certifications for CPR, including adult AED, first aid, and oxygen administration (American Heart Association, American Red Cross, or equivalent) and verified by the UDS.
- F. Successful completion of the NOAA Diver Exam (or equivalent in the case of Reciprocity Divers) as verified by the UDS or designee.
- G. Successful completion of the NOAA swim test (or equivalent in the case of Reciprocity Divers) and an open-water checkout dive equivalent to that required for NOAA Divers and conducted by the UDS, or designee.

- H. Successful completion of applicable NOAA specialized training (e.g., DUI Weight and Trim System, Gas consumption calculation, RASS, Line-tended Standby Diver) verified by UDS.
- I. Approval of the NDPM.

#### 2.17.5 Limitations.

- A. Maximum depth and tasks authorized may be limited by the UDS, LODO, or the NDPM based on review of the diver's resume and dive logs.
- B. Unless approved by the UDS, Volunteer Divers shall be directly supervised by an on-site NOAA DM or LD.
- C. NOAA Volunteer Divers must be at least 18 years of age.

#### 2.17.6 Equipment.

- A. Unless authorized by the UDS, Volunteer Divers shall be outfitted with their own diving equipment equivalent to that of NOAA divers, and annual service records will be provided to the UDS for review. The responsibility for any lost or damaged volunteer-owned diving gear or equipment rests with the sponsoring program or office.
- B. When not provided by the Volunteer Diver, and with verification of appropriate training, NOAA shall provide (when required) the diver with a diver-carried reserve breathing gas supply to be used while performing official NOAA dives.

#### 2.17.7 Responsibilities.

- A. NOAA Appointing Officer.

A person with hiring authority reviews and signs all required volunteer forms acknowledging approval and acceptance of liability for the volunteer while providing volunteer service to the NOAA office/program.

- B. Volunteer Diver.

- 1) Adheres to the standards contained within this Manual when conducting dives.
- 2) Refuses to dive when in their judgment, conditions are unsafe, or if they would be violating the precepts of their training or the requirements in this Manual.
- 3) Maintains good physical condition and a high level of diving proficiency.
- 4) Reports to the DM or LD any changes of a physical or psychological nature that may adversely impact their or their buddy's fitness to dive.
- 5) Stops or does not continue a dive if problems exist of a physical or psychological nature that can compromise the safety of the diver or dive team.
- 6) Ensures diving equipment used is maintained in a safe operating condition.

- 7) Adheres to the buddy system, actively monitors buddy status, including, but not limited to, cylinder pressure, and intervenes to the maximum extent practicable to ensure the safety of the dive team.
- C. Unit Diving Supervisor.
- 1) Reviews documentation from the applicant for compliance with minimum requirements.
  - 2) Reviews and maintains copies of signed forms from the NOAA hiring authority.
  - 3) Inspects Volunteer Divers' equipment for proper operating condition, reviews maintenance records, and replaces items not considered serviceable with other equipment provided by the diver or with NOAA equipment.
  - 4) Administers the written examination and conducts or delegates authority to conduct checkout dive(s).
  - 5) Forwards documentation and recommendation to LODO.
  - 6) Approves individuals to supervise volunteer diving activities.
- D. LODO. Reviews documentation and recommendations from the UDS, and forwards to the NDPM within ten (10) business days.
- E. NOAA Diving Program Manager.
- 1) Reviews documentation and recommendation from the UDS and LODO and makes final decision on acceptance of candidate.
  - 2) Reports decision to LODO and UDS in writing within ten (10) days of receipt of package from LODO.

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## 2.18 Fellowship / Scholarship Diver

### 2.18.1 General.

NOAA has the authority to accept voluntary service from fellowship and scholarship recipients under 16 U.S.C. § 742f. Department of Commerce Administrative Order (DAO) 202-311 defines voluntary service as "service provided by any person on their own initiative without a formal request from the United States Government through an authorized appointing officer." Volunteers meeting these requirements are considered employees of NOAA and as such are provided protection under the Federal Tort Claims Act, 28 U.S.C. § 2671 et seq. (FTCA) and Federal Employees' Compensation Act, 5 U.S.C. § 8101 et seq. (FECA), to the extent provided by law.

### 2.18.2 Requirements for Fellowship and Scholarship Recipients from Programs with NOAA Diving Reciprocity.

- A. Fellowship and scholarship recipients wishing to participate in official dives with the NOAA Diving Program and who are currently authorized divers in a diving program with whom NOAA has reciprocity for diving, may utilize a Letter of Reciprocity (LOR) to document their diving credentials.
- B. The following additional requirements must be met:
  - 1) Review of a Diving Physical by the NOAA Diving Medical Officer.
  - 2) Review NOAA Diving Policy presentation.
  - 3) Successful completion of NOAA-specific dive training (e.g., RASS, line tending, gas consumption, NOAA Diving standards and policies).
  - 4) Successful completion of skills demonstration and checkout dive(s) with a NOAA UDS or designee.
  - 5) Documentation of current annual service for any personally owned dive gear to be used on NOAA Diving operations.

#### 2.18.3 Requirements for Fellowship and Scholarship Recipients who are unaffiliated with a recognized diving program or who are from programs without NOAA Diving Reciprocity.

Fellowship recipients wishing to participate in official dives with the NOAA Diving Program and who are unassociated with any diving program or associated with a diving program without NOAA Diving reciprocity may participate in official NOAA Diving Program operations if the following requirements are met:

- A. Documentation of dive training to include Basic Open Water, Advanced Open Water, and Rescue Diver from a nationally recognized diving instruction entity.
- B. Approval of a Diving Physical by the NOAA Diving Medical Officer.
- C. Successful completion of the NOAA Diving Program Initial Swim Test.
- D. Current certification in Adult CPR, First Aid, Adult AED, and Oxygen Administration.
- E. Score of at least 80% on all sections of the NOAA Diving Written Examination.
- F. Successful completion of NOAA-specific dive training (e.g., pool skills demonstration, RASS, line tending, gas consumption, NOAA Diving standards and policies). Administered by NOAA Field Evaluator.
- G. Successful completion of Checkout Dive(s) with a NOAA Field Evaluator, UDS or designee.
- H. Documentation of current annual service for any personally owned dive gear to be used on NOAA Diving operations.

#### 2.18.4 Minimum Requirements, Limitations, Equipment and Responsibilities.



Other minimum requirements, limitations, equipment and responsibilities for fellowship and scholarship divers are identical to those for Volunteer Divers as found in Section 2.17 of this Manual.

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## **2.19 Recognition of Non-NOAA Diving Certifications**

### 2.19.1 General.

- A. The NDCSB may grant NOAA Diver status to individuals with non-NOAA dive certifications if it is determined that the certification is equivalent to, or greater than, NOAA certification.
- B. The NDCSB may grant a waiver for specific requirements of training, examinations, depth authorizations, and minimum activity to maintain authorizations. Legal or Medical standards cannot be waived.
- C. NDCSB will ultimately determine equivalency of non-NOAA dive certifications (e.g., commercial or military dive training and experience) towards meeting NOAA requirements.
- D. When a diver's resume provides clear evidence of significant scientific diving experience, the diver can be given credit for meeting portions of the 100-hour course requirements. The NDCSB will identify specific overlap between on-the-job training, previous scientific diving training/experience and course requirements, and then determine how potential deficiencies will be resolved. However, NOAA cannot "test-out" divers, regardless of experience, when they have no previous experience in scientific diving.

### 2.19.2 Responsibilities.

- A. NOAA Diver candidates must meet the requirements for safety training, medical clearance, and swim test outlined in Section 4.1 of this Manual.
  - B. Must pass a written examination covering the topics outlined in Section 4.2.1 of this Manual.
  - C. Must pass a practical examination (checkout dive) administered by a NOAA Dive Trainer covering the topics outlined in Section 4.2.2 and 4.2.3 of this Manual.
  - D. Must complete other NOAA-specific training as determined by the NDCSB.
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## **2.20 NOAA Diving Medical Officer (NDMO)**

### 2.20.1 General.

The NOAA Diving Medical Officer (NDMO) is a licensed health care provider with specialized training in diving and hyperbaric medicine, and is capable of recognizing and providing medical services and/or advice for diving related maladies. The NDMO is stationed at the NOAA Diving Center.

#### 2.20.2 Qualifications.

- A. Is a licensed health care provider assigned to NOAA.
- B. Is selected by the Director, NOAA Health Services with input from the NDPM.
- C. Completes NOAA-approved hyperbaric training courses, including but not limited to NOAA/Undersea and Hyperbaric Medical Society (UHMS) Physicians Training in Diving Medicine course and the Joint Medical Officer and Technician Course.
- D. Holds a NOAA diving certification and maintains authorization.

#### 2.20.3 Responsibilities.

- A. Maintains current education in the area of diving medicine.
- B. Conducts reviews of dive physicals and other medical submissions.
- C. Makes determinations of medical fitness to dive.
- D. Serves as an advisor to the NDPM regarding medical issues.
- E. Provides medical services and advice in support of diving operations.
- F. Provides medical training.
- G. Serves as a liaison between the non-NOAA diving medicine community and the NDP.
- H. Serves as Chairperson of the NOAA Diving Medical Review Board (NDMRB) and advisor on the NDCSB as appointed by the Director, OMAO.
- I. Confers with NDMRB as needed to resolve fitness to dive and other diving medical issues.
- J. Coordinates call schedule for the NOAA on-call DMO to ensure 24/7 phone coverage for NOAA diving emergencies.

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## 2.21 Other Diving Medical Officers within NOAA

### 2.21.1 General.

- A. A Hyperbaric Medical Officer (HMO) is a health care provider with specialized training in diving and hyperbaric medicine.

- B. These individuals may be assigned anywhere (e.g. attached to a specific ship or operations center) within NOAA.

#### 2.21.2 Qualifications.

- A. Is a licensed health care provider assigned to NOAA; and
- B. Completes a NOAA-approved hyperbaric training course.

#### 2.21.3 Responsibilities.

- A. Maintains current education in the area of dive medicine.
- B. Provides medical services and advice in direct support of diving operations.
- C. Provides medical training.
- D. Serves as the DMO on-call as requested by the NDMO.

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## 2.22 NOAA Diving Medical Review Board (NDMRB)

### 2.22.1 General.

- A. The NDMRB is a standing committee of a minimum of five (5) qualified hyperbaric physicians that advises the NDP on various diving-related medical issues. NDMRB members are accepted on an individual basis as volunteers pursuant to the Fish and Wildlife Improvement Act of 1978 (16 USC 742f). Recruitment of NDMRB members is initiated by the NDMO based upon potential member's experience, current research and reputation within the diving medicine community.
- B. Members of the NDMRB are selected by the NDMO and accepted (appointed) by the Director, OMAO after consultation with the NDPM, the Director, NOAA Health Services, and the Chair, NDMRB. Training for NDMRB members includes familiarization with the NDP's medical standards for divers and physical requirements for NOAA diving operations.
- C. The NDMO shall serve as the Chair, NDMRB.
- D. Appointments to the NDMRB are for a period of five (5) years and may be extended by the Director, OMAO after consultation with the NDPM, the Director, NOAA Health Services, and the Chair, NDMRB.
- E. The NDMRB does not provide advice as a group, but rather, all advice is forwarded by individual members to the Chair, NDMRB.

### 2.22.2 Responsibilities.

- A. Chair.

- 1) Receives general program policy guidance, excluding medical guidance, from the NDPM.
- 2) Consults with medical experts on medical-related issues for consideration by the NDMRB when requested or deemed necessary.
- 3) Summarizes all input from the NDMRB and reports findings and recommendations to the NDPM.
- 4) Seeks consultation from an undersea or hyperbaric physician before a decision is rendered when circumstances or the situation does not allow for input from the membership of the NDMRB and the Chair is not a physician.

B. NDMRB Members.

- 1) Recommends medical policy and changes in medical operating procedures that will foster a safe and efficient diving program.
- 2) Reviews diver's medical qualifications forwarded by the NDPM to assess application of the NDPM's medical evaluation criteria or other issues raised by the NDPM, NDCSB, or Chair, NDMRB.
- 3) Reviews appeals from divers who are medically disqualified from diving and provide medical opinions and recommendations to the Chair.
- 4) Provides medical reviews of diving incidents as requested by the Chair, NDMRB.
- 5) Recommendations and reviews are provided by members on an individual basis and not from the group as a whole.

### 2.22.3 Qualifications.

A. Chair.

- 1) Federal employee or a member of a uniformed service.
- 2) NOAA authorized diver.
- 3) Complete a NOAA-approved DMO course.
- 4) Must be a physician (MD/DO), NP, or PA.

B. NDMRB members.

- 1) Board certified physician in undersea and hyperbaric medicine, and
- 2) Recognized as a leader in undersea and hyperbaric medicine.

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## 2.23 NOAA Diving Technical Advisory Committee

### 2.23.1 General.

- A. The NOAA Diving Technical Advisory Committee (NDTAC) is a group of individuals outside of the agency that advises the NDP on various operational and technical issues. NDTAC members are accepted on an individual basis as volunteers pursuant to the Fish and Wildlife Improvement Act of 1978 (16 USC 742f). Recruitment of NDTAC members is based upon recommendations by members of the NDCSB based upon the potential member's knowledge, standing and expertise in a relevant field of diving technology.
- B. Members of the committee are selected by the NDCSB and accepted (appointed) by the Director, OMAO. Training of NDTAC members includes briefings on the requirements of the NOAA diving operations for which their expert advice is being sought.
- C. The committee shall not provide advice as a group, but rather, all advice is forwarded by individual members to the Chair, NDCSB, through the NDPM.

### 2.23.2 Responsibilities.

- A. Review unique or specialized diving projects, equipment, and techniques; and provide comments on their safety and feasibility to the NDCSB.
- B. Provide comments to the NDCSB on proposed new diving equipment, regulations, policies, and procedures affecting the NDP.

Reviews and comments are provided by members on an individual basis and not from the group as a whole.

### 2.24.3 Qualifications.

Individuals recognized as experts on a specific aspect of diving or type of gear.

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## 2.24 Vessel Operators Supporting NOAA Diving Operations.

For the purposes of this Manual, the term Vessel Operator shall refer to anyone meeting the following qualifications:

- A. Operators of NOAA owned ships supporting NOAA Diving operations shall hold a current Officer of the Deck qualification for that ship.
- B. Operators of NOAA owned small boats supporting NOAA Diving operations shall meet the training requirements documented in the NOAA Small Boat Standards and Procedures Manual.
- C. Operators of NOAA contracted ships and small boats supporting NOAA Diving operations shall be currently licensed by the United States Coast Guard at the required level commensurate with the vessel they are operating.

## Section 3: MEDICAL STANDARDS

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### 3.1 Medical Standards and Procedures for NOAA Diving

#### 3.1.1 General.

- A. The information contained within this Manual does not address all medical standards and procedures for diving under the auspices of NOAA.
- B. The [NOAA Diving Medical Standards and Procedures Manual \(NDMSPM\)](#) provides uniform criteria and interpretation of physical qualification for diving duties and should be referred to for specific information on medical standards for NOAA diving.
- C. The NDMSPM, which is based on standards from current diving medicine practice within a variety of government and civilian organizations, as well as experts in diving medicine, can be viewed and downloaded from the NDP website.

#### 3.1.2 Purpose.

The NDMSPM was developed to ensure that individuals diving under the auspices of NOAA are:

- A. Free of contagious diseases or medical conditions likely to endanger the health or safety of themselves or other personnel in the course of their diving duties;
- B. Medically capable of performing duties without significant aggravation of existing physical defects or medical conditions that may compromise diver safety or performance; and
- C. Medically fit to perform the duties of a NOAA diver.

#### 3.1.3 Scope.

- A. The Standards contained in the NDMSPM apply to all personnel who are authorized to dive under the NDP.
- B. NOAA reserves the right to deny diving privileges to anyone deemed unfit to dive by the NDMRB.
- C. Medical Clearance Authority.
  - 1) Authority for medical clearance for diving resides with NOAA.
  - 2) Objective data and opinions from physicians and other medical practitioners will be considered during the review process on NOAA fitness to dive cases;

however, the ultimate decision authority on fitness to dive rests with the NDMO; any restrictions or limitations will be noted in the diver's medical record.

## 3.2 Medical Examinations

### 3.2.1 General Information.

- A. All medical examinations must be conducted by a Medical Doctor (MD), Doctor of Osteopathy (DO), Nurse Practitioner (NP), or Physician Assistant (PA) licensed in the United States with final review and approval resting with the NDMO who specializes in diving and hyperbaric medicine.
- B. At the time the physical examination is performed, the examiner must complete, sign and date [NOAA Form 57-03-52 Report of Physical Exam – Diver](#).

### 3.2.2 Examination Types, Timing and Frequency of Medical Examinations.

- A. Examination types.
  - 1) An initial medical examination of all new applicants is required for diving authorization, and may be required for all NOAA divers whose certification has lapsed for more than 2 years.
  - 2) Periodic medical examinations are required of all active NOAA divers.
  - 3) [NOAA Form 57-03-54 Report of Medical History – Annual Update](#) shall be completed by all divers and is due to the NDMO in the anniversary month of the diver's current physical exam. The form is not required on the year a diver is due to complete a periodic medical exam.
- B. Schedule of Physical Examinations. The following standards apply to all NOAA diving physicals:

Age (in years) at time of last physical	Time between physicals
18-47	5 years
48	4 years
49	3 years
50-59	2 years
60+	1 year

- C. Physical examination requirements (See [NDMSPM](#)).

### 3.2.3 Reciprocity Divers.

- A. The NDCSB may authorize divers to participate in NOAA diving operations based on certification by external agencies with whom NOAA has written reciprocity agreements.
- B. NOAA will permit reciprocity divers that follow the basic AAUS medical standards.
- C. No review of medical records by the NDP is routinely required for these individuals. However, if a specific independent reason exists to believe individuals may not be fit to dive, additional medical information may be requested before they are allowed to dive with NOAA.

### 3.2.4 Observer Divers.

Observer Diver candidates shall submit to the NDMO, for review and approval, [NOAA Form 57-03-53 Report of Medical History – Observer Diver](#) signed by an MD, DO, NP, or PA licensed in the United States.

### 3.2.5 Recordkeeping.

- A. All diver physical examinations and medical information are protected under the Privacy Act of 1974, 5 U.S.C. § 552a, Public Law No. 93-579, (December 31, 1974).
- B. The NDP shall maintain medical records for each certified NOAA Diver in a secure location.
- C. All medically-related documents shall be sent to the attention of the NDMO. All documents that are submitted to the NDMO's attention shall be:
  - 1) Treated as confidential, in accordance with federal privacy laws; and
  - 2) Retained in accordance with applicable federal statutes.
- D. Availability of Records.
  - 1) Medical records shall only be released upon written authorization of the diver or former diver.
  - 2) Records and documents required by this standard shall be retained as outlined in Section 11.1.4 of this Manual.

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## 3.3 Reporting Changes in Medical Condition

### 3.3.1 Requirements.

Divers are responsible for immediately reporting information concerning changes to their medical qualifications for diving duty.



- A. Any new medical condition other than minor acute episodic illness (e.g., common cold, seasonal allergies) since completion of the diver's last history and/or physical must be reported in writing to the NDMO. This includes any surgery, hospitalizations, fractures, or other injuries to bone or joint.
- B. The diver shall notify the UDS of situations in which the NDMO's determinations result in a not-fit to dive status.
- C. The diver is required to notify the UDS and on-site diving supervisor of any restrictions placed upon their diving activities by the NDMO.
- D. Changes in medical condition must be reported on an annual basis on [NOAA Form 57-03-54 Report of Medical History - Annual Update](#).

### 3.3.2 Consequences of Non-Disclosure.

- A. Any evidence of either non-disclosure or falsification of medical information shall result in suspension of diving certification pending investigation by the NDCSB.
- B. If the investigation reveals that the diver intentionally withheld or falsified information, their diving certification may be summarily terminated.

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## 3.4 Lapsed Diving Physicals

### 3.4.1 Expiration of Diving Physicals.

- A. NOAA Diver physical exams expire 12, 24, 36, 48, or 60 months from the date the physical exam was performed, based on the age of the diver (Section 3.2.2 B).
- B. If a diver's physical has lapsed for less than 24 months, they must submit a periodic physical with all required tests to the NDMO for assessment of fitness to dive. Additional tests may be required at the discretion of the NDMO.

### 3.4.2 Annual Medical Status Report.

Failure to submit the Report of Medical History – Annual Update by the end of the month that appears in the date box of the current physical exam shall result in temporary suspension of diving privileges until such time as the form is submitted and reviewed.

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## 3.5 Funding for NOAA Diving Physical Examinations

### 3.5.1 General.

- A. In order to maximize the safe conduct of diving operations, NOAA divers are required to meet initial and periodic medical and fitness standards for diving.

- B. In recognition of the important benefits of being medically and physically fit to dive, NOAA Line Offices (LO) are authorized to use government funds to cover costs associated with obtaining physical examinations for diving purposes. (See 5 CFR 339, Subpart C.)
- C. In lieu of using government funds to pay for diving physical examinations, LO may choose to require employees to obtain the examinations via their personal health insurance programs. In such cases, LO may reimburse NOAA employees for costs not covered by their personal health insurance programs.

### 3.5.2 Eligibility.

- A. In order to use government funds for the purpose of obtaining diving physical examinations, individuals must be NOAA employees who are currently certified as NOAA divers or enrolled in a NOAA diving certification course, either initially or in a recertification program.
- B. Use of government funds to pay for diving physical examinations is limited to the following classifications of NOAA federal employees: NOAA Corps Officers, and Commerce Alternate Pay System, Wage Grade, and Wage Marine employees.

### 3.5.3 Authority for Approving Funding of NOAA Diving Physical Exams.

Final authority to expend government funds for the purpose of obtaining diving physical examinations rests with the appropriate LO unit, program, or ship official.

### 3.5.4 Responsibilities.

#### A. NOAA Diver or Diver Candidate.

Discusses funding options with appropriate UDS and NOAA funding manager.

#### B. NOAA Unit Diving Supervisor.

- 1) Discusses funding options with diver, or diver candidate, and NOAA funding manager.
- 2) Provides information on funding options to appropriate funding manager.

#### C. NOAA Funding Manager.

- 1) Discusses funding options with diver, or diver candidate, and UDS.
- 2) Notifies diver, or diver candidate, and UDS of decision.

## Section 4: DIVER CERTIFICATION, AUTHORIZATION, AND TRAINING

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### 4.1 Diver Candidate Requirements

#### General

- 1) NOAA Diver Training requires a minimum cumulative time of 100 hours of practical and theoretical training including examinations and a minimum of 12 open water dives.
- 2) Basic Open Water diver training is provided in conjunction with NOAA diver training however no part of entry level training may be counted in any way towards the scientific diver training of 100 hours and 12 dives.
- 3) Any candidate who does not convince the appropriate NOAA Diving Program personnel that they possess the necessary judgment, under diving conditions, for the safety of the diver and their buddy, may be denied NOAA authorization and diving privileges.

#### 4.1.1 Safety Training.

Candidates for NOAA Diver authorization must provide proof of current certification in the following [safety training](#):

- A. Cardio-pulmonary resuscitation, including adult AED;
- B. First Aid (American Red Cross, American Heart Association or equivalent); and
- C. Oxygen administration (by a NOAA-approved agency).

#### 4.1.2 Medical Clearance.

- A. All NOAA diver candidates must successfully pass a NOAA diving physical examination prior to beginning the NOAA Diver authorization process.
- B. Specific physical examination requirements are briefly described in Section 3.2 and covered in detail in the NOAA Diving Medical Standards and Procedures Manual which can be viewed and downloaded from the NDP website at <https://sites.google.com/noaa.gov/ndp/resources/diving-medical-standards-procedures-manual>.
- C. [NOAA Form 57-03-52 Report of Physical Examination – Diver](#) should be used to document the diving physical examination. Other standard forms used by NOAA for initial and periodic exams may be accepted. Check with NDMO for verification.

- D. Physical exams must be completed by a credentialed provider (must be a Medical Doctor (MD), Doctor of Osteopathic Medicine (DO), Nurse Practitioner (NP), or Physician's Assistant (PA), preferably with hyperbaric training.)
- E. All physical exams shall be submitted directly to and approved by the NDMO.
- F. NOAA Line Offices (LO) are authorized to use government funds to cover costs associated with obtaining physical examinations for diving purposes for individuals who are current NOAA employees.

#### 4.1.3 Initial Swim Test.

##### A. General.

1. All NOAA diver candidates must successfully pass the NOAA Initial Swim Test prior to undergoing initial NOAA Diver authorization.
2. All swim test skills are to be completed in one (1) pool session.
3. Completion of swim test skills shall be observed and documented on [NOAA Form 57-03-39 Initial Swim Test Evaluation](#), by the NOAA diver candidate's UDS or designee.
4. All swim test skills will be conducted without swimming aids, and where exposure protection is needed, the candidate must be appropriately weighted to provide for neutral buoyancy.

##### B. NOAA Swim Test requirements include:

- 1) Swim 550 yards (500 meters) on the surface without stopping in under 15 minutes using any stroke other than backstroke (goggles are allowed);
- 2) Swim 25 yards (22 meters) underwater without surfacing and without pushing off from the wall of the pool; and
- 3) Tread water for 30 minutes.

#### 4.1.4 Training Authorization.

Candidates for NOAA Diver authorization must provide a completed [NOAA Form 57-03-38 Training Request and Authorization](#), which has been signed by their direct supervisor and UDS.

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## 4.2 NOAA Dive Training Topics

### 4.2.1 Theoretical training

Theoretical Training / Knowledge Development	
Required Topics:	Optional Topics:
Diving Emergency Care Training <ul style="list-style-type: none"> <li>• Cardiopulmonary Resuscitation (CPR)</li> <li>• AED</li> <li>• Standard or Basic First Aid</li> <li>• Recognition of DCS and AGE</li> <li>• Field Neurological Exam</li> <li>• Oxygen Administration</li> </ul>	Small Boat Operation
	Specialized Breathing Gas <ul style="list-style-type: none"> <li>• Nitrox</li> <li>• Mixed Gas</li> </ul>
	Specialized environments and conditions
	Pre/Post Dive Procedures
	Rebreathers
Dive Rescue and Accident Management <ul style="list-style-type: none"> <li>• Unconscious Diver Rescue</li> </ul>	Specialized Diving Equipment <ul style="list-style-type: none"> <li>• Full Face Mask</li> <li>• SMB's/Lift Bag</li> <li>• Line Reels</li> <li>• Line Tended Standby</li> </ul>
Scientific Method <ul style="list-style-type: none"> <li>• Data Gathering Techniques</li> </ul>	Other Topics and Techniques at discretion of NDCSB and NDC.
Dive Environments	
Hazards of Breath-Holding	
Decompression Theory and Application/ Management Tools <ul style="list-style-type: none"> <li>• NOAA Dive Tables</li> <li>• Computers</li> <li>• Dive Planning</li> <li>• Gas Consumption</li> </ul>	
Diving Physics	
Diving Physiology	
Diving Equipment <ul style="list-style-type: none"> <li>• Drysuits</li> </ul>	
Standards, Policies, and Procedures <ul style="list-style-type: none"> <li>• NOAA</li> <li>• OSHA</li> <li>• AAUS</li> </ul>	
Navigation	

HazMat Training	
<ul style="list-style-type: none"> <li>• HP Cylinders</li> </ul>	
Hazardous Marine Life	
Specialized Environment and Conditions	
Specialized Breathing Gas	
<ul style="list-style-type: none"> <li>• Nitrox</li> </ul>	

#### 4.2.2 Practical Training

<b>Practical Training / Skill Development</b>	
<p>Confined Water</p>	<p>At the completion of training, the trainee performs the following, as a minimum, in a pool or in sheltered water:</p> <ul style="list-style-type: none"> <li>• Entering and exiting water with full SCUBA equipment;</li> <li>• Clearing of fully flooded mask and regulator while submerged;</li> <li>• Recovery of a regulator using two different methods;</li> <li>• Demonstrate air sharing and ascent using an alternate air source, as both donor and recipient, with and without a mask;</li> <li>• Proficiency in gas sharing and ascent, including buddy breathing and use of an alternate air delivery source, as donor and recipient, with and without a mask;</li> <li>• Ability to remove and replace equipment SCUBA unit and weight belt while submerged;</li> <li>• Complete a simulated out of air RASS ascent;</li> <li>• Complete a simulated emergency swimming ascent;</li> <li>• Understanding of underwater hand and light signals;</li> <li>• Ability to alternate between snorkel and SCUBA while kicking;</li> <li>• Simulated in-water mouth-to-mouth resuscitation Rescue and transport, as a diver, a passive simulated victim of a diving accident; and</li> <li>• Watermanship ability, which is acceptable to the Course Director or Diver Instructor.</li> </ul>

Open Water Skills	<p>The trainee must show their ability to perform, as a minimum, the following in open water:</p> <p>Open water skills checkout dives will occur in depths between 15- 40 feet:</p> <ul style="list-style-type: none"> <li>• Surface dive to a depth of 10 feet (3 meters) without scuba;</li> <li>• Entering and exiting procedures to include shore, pier, and small boat while wearing SCUBA equipment;</li> <li>• Kick on the surface 400 yards (366 meters) while wearing scuba gear, but not breathing from the scuba unit;</li> <li>• Clearing of fully flooded mask and regulator while submerged;</li> <li>• Recovery of a regulator using two different methods;</li> <li>• Ability to remove and replace equipment SCUBA unit and weight belt (if appropriate) while submerged;</li> <li>• Proficiency in gas sharing and ascent, including buddy breathing and use of an alternate air delivery source, as donor and recipient, with and without mask recipient;</li> <li>• Complete a simulated emergency swimming ascent;</li> <li>• Complete a simulated out of air RASS ascent;</li> <li>• Underwater communications;</li> <li>• Demonstrate ability to achieve and maintain neutral buoyancy while submerged;</li> <li>• Demonstrate techniques of self-rescue and buddy rescue;</li> <li>• Underwater navigation;</li> <li>• Proper use of underwater tools and techniques;</li> <li>• Planning and execution of a dive; and</li> <li>• Adequate judgment for safe diving.</li> </ul> <p><b>Additional Considerations:</b> Students should be exposed to open-water conditions while diving at night, and under conditions of reduced visibility.</p>
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	<p><b>Rescue Skills:</b></p> <ul style="list-style-type: none"> <li>• Rescue from depth and transport 25 yards (23 meters), as a diver, a passive simulated victim of an accident: surface diver, establish buoyancy, stabilize victim;</li> <li>• Demonstrate simulated in-water mouth-to-mouth resuscitation;</li> <li>• Removal of victim from water to shore or boat; and</li> <li>• Stressed and panicked diver scenarios.</li> </ul>
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#### 4.2.3 Examinations

<b>Examinations</b>	
Equipment	<p>The trainee will be subject to examination/review of:</p> <ul style="list-style-type: none"> <li>• Personal diving equipment;</li> <li>• Task specific equipment; and</li> <li>• Function and operation of decompression computer to be employed by the diver (if applicable).</li> </ul>
Written Exam	<p>The trainee must pass a written examination with a minimum score of 80%. The exam must be reviewed and approved by the appropriate NDP designee that demonstrates knowledge of at least the following:</p> <ul style="list-style-type: none"> <li>• Function care, use, and maintenance of diving equipment;</li> <li>• Advanced physics and physiology of diving;</li> <li>• Diving regulations;</li> <li>• Applicable diving environments;</li> <li>• Emergency procedures for dive mode(s) and environments, including buoyant ascent and ascent by air sharing;</li> <li>• Currently accepted decompression theory and procedures;</li> <li>• Proper use of dive tables;</li> </ul>



<b>Examinations</b>	
Written Exams	<p>Hazards of breath-hold diving and ascents;</p> <ul style="list-style-type: none"> <li>• Planning and supervision of diving operations;</li> <li>• Navigation;</li> <li>• Diving hazards &amp; mitigations; Cause symptoms, treatment, and prevention of diving-related injuries and illnesses; and</li> </ul> <p>Applicable theoretical training and knowledge development from the required and suggested topics (above).</p>

### 4.3 NOAA Diver Training Modalities

#### 4.3.1 NOAA Dive Center Training.

##### A. General.

- 1) NOAA Diving Center Training includes entry-level certification and oxygen administration in addition to the 100 hours and 12 open water dives to meet the AAUS Scientific Diver equivalent.
- 2) Diver candidates. Students in diving classes must meet the initial certification requirements outlined in Section 4.1.
- 3) Instructors.
  - a. NDC dive instructors shall be experienced in the subject being taught and approved by the NDPM.
  - b. NDC dive instructors will maintain qualifications as advanced open water and rescue instructors in at least one (1) nationally recognized diving certification organization.
  - c. Other personnel may serve as instructors in theoretical training without having a certification from a nationally recognized diving certification organization.
  - d. NDC instructors shall carry out their duties as directed by the NDPM or by the NOAA Diving Center Manager (NDCM) where appropriate.
  - e. The NDCM shall serve as the Course Director.
- 4) Standards.

- a. Training dives conducted by employees and contract, reciprocity, and volunteer divers undertaken in the furtherance of science may be conducted under the Scientific Exemption as outlined in 29 CFR § 1910, Subpart T.
- b. Training dives conducted by employees and contract, reciprocity, and volunteer divers which do not qualify for the Scientific Exemption must follow OSHA Commercial Diving Standards outlined in 29 CFR § 1910, Subpart T.
- c. Training and certification of entry-level divers will follow the current version of the RSTC/WRSTC standards.

## B. Nitrox Training Requirements

- 1) Classroom instruction topics for nitrox should include, but are not limited to:
  - a. Physical gas laws pertaining to Nitrox, partial pressure calculations and limits, and equivalent air depth (EAD) concept and calculations;
  - b. Oxygen physiology and oxygen toxicity and calculation of oxygen exposure and Maximum Operating Depth (MOD);
  - c. Determination of decompression schedules (both by EAD method using approved air dive tables, and using approved Nitrox dive tables);
  - d. Dive planning and emergency procedures;
  - e. Gas analysis;
  - f. Personnel requirements; and
  - g. Equipment marking and maintenance requirements.
  - h. The NDCSB may choose to limit standard Nitrox diver training to procedures applicable to diving, and set aside training such as Nitrox production methods and oxygen cleaning.
- 2) Practical training for nitrox will consist of the following:
  - a. Oxygen analysis and logging of Nitrox gases;
  - b. Determination of MOD, oxygen partial pressure exposure, and oxygen toxicity time limits for various Nitrox gases at various depths; and
  - c. Determination of nitrogen-based no decompression limits by EAD method using air dive tables, and/or using Nitrox dive tables, as approved by the NDCSB.
  - d. Nitrox dive computer use may be included (Section 5.4.6).

- 3) Written Examination for nitrox. Trainee shall successfully pass a written exam demonstrating knowledge of at least the following:
  - a. Function, care, use, and maintenance of equipment used for Nitrox diving;
  - b. Physical and physiological considerations of Nitrox diving;
  - c. Diving standards and procedures as related to Nitrox diving;
  - d. Given the proper information, calculation of:
    - e. Equivalent air depth (EAD) for a given FO<sub>2</sub> and actual depth;
    - f. PO<sub>2</sub> exposure for a given FO<sub>2</sub> and depth;
    - g. Appropriate Nitrox gas for a given PO<sub>2</sub> exposure limit, and planned depth and time;
    - h. MOD for a given gas blend and PO<sub>2</sub> exposure limits;
    - i. Dive table selection and usage;
    - j. Nitrox production methods and considerations;
    - k. Oxygen analysis; and
    - l. Nitrox operational guidelines and dive planning.
- 4) Open Water Dives Required for Nitrox Certification
  - a. A minimum of two (2) supervised open-water dives are required prior to using Nitrox.
  - b. If the MOD for the gas being used can be easily exceeded at the training location, direct, in-water supervision is required.

C. Attendance.

- 1) Students are required to attend all training sessions.
- 2) Failure to attend all classroom sessions without prior approval of the Course Director may result in dismissal from the course.

D. Student to Instructor Ratios.

On dives in which student divers are accompanied by an instructor, the following instructor to student ratios shall apply, unless approved otherwise by the NDPM or their designee:

- 1) Pool or similar environments: One (1) instructor per eight (8) students; and
- 2) Open-water: One (1) instructor per four (4) students.

E. Termination of Instruction.

- 1) Students may be dismissed from participation in a course by the Course Director for any of the following reasons:
  - a. Failure to attend class;
  - b. Failure to demonstrate minimum proficiency in one (1) or more skills;
  - c. Failure to pass a written exam with a minimum score of 80%;
  - d. Development of a medical condition not conducive to continuing the training program; or
  - e. Disruptive behavior in class or failing to follow instructions.
- 2) NOAA Dive Instructors may allow students who initially fail to complete a skill or exercise to repeat them until they demonstrate adequate performance.
- 3) Students may voluntarily discontinue any training class for any reason at any time.

F. Theoretical Training.

1. Academic topics listed in Table 4.2 must be addressed.
2. A written exam must be completed.

G. Practical Training.

- 1) Students must demonstrate successful completion of all skills listed in Table 4.2.2 in a pool and open-water environment.
- 2) NDC Dive Instructors may allow students who initially fail to complete a skill or exercise to repeat them until they demonstrate adequate performance.

H. Documentation of Completion.

- 1) Successful completion of all portions of the NOAA Diver Training Program shall be documented by NDC personnel and forwarded to the NDPM.
- 2) The NDPM will review the documentation for compliance with NDP requirements and if complete, issue a NOAA Diver certification card, Letter of Certification, and initial Letter of Authorization.

I. Other Requirements and Considerations.

- 1) Support Boat.
  - a. Unless otherwise authorized by the Course Director, a support boat shall be in the water and standing by in case of emergency during all open-water training dives.

- b. The boat shall be outfitted and operated per the NOAA Small Boat Standards and Procedures Manual.
- 2) Standby Diver.
- a. Unless otherwise authorized by the course director, a line-tended standby diver, or a standby buddy team shall be ready to enter the water in an emergency within one minute of notification by the DM for all training dives.
  - b. Standby divers must be approved by the Course Director.
- 3) Student Health and Welfare.
- a. Dive classes should be designed to allow students:
    - i. A minimum of eight (8) hours of rest during each 24-hour period; and
    - ii. A minimum of 30 minutes surface interval between dives.
  - b. Instruction should be limited to ten (10) hours a day.
  - c. Dive students shall be:
    - i. Encouraged to remain well hydrated during multi-dive, multi-day dive training;
    - ii. Instructed to refrain from post-dive physical exertion; and
    - iii. Instructed to immediately report any signs or symptoms of any diving-related maladies.
- 4) Equipment. Students from other agencies using Non-NOAA equipment must have all equipment inspected by an instructor and provide maintenance records showing adherence to manufacturer specifications prior to class.

#### 4.3.2 Local NOAA Dive Unit Candidate Evaluation.

##### A. General.

- 1) Diver candidates. Students in diving classes must meet the initial authorization requirements outlined in Section 3.1 as well as the following:
- a. Scuba diving certification in Basic Open Water, Advanced Open Water and Rescue from a nationally or internationally recognized diver training agency that meets the RSTC/WRSTC standards; and
  - b. A minimum of 50 logged dives with twelve (12) of these dives in the last twelve (12) months. This requirement may be increased by the Field Evaluator in consultation with the Unit Diving Supervisor of the NOAA Diver Candidate.

OR

c. NDCSB approved military or commercial training.

2) Field Evaluator.

a. Evaluators shall have completed the NOAA Dive Field Evaluation program and be approved by the NDPM.

b. Admittance to the NOAA Field Evaluator instructional class shall be approved by the NDCSB.

3) Standards.

a. Training dives conducted by affiliates, reciprocity, and volunteer divers undertaken in the furtherance of science, may be conducted under the Scientific Exemption as outlined in 29 CFR § 1910, Subpart T.

b. Training dives conducted by affiliates, reciprocity, and volunteer divers which do not qualify for the Scientific Exemption must follow the OSHA Commercial Diving Standards outlined in 29 CFR § 1910, Subpart T.

4) Student Experience Level

a. Scientific divers in good standing with an AAUS Organizational Member in the past 5 years will receive credit for their previous training and experience, along with the listed requirements found on [NOAA Form 57-03-42 Field Evaluator Reciprocity Crossover Student Evaluation Record](#). This document must be signed and dated by the NOAA Field Evaluator.

b. Divers who have not taken a specific scientific diving course shall complete the academic instruction requirements and proof of passing written exam shall be recorded on [NOAA Form 57-03-37 Student Field Evaluation Record](#), signed and dated by the NOAA Field Evaluator.

B. Theoretical Training.

1. Academic topics listed in Table 4.2 must be addressed if not included in previous training. Supplemental training includes: NOAA Diving Standards, NOAA equipment, physics, physiology, hazards life, general dive skills & tech, emergency procedures, dive planning, and NOAA dive tables.

2. A written exam must be completed if previous dive training did not include a specific scientific diving course.

C. Practical Training.

1) Students must demonstrate successful completion of all skills listed on [NOAA Form 57-03-36 Field Evaluator Skills Checklist](#), per performance criteria specified in the [NOAA Diver Student Study Guide](#), in a pool and in open-water.

- 2) In addition to basic scuba skills, students must also demonstrate proficiency in the following NOAA-specific skills and equipment:
    - a. NOAA Reserve Air Supply System;
    - b. Buddy breathing; and
    - c. NOAA Standardized Equipment Program gear configuration.
  - 3) Completion of practical instruction shall be documented on [NOAA Form 57-03-36, Field Evaluator Skills Checklist](#), signed and dated by the NOAA Field Evaluator.
  - 4) NOAA Field Evaluators may allow students who initially fail to complete a skill or exercise to repeat them until they demonstrate adequate performance.
- D. Documentation of Completion.
- 1) Successful completion of the academic and practical portions of the NOAA Diver Training Program shall be documented on the Student Evaluation Record by the NOAA Field Evaluator and forwarded through the LODO to the NDPM.
  - 2) The NDPM will review the form for compliance with NDP requirements and if complete, issue a NOAA Diver certification card, Letter of Certification, and initial Letter of Authorization.

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## 4.4 Depth Authorizations

### 4.4.1 Depth Authorization Progression.

- A. Indicates the maximum depth in which a diver can conduct operations and may supervise other divers holding a lesser depth authorization. A diver requires a valid depth authorization to be considered active.
- B. A diver may be authorized to the next depth level after successfully completing the requirements for that level. A diver may exceed their depth authorization when accompanied and supervised by a dive buddy holding a depth authorization greater or equal to the intended depth. Dives must be planned and executed with the approval of the UDS.
- C. Each diver must also demonstrate proficiency in the use of the appropriate decompression profiling method.

- D. In the event a diver within NOAA does not hold an authorization at the desired next level, the NDCSB may authorize a required progression or procedure for a diver to attain a deeper authorization. If local conditions do not conform to traditional depth progressions, the NDCSB may devise a reasonable accommodation. However, the total number of dives to obtain a given depth authorization must follow the cumulative number of dives listed below.
- 1) Authorization to 30 fsw.
    - a. Initial diver depth authorization, approved upon the successful completion of training.
    - b. Cumulative minimum supervised dives: 12.
  - 2) Authorization to 60 fsw.
    - a. Current authorization to 30 fsw.
    - b. 12 supervised dives to depths between 31 and 60 fsw under supervision of a diver approved by the UDS.
    - c. For a minimum total time of 4 hours.
    - d. Cumulative minimum supervised dives: 24.
  - 3) Authorization to 100 fsw.
    - a. Current authorization to 60 fsw.
    - b. 6 supervised dives to depths between 61 and 100 fsw under supervision of a dive buddy approved by the UDS.
    - c. Cumulative minimum supervised dives: 30.
  - 4) Authorization to 130 fsw.
    - a. Current authorization to 100 fsw.
    - b. 6 supervised dives to depths between 100 and 130 fsw under supervision of a dive buddy approved by the UDS.
    - c. Cumulative minimum supervised dives: 36.

#### 4.4.2 Authorization to Dive Deeper than 130 fsw.

- A. A diver holding a 130 fsw authorization may be authorized to a depth greater than 130 fsw after successfully completing a NDCSB-approved deep-diving training program. See Sections 7 and 8 for more information.
- B. Dives requiring in-water decompression or deeper than 130 fsw must be pre-approved by the NDCSB.

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## 4.5 Maintaining Authorization

### 4.5.1 General.

In order to maintain active dive status, NOAA Divers must complete the requirements outlined below. Failure to do so may result in temporary suspension of diving privileges.



#### 4.5.2 Dive and Depth Proficiency Requirements.

- A. In order to maintain dive authorization, NOAA Divers must log a minimum of three (3) dives during the preceding quarter. Quarters are Jan-Mar, Apr-Jun, Jul-Sep, Oct-Dec. For example, if three (3) dives are logged in Q1, the diver will remain proficient through the end of Q2.
- B. If 24 dives are completed in a calendar year, proficiency is earned for the remainder of that calendar year, and will remain active until the end Q1 following the end of the calendar year.
- C. At least one dive must be logged near the maximum depth of the diver's authorization during each 6-month period.
- D. Proficiency-only dives conducted by employees and contract, reciprocity, and volunteer divers are defined as dives limited to the familiarization with diving equipment and practicing safety procedures and may be conducted under the Scientific Exemption as outlined in 29 CFR § 1910, Subpart T.
- E. Proficiency may also be obtained by training or operational dives conducted by employees and contract, reciprocity, and volunteer divers and are subject to the applicable standards for which the training or operation is intended.

#### 4.5.3 Medical Standards. (See Section 3).

#### 4.5.4 Emergency Care Training.

NOAA Divers and DPICs must remain current and proof of training shall be provided to the NOAA Diving Center by the UDS or designee in:

- A. Adult CPR, including AED (American Red Cross, American Heart Association, or equivalent);
- B. First Aid (American Red Cross, American Heart Association, or equivalent); and
- C. Oxygen administration (American Red Cross, American Heart Association, DAN, or equivalent). In addition to the instructor-led oxygen administration certification, the NOAA on-line refresher shall be completed every year in which an instructor-led course is not taken.

#### 4.5.5 Annual Watermanship Assessment.

##### A. General.

- 1) NOAA Divers must pass the NOAA Diving Watermanship Assessment on an annual basis.
- 2) Completion of this requirement is to be documented by the UDS or designee and filed on site. The preferred method is by using [NOAA Form 57-03-34 Annual Training Record](#).

- 3) Failure to meet the minimum watermanship assessment standards, or submit the form annually, is cause for temporary suspension from diving.
- B. The options for the watermanship assessment timed swim are:
- 1) Swim 550 yards (500 meters) in bathing suit and mask/goggles using any stroke except backstroke in 15 minutes or less;
  - 2) Swim 550 yards (500 meters) using mask, fins, and snorkel, with or without wetsuit, in 15 minutes or less;
  - 3) Swim 550 yards (500 meters) in drysuit with mask, snorkel and fins in 16 minutes or less;
  - 4) Swim 550 yards (500 meters) underwater in scuba gear and wetsuit in 18 minutes or less; or
  - 5) Swim 550 yards (500 meters) underwater in scuba gear and drysuit in 22 minutes or less.
- C. Responsibilities.
- 1) Divers. All NOAA Divers must pass the NOAA Diving Watermanship Assessment on an annual basis.
  - 2) Unit Diving Supervisors.
    - a. Monitors administration of the NOAA Diving Watermanship Assessment on an annual basis.
    - b. Suspends diving authorization of assigned divers not passing the NOAA Diving Watermanship Assessment.
    - c. Advises the respective LODO of assigned divers who have not passed the NOAA Diving Watermanship Assessment
    - d. Delegates, as appropriate, administration of the NOAA Diving Watermanship Assessment to DMs or LDs.
  - 3) NOAA Line or Staff Office Diving Officers. Advise the NDPM of assigned divers who have not passed the NOAA Diving Watermanship Assessment.
  - 4) NOAA Diving Program Manager. Ensure NDC diver database reflects current diving status of all divers after notification by LODOs/SODO of assigned divers who have not passed the NOAA Diving Watermanship Assessment.

#### 4.5.6 Physical Conditioning Training.

- A. Diving is physically demanding and it is imperative that both divers and managers recognize the need for a continual and aggressive exercise program that exceeds basic health maintenance standards.
- B. In order to help maintain appropriate fitness to dive, immediate supervisors may grant currently authorized NOAA Divers up to three (3) hours per week of official time performing aerobic and/or strength training exercises to help maintain conditioning level sufficient to pass the annual watermanship assessment. [See 5 USC 7901(a)].

#### 4.5.7 Annual Training Requirement.

##### A. General.

- 1) All NOAA Divers shall complete annual refresher training consisting of in-water skills and academic instruction.
- 2) Training shall be documented in the Unit Log.
- 3) Divers who fail to complete annual refresher training shall have their diving privileges suspended.

##### B. Requirements.

- 1) In-water Training. The UDS or designee will conduct a checkout dive with each diver to assess in-water rescue and basic diving skills, including the retrieval of an unconscious diver from the surface of the water to a vessel or shore.
  - a. Completion of skills is to be documented by the UDS or designee. The preferred method is by using [NOAA Form 57-03-34 Annual Training Record](#).
  - b. Copies of the most recent checkout reports must be kept by the UDS or designee for each diver and noted on the annual Diving Unit Safety Inspection (DUSI) Checklist.
- 2) Academic Training. Complete academic instruction (self-study or instructor-lead) in the following topics:
  - a. Oxygen administration;
  - b. Recognition and treatment of diving accidents and injuries;
  - c. NOAA Diving Standards, Policies, and Procedures;
  - d. Rescue techniques;
  - e. NOAA No-Decompression Tables;
  - f. Diving accident management (DMs and LDs only); and

- g. 5-minute neurological examination (DMs and LDs only).
- 

## 4.6 Reauthorization

### 4.6.1 General.

NOAA Divers whose dive authorizations have lapsed due to lack of activity shall be temporarily suspended pending the completion of a reauthorization program.

### 4.6.2 Requirements.

#### A. 3-6 month lapse in diving proficiency.

- 1) If a diver does not maintain proficiency during a quarter, they must perform a training-only, basic checkout dive with the UDS or designee.
- 2) Based on the diver's performance during the checkout dive, the UDS may require additional academic or practical training in order to recertify.
- 3) Once the diver has met the reauthorization requirements prescribed by the UDS, the UDS will reauthorize the diver and notify the NDC and the diver may resume on-duty diving.

#### B. 6-12 month lapse in diving proficiency or depth authorization.

##### 1) Lapse in Diving Proficiency

- a. If a diver does not maintain proficiency for a period of 6-12 months, the LODO is responsible for reauthorization.
- b. Divers must complete a minimum of a training-only, basic checkout dive with the UDS or designee.
- c. [NOAA Form 57-03-34 Annual Training Record](#) must be completed.
- d. The UDS will forward a copy of the annual training record and a recommendation to the LODO for consideration.
- e. The LODO will determine if the diver has met the reauthorization requirements and will either authorize the diver to return to diving status or specify any additional requirements needed to reauthorize.
- f. Once the diver is cleared to return to diving, the LODO will reauthorize the diver and notify the NDC and the UDS that the diver may resume on-duty diving.

##### 2) Lapse in Depth Authorization.

- a. Complete one dive accompanied and supervised by a dive buddy holding a depth authorization greater or equal to the intended depth.

- b. This dive is a task-free dive and may not be combined with a checkout dive.
  - c. Must demonstrate gas management and proper buoyancy during the dive.
- C. More than 12 month lapse in proficiency or depth authorization.
- 1) A lapse in diving proficiency for a period of more than 12 months, they must complete a refresher training program specified by the LODO.
  - 2) A lapse in depth authorization, one task-free dive with the UDS or designee authorized to that depth must be completed.
  - 3) After a 12 month lapse in proficiency the LODO may require an assessment of SEP eligibility.
  - 4) After a diving proficiency lapse for 24 months or more months, they must complete a refresher training program specified by the LODO.
  - 5) After a diving proficiency lapse for 24 or more months, they must complete a diving medical physical as outlined in Section 3.4.
- 

## 4.7 Suspension and Revocation of Dive Authorizations

### 4.7.1 General.

- A. NOAA dive authorizations may be temporarily suspended or permanently revoked for cause. Notice of suspensions/revocations will be provided in writing to the diver. Serious suspensions and revocations will be part of the diver's permanent record.
- B. Temporary suspension of NOAA dive authorization is typically issued for medical reasons or minor infractions of NOAA diving regulations, policies, or procedures. The length of suspension and requirements for reauthorization vary based on the severity of the infraction.
- C. Permanent revocation of dive authorization is typically reserved for more serious conditions or violations of NOAA diving regulations, policies, or procedures.

### 4.7.2 Temporary Suspension.

- A. Representative examples of situations and infractions leading to temporary suspension include, but are not limited to:
  - 1) Failure of a diver to maintain minimum diving proficiency;
  - 2) A lapse of CPR, including adult AED, first aid, and/or oxygen administration;
  - 3) Failure to pass the Annual Watermanship Assessment;
  - 4) The NDMO has concerns about findings on [NOAA Form 57-03-54 Report of Medical History – Annual Update](#);

- 5) Failure of a diver to pass a NOAA diving physical examination within the prescribed, age-based interval;
- 6) Failure of a diver to properly use or maintain NOAA-provided diving gear or support equipment;
- 7) Failure of a diver to comply with the policies and procedures of this Manual;
- 8) Reporting to the dive station mentally or physically impaired due to alcohol or other substance abuse;
- 9) Failure to receive medical clearance to dive from the NDMO; or
- 10) Surfacing from a dive with a cylinder pressure of less than 500 pounds per square inch (psi).

B. Dive authorizations can be temporarily suspended for cause by the NDPM, LODO, DLODO, NDSO, UDS, or on-site DM/LD.

#### 4.7.3 Permanent Revocation.

A. Representative examples of situations and infractions leading to permanent revocation include, but are not limited to:

- 1) Flagrant violation of NOAA standards, regulations, and policies; (e.g., diving solo without a tender, diving after notification of a lapsed physical exam without obtaining reauthorization); and
- 2) A not-fit-for-duty determination has been made by the Chair, NDMRB, following an Individualized Assessment (See NOAA Diving Medical Standards and Procedures Manual).

B. Permanent revocation of dive authorizations shall only be issued by the NDPM upon direction of the NDCSB.

#### 4.7.4 Suspension or Revocation Appeal Process.

A. Suspended divers may appeal the decision to the NDCSB within 30 days of receipt of notification.

B. Terminated divers may appeal the decision to the Director, OMAO within 30 days of receipt of notification.

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## 4.8 Divemaster Training

### 4.8.1 NOAA Diving Center Training

A. General.

1. Used to teach divers how to lead, manage dives, and handle dive emergencies.

- B. Instructors.
    - 1. Staffing for the course can be found in 4.3.1 3 above.
    - 2. Signed off by NDPM.
  - C. Attendance.
    - 1. Attendance requirements can be found in Section 4.3.1. B above.
  - D. Instructor to Student Ratio.
    - 1. In-water: One (1) instructor per four (4) students.
  - E. Termination.
    - 1. Reasons for termination can be found in Section 4.3.1 D above.
  - F. Theoretical Training.
    - 1. NOAA specific training.
    - 2. Forms and responsibilities.
  - G. Practical Training.
    - 1. If taking at NDC: Hands-on training with NOAA Diver Course.
    - 2. If taking Mobile Divemaster Course: Hands-on training with unit shams.
    - 3. In-water observation and training.
  - H. Documentation of Completion.
    - 1. Letter of completion.
    - 2. Notation in NDL.
- 

## 4.9 NOAA Field Evaluator Training

### 4.9.1 Local NOAA Unit Training

- A. General.
  - 1. Focuses on evaluating students in the water conducting skills.
  - 2. Managing all aspects of annual requirements and reciprocity divers.
- B. Instructors.
  - 1. Staffing for course can be found in 4.3.1. 3 above.
  - 2. Signed off by NDPM.
- C. Attendance.
  - 1. Attendance requirements can be found in Section 4.3.1. B above.
- D. Instructor to Student Ratio.
  - 1. One (1) instructor per four (4) students for both in water and topside.
- E. Termination.

1. Reasons for termination can be found in Section 4.3.1. D above.
- F. Theoretical Training.
1. Hands-on training with NOAA Diving Center Instructor.
  2. In-water observation and training with NOAA Dive Center Instructor.
  3. Classroom Training with NOAA Diving Center Instructor.
- G. Practical Training.
1. Skill review and demonstration quality.
  2. Evaluating and problem-solving student skills.
- H. Documentation of Completion.
1. Letter of completion.
  2. Notation in NDL.

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## 4.10 UDS Training

### 4.10.1 General

The Unit Diving Supervisor (UDS) is primarily an administrative position charged with overseeing the overall operations of a shore-based NOAA Dive Unit. The UDS represents the NOAA Diving Program at the Diving Unit and ensures compliance with all standards, policies and procedures enacted by the NOAA Diving Control and Safety Board.

A. Prerequisites.

- 1) Current or former authorized NOAA diver.
- 2) Current certification in CPR, AED, First Aid and Oxygen Administration.
- 3) A minimum of five (5) years' experience in diving.
- 4) Completion of a NOAA Divemaster course is recommended before assuming the UDS position, but must be completed within twelve (12) months of appointment to the position by the NDCSB.

B. Theoretical Instruction.

In addition to the theoretical training given in the NOAA Divemaster course, instruction shall be provided in the following subjects:

- 1) Authorizing new NOAA Divers through NDC or local training modalities;
- 2) Documenting credentials of incoming and outgoing reciprocity divers;
- 3) Conducting Dive Unit internal inspections;



- 4) Preparing Dive Unit annual reports;
  - 5) Preparing, approving and submitting pre- and post-dive plans; and
  - 6) Completing other administrative tasks related to Dive Unit administration.
- C. Practical Training.

In addition to the practical training given in the NOAA Divemaster course, instruction shall be provided in the following subjects:

- 1) Observing swim tests;
  - 2) Directing rescue drills; and
  - 3) Conducting checkout dives.
- D. Training Modalities.

At the discretion of the LODO, the above training may be provided collectively at biennial UDS Workshops or individually by the LODO or DLODO.

- E. Mentoring.

Each newly designated UDS will be assigned an experienced UDS to serve as a mentor and provide peer-to-peer guidance on administering the Dive Unit.

- F. Documentation of Completion.

Successful Completion of UDS training will be documented in the NOAA Dive Log.

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## 4.11 Specialty Training

### 4.11.1 General.

- A. NDC offers a variety of specialized training courses.
- B. The duration, theoretical, and practical aspects of each class is based upon the training requirements along with individual student needs.
- C. These courses include, but are not limited to:
  - 1) Tethered Communication
  - 2) NOAA Diver Refresher Training
  - 3) NOAA Diving Medical Technician Training
  - 4) Topside Line Tender

- D. Training for advanced diving modes (e.g. staged decompression, trimix, CCRs, etc.) are further defined in sections 7 and 8 and are subject to NDCSB approval.

## Section 5: DIVING AND SUPPORT EQUIPMENT

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### 5.1 General Policy

#### 5.1.1 Operation and Maintenance.

- A. All equipment (e.g., diver worn, dive support, air systems, hyperbaric chambers) shall be operated and maintained in accordance with the specifications outlined in the manual. If no standard is provided in this manual, follow manufacturer's recommendations.
- B. All equipment shall be regularly inspected and tested by the person using it prior to diving.
- C. All equipment in need of modification, repair, test, calibration or maintenance shall be tagged, logged and removed from service. Once servicing is complete, a record shall be made which includes the date, serial number of the equipment, nature of work performed, and the name or initials of the person or company performing the work. All of this information should be recorded in the Unit or Ship log. The equipment covered by this requirement includes:
  - 1) Regulators;
  - 2) Gauges (SPG, Depth Gauges, Timers and Dive Computers);
  - 3) Buoyancy Compensator Devices (BCDs);
  - 4) Dry suits;
  - 5) Scuba cylinders and valves;
  - 6) Full face masks;
  - 7) Compressors, air filtration systems, gas control panels and storage banks;
  - 8) Surface supplied diving equipment;
  - 9) Rebreather systems; and
  - 10) Additional equipment categories as determined by the NDCSB.
- D. Equipment that is subjected to extreme usage under adverse conditions may require more frequent testing and maintenance than recommended by the manufacturer as determined by the NDCSB.
- E. All diving equipment shall be stored in a secure, properly ventilated space free of noxious fumes or corrosive materials.

- F. Diving units should be afforded sufficient space to properly maintain and organize all diving equipment.
- G. An inventory of SEP issued diving equipment shall be conducted by each diver annually and the results submitted to the UDS and recorded in the Unit Log.
- H. All equipment shall be free of corrosion and deterioration that may impede its intended use.
- I. Any LODO-approved deviation from the standard SEP gear or configuration shall be in written form and kept at the unit level by the UDS.
- J. Maintenance records on non-SEP diving equipment shall be kept at the unit level by the UDS.

#### 5.1.2 Oxygen Safety.

- A. Equipment used with gases containing over 40 percent oxygen by volume shall be designed for or adapted for oxygen service.
- B. Prior to use, all components exposed to gas mixtures containing greater than 40 percent oxygen by volume shall be cleaned of combustible materials according to CGA 4.1 standards.
- C. Oxygen systems over 125 psig and compressed air systems over 500 psig shall have slow-opening shut-off valves.

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## 5.2 Standardized Equipment Program

### 5.2.1 Eligibility.

Participation in the Standardized Equipment Program (SEP) is voluntary for all full-time employees (FTEs) and long-term NOAA-contract employees in the NOAA Diving Program who are authorized to do so by their contracting offices within NOAA. Divers with more than a 12 month lapse in proficiency may have their eligibility reviewed by their LODO.

### 5.2.2 Equipment.

- A. Divers participating in the Standardized Equipment Program will be supplied with a full set of diving equipment. This includes: a primary regulator set (first and second stage, submersible pressure gauge, octopus second stage or other alternate air source regulator depending on Unit requirements), depth/timing gauge and compass), a secondary Reserve Air System Supply (RASS) regulator set (first and second stage and submersible pressure gauge), if required, and a Buoyancy Compensator Device (BCD). Additional equipment includes a wetsuit, boots, gloves, hood, fins, weight belt/harness, knife, and a gear storage bag.

- B. Participants in the SEP who have been certified by NOAA to dive using a dry suit have the option to request these items.
- C. Participants in the SEP may request additional diving gear not routinely issued. SEP may provide this equipment at the discretion of the SEP Coordinator.
- D. The SEP Coordinator may replace SEP gear which has been lost, damaged, or has exceeded its service life. Normal wear and tear will be taken into consideration, however loss or damage due to carelessness or neglect will be charged to the diver's Unit.
- E. Each diver is accountable for the care and condition of the SEP equipment issued to them.
- F. NOAA Divers are authorized to display NOAA, Line Office, Program or site logos and/or insignia on SEP and other NOAA-owned diving equipment.

### 5.2.3 Servicing.

#### A. General

All equipment must meet manufacturers required service intervals as well as NOAA baseline requirements listed in this section.

#### B. Annual Service.

Regulator sets, BCDs, and alternate air source second stage regulators shall be shipped to the designated maintenance facility annually for service. Current vendor information is available through the SEP Coordinator. Drysuit valves should be tested for functionality prior to each use and replaced as needed.

#### C. Scheduling.

It is the responsibility of the UDS to monitor the service dates of all SEP equipment issued to their Unit and coordinate shipping and servicing dates with the SEP Coordinator so that no gear exceeds twelve (12) months between consecutive service dates.

- D. All other service is the responsibility of the Unit and service needs should be brought to the attention of the UDS.

### 5.2.4 Fees.

#### A. Enrollment Fee.

An initial fee may be charged to each diver upon enrollment in the SEP. The amount of this fee is set by the NDC.

#### B. Annual Maintenance Fee.

An annual fee may be assessed to each Unit for each diver enrolled in the SEP. The amount of this fee is set by the NDC.

C. Authorization of Payment.

NDC will determine the fees charged to each Unit for newly enrolled and continuing divers. It is the responsibility of the UDS to ensure the assessment fees are forwarded to the appropriate financial office for the Unit for payment.

### 5.2.5 Equipment Return.

When a diver leaves the NDP, or is no longer actively diving in a mission support role, all SEP issued equipment shall be returned to the SEP coordinator. It is the responsibility of the UDS to ensure this gear is collected from the diver and promptly returned.

## 5.3 Support Equipment

### 5.3.1 Emergency Oxygen Kits.

- A. An emergency oxygen kit, appropriate for the diving being conducted, and including sufficient gas volume, positive-pressure ventilator and a bag-type manual resuscitator with transparent mask or equivalent capable of ventilating an unconscious victim shall be available at the diving location.
- B. Oxygen regulators must be capable of supplying oxygen to two (2) individuals simultaneously, one (1) via a demand resuscitator valve and the other via a device connected to the variable flow port.
- C. Oxygen kits must have a sufficient quantity of oxygen to supply one (1) diver for:
  - 1) The time required to transport them to a higher-level medical care facility; or
  - 2) 12 hours, whichever is less. Refer to the following table for the delivery duration times for common oxygen cylinders.

Cylinder Type	Fill Pressure (psi)	Capacity (liters)	Duration at 15 lpm
Aluminum D	2015	424.7	~28 min
Steel D	2015	410.4	~27 min
Jumbo D	2015	648.3	~43 min
Aluminum E	2015	679.4	~45 min
Aluminum 63	2216	1646.3	~110 min

- D. The regulator and valve used to deliver oxygen (e.g., Elder valve, demand inhalator valve, manually triggered valve [MTV], multifunction regulator) when on a quarterly elder valve testing cycle shall be serviced every two (2) years to ensure delivery pressure is within the manufacturer's specifications. If the manufacturer has no service recommendation, valves shall be serviced every two (2) years. NDC-issued equipment will be serviced by NDC, non-NDC equipment will be serviced by the Dive Unit. If an elder valve is not tested quarterly then service annually.
- E. The regulator and valve used to deliver oxygen shall be tested for delivery pressure every three (3) months and the results recorded on [NOAA Form 57-03-85 Emergency Oxygen Kit Demand Valve Test](#).
- F. If an NDC issued regulator is determined to be out-of-specification, the NDC shall be notified and a replacement will be provided by NDC.
- G. Oxygen kits shall be checked for functionality before every day of diving.
- H. When not in use, oxygen kits shall be stored in a space where it is clean, protected, properly labeled, and readily available.

#### 5.3.2 First Aid Kits.

- A. A first aid kit appropriate for the diving location and approved by the NDMO shall be available at the diving location.
- B. First aid kits should have the minimum equipment and supplies listed in the NOAA First Aid Kit contents list (See Appendix 4).

#### 5.3.3 Automated External Defibrillator (AED).

- A. An AED shall be present at every dive site.
- B. AEDs shall be tested monthly for battery function.
- C. AED pads and batteries shall be within expiration date.

#### 5.3.4 Breathing Gas Compressor Systems.

- A. Breathing gas compressors shall be:
  - 1) Maintained and operated in accordance with the manufacturer's recommended guidelines; and
  - 2) Located in a space that is clean, free of flammable material, and sufficiently ventilated to prevent system overheating.
- B. Breathing gas compressor intakes shall be clearly labeled and located away from areas containing exhaust or other contaminants.

- C. Hearing protection shall be made available as necessary to comply with OSHA standards.
- D. Breathing gas compressor final stage relief valves shall be calibrated by a certifying authority every three (3) years.
- E. At least one (1) gauge in breathing gas production and storage systems that is capable of monitoring pressure in all components of the system shall be calibrated against a master gauge and retested before the expiration of the calibration period.
- F. The output of NOAA compressor systems shall be tested for gas purity every six (6) months or 100 hours of compressor operation, whichever is more frequent, and test results maintained at both the unit and NDC.
- G. Non-oil lubricated compressors (e.g., Rix) shall have the rod end and thrust bearings greased and in good condition. They need not be tested for oil mist contaminants.
- H. Divers shall ensure non-NOAA compressors have been tested for air purity during the past six (6) months before cylinders can be filled from that facility.
- I. When possible, the test results should be posted near the compressor.
- J. A log shall be maintained showing operation, repair, overhaul, filter maintenance, and temperature adjustment for each compressor.
- K. A copy of the manufacturer's operator's manual shall be readily available for reference and written operating procedures posted near the compressor.
- L. All breathing gas system components (e.g., plumbing, valves, and gauges) shall be:
  - 1) Properly rated for the working pressure of the system and directly labeled with their functions or included in a schematic diagram posted near the system;
  - 2) Properly secured at no more than 36-inch intervals;
  - 3) Compressed air systems over 500 psig must have slow-opening shut-off valves; and
  - 4) Pressurized to Maximum Allowable Working Pressure (MAWP) and tested for leaks every twelve (12) months.
- M. Low pressure compressors used for surface supplied diving or to bank gas for nitrox production 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.
- N. All scuba charging whips shall be:



- 1) Properly secured with a terminated stainless steel cable at 36-inch intervals along their length to prevent injury to personnel during cylinder filling operations; and
  - 2) Visually inspected for damage or deterioration prior to each use.
- O. All divers who fill scuba cylinders shall be properly trained in the specific procedures involved and the training shall be documented in the Unit Log.
- P. Compressed gas storage cylinders shall:
- 1) Be designed, constructed and maintained in accordance with OSHA regulations as described in 29 CFR 1910.6 and 1910.169;
  - 2) Be stored in a ventilated area, protected from excessive heat and the area shall be labelled with compressed gas storage signage;
  - 3) Be secured from falling;
  - 4) If cylinder is a low pressure (LP) volume tank or a high pressure (HP) storage flask that is not a Scuba cylinder or standard 'K'-style cylinder:
    - a. Have a serial number or unique identifier which allows documentation of testing and maintenance;
    - b. Be equipped with a pressure gauge when in service, if assembled in a bank, the bank requires one pressure gauge on the final flask;
    - c. Be equipped with an inlet side check valve except for shared inlet/outlet valves which do not require a check valve; and
    - d. Be equipped with a condensate drain located at the lowest point.
  - 5) Have shut-off valves recessed into the cylinder or protected by a cap, except when in use or interconnected;
  - 6) If subject to DOT standards, be hydrostatically tested every five (5) years if part of a bank of cylinders, including those stamped with a star (★) in the codes;
  - 7) If subject to ASME standards, be externally inspected annually and internally examined every five (5) years;
  - 8) Per 49 CFR 180.205 (c), be allowed to remain in service until it requires refilling if the cylinder was filled before the expiration of the visual or hydrostatic test date; and

- 9) Be available for use within twelve (12) months of being filled if containing air. All cylinders containing gases other than air shall be analyzed by the diver prior to use, all cylinders containing air and filled more than twelve (12) before use shall be analyzed by the diver prior to use.

### 5.3.5 Air Quality Standards.

- A. Breathing air for the NOAA Diving Program shall meet the minimum specifications as set forth in OSHA regulations at 29 CFR 1910.430(b)(3). Stricter standards may be required by the NDCSB.

Constituent	Specification
Oxygen (percent by volume)	20 - 22%
Carbon dioxide (by volume)	1000 ppm (max)
Carbon monoxide (by volume)	10 ppm (max)
Condensed Hydrocarbons (as CH <sub>4</sub> by volume)	25 ppm (max)
Odor and taste	Not objectionable
Oil, mist, particulates	5 mg/m <sup>3</sup> (max)
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 ppm v/v) or 10 degrees lower than the coldest temperature expected in the area is required.	

- B. For remote site operations using gas sources not controlled by NOAA, every effort should be made to verify breathing gas meets the requirements of this standard. If CGA Grade E gas is not verifiable, the NDCSB must be consulted.

### 5.3.6 Breathing Gas Supply Hose Connectors.

Breathing gas supply hose connectors shall:

- A. Be made of corrosion-resistant materials;
- B. Have a working pressure at least equal to the working pressure of the hose to which they are attached; and
- C. Be resistant to accidental disengagement.

## 5.4 Open-Circuit Scuba Diving Equipment

### 5.4.1 Minimum Equipment Requirements.

- A. Unless approved by the LODO, each diver shall be outfitted in a configuration similar to those shown in Appendix 5.

- B. At a minimum, all NOAA-authorized divers are required to use the following NOAA-issued diving equipment when conducting official duty dives, unless specifically approved by the LODO:
- 1) A primary breathing gas supply and regulator;
  - 2) A diver-carried reserve breathing gas supply consisting of an independent reserve cylinder with a separate regulator (when required);
  - 3) A redundant second stage regulator on the primary cylinder(s) for air sharing;
  - 4) A pressure gauge for each independent cylinder, readable by the diver during the dive. The gauge may be analog or integrated into a dive computer, but it must have a HP hose connecting it directly to the first stage of the regulator;
  - 5) A buoyancy compensation device which includes powered and manual inflation capabilities and an over-pressurization relief valve;
  - 6) A weight system capable of quick release;
  - 7) A knife or other cutting device accessible by either hand;
  - 8) A mask, snorkel, and fins;
  - 9) A timekeeping device;
  - 10) A compass;
  - 11) A depth gauge;
  - 12) Thermal protection appropriate for the conditions;
  - 13) No decompression dive tables, appropriate for the breathing gases being used; and
  - 14) A whistle or other sound-producing device.
- C. The valve of the reserve breathing gas supply shall be in the closed position prior to and during the dive to ensure the air supply will not unintentionally be depleted during the dive.
- D. Distribution of RASS.
- 1) The NDC will issue RASS regulator sets (but not cylinders) to NOAA Divers as a standard piece of diving equipment under the Standardized Equipment Program.
  - 2) Each UDS shall determine the minimum number of RASS required for their unit.

- 3) RASS shall be available for divers to “check out” from the diving unit or from the NDC.
- 4) Excess RASS cylinders can be returned to the NDC to eliminate the need for yearly servicing of unused equipment.

#### 5.4.2 Regulators.

- A. Unless supplied by the Standardized Equipment Program (SEP), all scuba regulators shall be approved by the LODO.
- B. Scuba regulators shall be inspected and tested by the user before each use, and serviced and tested by a qualified technician every 12 months or following manufacturer’s recommendations, whichever are more frequent.
- C. Regulator sets shall consist of a primary first and second stage, an alternate second stage, a submersible pressure gauge and a low-pressure inflator hose (except for RASS regulators which lack an inflator hose).
- D. A full face mask may be substituted for the primary second stage regulator. If using an FFM, the diver shall carry a back-up mask.
- E. Scuba regulators, including first stages, second-stages and alternate second stage air sources, shall be serviced annually, unless more frequent service is deemed necessary.

#### 5.4.3 Buoyancy Compensator Devices.

- A. Buoyancy Compensator Devices (BCD) shall be worn on all dives utilizing scuba.
- B. BCDs shall enable the diver to achieve and maintain neutral and positive buoyancy during a dive, including at the surface, and be configured with a manually-activated inflation source, an oral inflation assembly, and an exhaust valve.
- C. BCD inflator assemblies shall be serviced annually or in accordance with the manufacturer’s recommended guidelines, whichever is more frequent.
- D. BCDs shall not be used as a lifting device in lieu of lift bags.

#### 5.4.4 Gauges and Timekeeping Devices.

- A. Each independent cylinder used shall be equipped with a pressure gauge that can be monitored by the diver during the dive.
- B. Pressure gauges included in divers’ breathing gas delivery systems shall be checked for accuracy on an annual basis and documented in a maintenance log.
- C. A timekeeping device shall be:

- 1) Worn by each diver; and
- 2) Present at the diving location for topside support.

D. Depth gauges shall be tested:

- 1) Every year against a master reference gauge, with no deviation greater than +3.0/-0.0 fsw between any two (2) equivalent gauges; or
- 2) When there is a discrepancy greater than two (2) percent of full scale between any two (2) equivalent gauges.

E. Submersible pressure gauges shall be tested annually against a master reference gauge, with no deviation greater than +/- 10 percent of scale.

#### 5.4.5 Scuba Cylinders and Cylinder Valves.

A. Scuba Cylinders shall be:

- 1) Designed and constructed in accordance with the specifications for 3AA, 3AL, SP and exemption cylinders as found in 49 CFR 180.209(b), (e), (f), (h), (j), and (m);
- 2) Hydrostatically tested every five (5) years in accordance with U.S. Department of Transportation standards;
- 3) Visually inspected internally and externally by a qualified technician annually or when suspect; and
- 4) Lashed down in a horizontal or vertical position or stowed in a rack during transportation in a motor vehicle.

B. Scuba cylinder valves shall be functionally inspected at intervals not to exceed 12 months.

#### 5.4.6 Dive Computers

#### 5.4.7 General

- A. Any commercially available dive computer may be used for no-decompression diving after completing a [NOAA Form 57-03-68 Dive Computer User Agreement](#).
- B. Divers must limit depth-time combinations that do not result in “ceilings” or mandatory decompression stops whenever using a dive computer
- C. Divers must be thoroughly familiar with the operations manual(s) for the dive computer(s) they intend to use, and agree to conduct dives in accordance with the manufacturer’s guidelines outlines in the operations manual(s).

- D. Air Integrated dive computers will have either an HP hose connecting the computer directly to the first stage of the regulator or, if using a transmitter, be equipped with a back-up analog gauge.
- E. Dive computers are not issued by SEP.

#### 5.4.8 Using a Dive Computer

- A. A safety stop performed during the ascent phase of the dive should be conducted on any dive that exceeds 30 fsw.
- B. For all no-decompression dives conducted deeper than 60 fsw and all repetitive dives deeper, a safety stop is recommended at a depth between 15-20 fsw for 3-5 minutes. (Section 6.3.7)
- C. On any given dive, both divers in the buddy pair must follow the most conservative dive profile.
- D. Divers will terminate the dive and begin ascent whenever the first dive computer in the group reaches the no-decompression the limit. It is strongly recommended to terminate the dive when the first dive computer in the group indicates that the diver has five (5) minutes of no-decompression time remaining.
- E. If a dive computer is used, the diver must use the same computer used on repetitive dives or switch to tables.
- F. A diver may carry a back-up or secondary dive computer to avoid potential lapses in diving operations.
- G. If a diver accidentally exceeds the no-decompression limits on their dive computer, diver will terminate the dive and immediately begin ascent to the surface following surfacing instructions (e.g. decompression requirements) displayed on the computer. This event must be reported to the UDS.
- H. If flying after diving, divers will refrain from flying following dives conducted with dive computers until the computer indicates that it is safe and requirements listed in Section 6.4.3 are met.

#### 5.4.9 Dive Computer Maintenance

- A. Divers will maintain their dive computer in accordance with the manufacturer's guidelines including inspections by an authorized technician;
- B. Batteries must be replaced annually or when depleted;
- C. O-rings must be inspected annually and replaced as needed; and
- D. Dive computer service and testing records must be retained in the Unit Dive Log.

#### 5.4.10 Failure of a Dive Computer

- A. If a dive computer fails during diving operations:
  - 1) If a back-up computer has been in use on all dives and functioning normally, continue dive operations.
  - 2) If a dive computer fails during a dive and the diver is not equipped with a back-up, terminate the dive and immediately begin appropriate surfacing procedures.
  - 3) Diver will refrain from diving for 24 hours before activating and using a new or replacement dive computer.

#### 5.4.11 Nitrox Diving with Computers

- A. Dive computers used for nitrox diving must be checked and set to correct PO<sub>2</sub> (1.4 ATA) and FO<sub>2</sub> before each dive.
- B. Diver must have a clear understanding of the conservative settings and gradient factors available on the dive computer model in use.

#### 5.4.12 Decompression Diving with Computers

- A. Each diver shall have redundant means of tracking dive time and depth through two (2) NOAA-approved dive computers
- B. Dive computers used for decompression diving must use the approved algorithms: Buhlmann 16 or the ZH-L16 GF algorithm. If another algorithm is preferred, NDCSB must approve on a case-by-case basis.
- C. All dive computers and/or computer-based decompression schedule-generating software programs will be set to a conservative gradient between of 50/70 and 50/85, unless otherwise approved by the NDCSB.

#### 5.4.13 Other Maintenance Requirements.

- A. Weight-harness systems with quick-release mechanisms shall be inspected for damage prior to each diving day and the weight-release mechanism tested for proper function every three (3) months.
- B. Standby diver tending line (without communication wires) shall be examined annually for condition and proper markings with results recorded in the Unit Log.

#### 5.4.14 Use of NOAA-Owned Diving Equipment Off-Duty.

- A. General.
  - 1) In order to maximize the safe conduct of diving operations, NOAA divers are required to regularly train to maintain a high level of proficiency through the performance of diving activities on a routine basis.

- 2) In recognition of the important benefits of regular training in diving with a uniform set of diving equipment, NOAA divers may use NOAA-owned diving equipment on off-duty dives for the purpose of maintaining diving proficiency. Such training maintains familiarity with the controls/functions of equipment, develops muscle memory to react automatically during emergencies, and promotes physical fitness.
- 3) NOAA Divers using NOAA-owned equipment off-duty must follow the provisions in this manual with two exceptions:
  - a. Dives within no-decompression limits do not need to file a Dive Operations Plan (DOP),
  - b. The standards in this Manual for OC and CCR decompression diving are designed for task-loaded occupational diving. Therefore off-duty OC and CCR diving with NOAA-owned gear and no task-loading shall adhere to the recreational industry standards under which the diver is certified.

#### B. Minimum Requirements.

- 1) NOAA divers shall be currently authorized to dive by the NDP in order to use NOAA-owned gear off-duty. Divers whose diving proficiency has lapsed may participate in the off-duty program for the purpose of obtaining reauthorization, with UDS approval.
- 2) Prior to using NOAA-owned diving equipment on off-duty dives, each diver must sign and comply with [NOAA Form 57-03-70 NOAA-Owned Diving Equipment Off-Duty User Agreement](#). Copies of these documents will be maintained at the Diving Unit by the UDS.
- 3) Divers using NOAA-owned equipment on off-duty dives must complete two (2) of the following skills during each dive:
  - a. Ditch and don BCD;
  - b. Weight belt removal / replacement;
  - c. Disconnect / reconnect inflators (BCD/dry suit);
  - d. Drysuit roll-outs and venting;
  - e. Buddy breathing;
  - f. Air sharing;
  - g. Deploy and use RASS;
  - h. Recover unconscious diver from water;
  - i. Mask removal, replace, and clear;



- j. Maintain neutral buoyancy for two (2) minutes;
  - k. Control descent / ascent rate;
  - l. Underwater communication (hand signals);
  - m. Underwater navigation and orientation, and/or;
  - n. Regulator recovery.
- 4) All off-duty dives using NOAA-owned equipment shall be logged as “Training/Proficiency” and “Non-Duty” using the NDP online dive log.
- C. Eligibility.
- 1) Only those NOAA divers in active status with the NDP and possessing NOAA-owned equipment are eligible to participate in the NOAA-owned off-duty diving program.
  - 2) Only NOAA employees and approved contractors are eligible to participate in the SEP.
- D. Authority for accepting divers into the NOAA-owned off-duty diving program.
- 1) Authority for accepting divers into the NOAA-owned off-duty diving program rests with the UDS.
  - 2) The NDPM, LODO, or UDS may revoke approval to participate in this program for cause, at any time.
- E. Limitations.
- Maximum depth and tasks authorized may be limited by the NDPM, LODO, or UDS based on review of the divers’ resumes and diving logs.
- F. Responsibilities.
- 1) NOAA UDS.
    - a. Reviews NOAA-owned off-duty forms for compliance with minimum requirements and maintains records as directed in the form instructions.
    - b. Monitors adherence to standards outlined in the NOAA-owned off-duty forms and suspends off-duty use of NOAA-owned equipment if violations are detected.
  - 2) NOAA LODO.
    - a. Reviews and grants approval for NOAA-owned off-duty equipment use for reauthorization of divers whose proficiency has lapsed by more than six (6) months.

- b. Monitors adherence to standards outlined in the off-duty forms and suspends off-duty use of equipment if violations are detected.
- 3) NOAA DPM.

Monitors adherence to standards outlined in the off-duty forms and suspends NOAA-owned off-duty use of equipment if violations are detected.

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## 5.5 Tethered Scuba Diving Equipment

### 5.5.1 Servicing and Testing.

The following annual servicing and testing is required for all tethered scuba diving systems:

- A. All full-face masks used for tethered scuba diving must be serviced by a certified repair technician annually.
- B. The entire communication/strength tether, including the seizing of the "D" ring on the tether, must be visually inspected annually.

### 5.5.2 Documentation.

Results of annual servicing and inspection shall be noted on the annual DUSA checklist and retained until, at a minimum, the next annual servicing and inspection.

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## 5.6 Hyperbaric Chamber Equipment and Systems

### 5.6.1 General.

- A. Hyperbaric chambers used by NOAA divers manufactured after 1977 shall be built and maintained in accordance with the American Society of Mechanical Engineers (ASME) Code or equivalent.
- B. Hyperbaric chambers used by NOAA divers manufactured prior to 1977 shall be maintained in conformity with the code requirements to which they were built, or equivalent.
- C. Each hyperbaric chamber shall be equipped with:
  - a. A means to maintain the atmosphere below 25 percent oxygen by volume;
  - b. Mufflers on intake/exhaust lines, shall be regularly (inspected/maintained);
  - c. Suction guards on exhaust line openings; and
  - d. A means for extinguishing fire, and shall be maintained to minimize sources of ignition and combustible material.

### 5.6.2 Multi-lock chambers.

- A. The following minimum components must be on site and fully-functional prior to commencing Hyperbaric Oxygen (HBO) treatments:
- 1) An adequate and fully accessible chamber air supply (i.e., HP or Low Pressure), this shall include a backup supply in case of loss of the primary;
  - 2) Oxygen Built-in Breathing Systems (BIBS) masks with overboard dump systems (minimum one (1) per occupant);
  - 3) An emergency air BIBS mask (minimum one (1) per occupant);
  - 4) Depth gauge (minimum one (1) per lock);
  - 5) Fire prevention (internal);
  - 6) Timer (e.g., stop watch, wrist watch, wall clock);
  - 7) Two-way voice communications;
  - 8) One (1) view port (minimum one (1) per lock);
  - 9) Illumination capability to light the interior; and
  - 10) USN Treatment Tables (TTs).
- B. Support equipment, supplies and materials. The following items must be readily available on site prior to commencing HBO treatments:
- 1) Medical Supplies: Primary and secondary emergency supplies are listed in Appendix 1 of the [Operating Standards for NOAA Hyperbaric Chambers](#).
  - 2) Reference Materials, current editions of:
    - a. USN Diving Manual;
    - b. NOAA Diving Manual;
    - c. Advanced Cardiac Life Support algorithms;
    - d. Operational Procedures Manual for specific chamber;
    - e. [NOAA Diving Accident Management Field Reference Guide](#); and
    - f. [Operating Standards for NOAA Hyperbaric Chambers](#).
- C. Gas supply requirements.
- 1) Compressed Air Supply Requirements:
    - a. All chambers shall have access to two (2) sources of compressed air for pressurization, ventilation and BIBS supply; and
    - b. Minimum quantities shall be in accordance with the NOAA Diving Manual.
  - 2) Oxygen Supply Requirements:
    - a. The chamber shall be capable of supplying 100 percent oxygen to each occupant in the chamber via BIBS masks; and
    - b. Minimum quantity required is 475 ft<sup>3</sup>. This quantity is based on a USN TT (TT6) with full extensions at 60-feet and 30-feet for one (1) diver breathing oxygen (respiratory minute volume of 0.475 acfm) throughout the treatment (400 ft<sup>3</sup>), plus the tender, during the last 30 minutes and the ascent (75 ft<sup>3</sup>).

## Section 6: DIVING STANDARDS AND PROCEDURES

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### 6.1 General

#### 6.1.1 Qualification Requirements.

- A. For the purpose of performing operational scientific dives, or scientific training and proficiency dives consistent with this Manual, divers must meet the definition of a scientist listed in Section 1.1.2.
- B. Individuals not meeting the above requirement may participate in scientific dives as a “scientist-in-training” if the individual is appropriately briefed on the specific tasks to be performed during the dives by a scientist as defined in Section 1.1.2.
- C. Diving activities in which the participants do not meet the definitions of scientist or scientist-in-training and the tasks do not meet the requirements for operational or training scientific dives must follow the OSHA Commercial Diving Standards outlined in 29 CFR § 1910 Subpart T.

#### 6.1.2 Diving Experience or Training.

- A. Each dive team member shall have the experience or training necessary to perform assigned tasks in a safe and healthful manner.
- B. Each dive-team member shall have experience or training in the following:
  - 1) The use of tools, equipment and systems relevant to assigned tasks;
  - 2) Techniques of the assigned diving mode; and
  - 3) Diving operations and emergency procedures.
- C. All scientific training and proficiency dives conducted by employees and contract, reciprocity, and volunteer divers under the auspices of the NOAA Diving Program (NDP) that are undertaken in furtherance of scientific diving may be conducted consistent with the standards outlined in the NOAA Diving Standards and Safety Manual provided the requirements for the scientific exemption outlined in 29 CFR § 1910.401(a)(2)(iv) are followed.
- D. Scientific training and proficiency dives are not required to comply with the commercial dive standards at 29 CFR § 1910, Subpart T provided the dives are not combined with any element comprising a working or commercial dive.

- E. NOAA divers are to conduct scientific training and proficiency dives per the standards outlined in the NOAA Diving Standards and Safety Manual (NDSSM). Included within this Manual are specific requirements that must be met in order to conduct scientific training or proficiency dives under the OSHA scientific exemption.

#### 6.1.3 Activities Authorized.

- A. NOAA Divers can participate in activities commensurate with their level of training.
- B. Specialized training is required for activities involving equipment, techniques, and in environments beyond the diver's initial training (e.g., tow-board diving, blue-water diving, and use of full-face masks).
- C. Training for tasks outside the scope of the diver's initial NOAA Diver Training as referenced in Section 4.2 and conducted by nationally or internationally recognized diver training entities must be approved by the UDS and LODO.
- D. Specialized training for tasks outside the scope of the diver's initial NOAA Diver Training or other nationally or internationally recognized diver training entities shall be considered for a Special Task Endorsement (STE). New STE training modules shall be approved by the NDCSB. Initial STE certifications shall be approved by the LODO. STE certification renewals shall be approved by the LODO.

#### 6.1.4 Diver Responsibility.

- A. While the employer has ultimate responsibility for safety in the workplace, divers are responsible for their own safety and share responsibility for the safety of their buddy. It is the responsibility of the diver to terminate the dive, without fear of penalty, whenever they feel it is unsafe to continue the dive, unless to do so compromises the safety of another diver already in the water. Part of this responsibility is the requirement to refuse to dive if in the diver's judgment:
  - 1) Conditions are unsafe or unfavorable;
  - 2) They are not in sufficient physical or mental condition for diving; or
  - 3) They would violate the dictates of their training or the NDP regulations, policies or procedures including that their breathing gas meets standards specified in this Manual.
- B. The diver should report to the DM/LD:
  - 1) The conditions that led them to terminate the dive;
  - 2) Any signs or symptoms of diving maladies; and
  - 3) Any unsafe acts that could jeopardize their or their fellow divers' health and safety.

- C. All divers are responsible for the proper use and maintenance of NOAA-issued diving equipment.
- 6.1.5 Application of OSHA Commercial Diving Standards.
- A. NOAA Divers may perform dives utilizing dive equipment and techniques listed in this Manual, as long as they have received proper instruction in the equipment to be used and work to be performed.
  - B. Dives not qualifying for the scientific exemption must comply with the OSHA Commercial Diving Standards outlined in 29 CFR § 1910, Subpart T.
  - C. NOAA Divers are prohibited from performing dives requiring equipment and/or techniques not identified in this Manual without approval from the NDCSB.
  - D. Unit Diving Supervisors are responsible for determining whether or not a dive can be performed under the OSHA Scientific Exemption (29 CFR § 1910.401(a)(2)(iv)) based on review of the dive plan and the qualifications of the divers involved.
- 6.1.6 Restrictions.
- A. Dive team members:
    - 1) Shall not engage in diving operations under the auspices of the NDP unless they are currently authorized to dive;
    - 2) Shall only be assigned tasks consistent with the individual's verifiable experience or training, except that limited additional tasks may be assigned to an individual undergoing training provided that these tasks are performed under the direct supervision of an experienced dive team member;
    - 3) Shall not participate in advanced tasks which require a Special Task Endorsement (STE) unless they hold a current STE for the task(s). These include, but are not limited to; large lift bags (>100 lbs. buoyancy), light pneumatic and hydraulic tools, tow-boarding, etc.
    - 4) Shall not perform tasks in deep water (>60 fsw) until they have demonstrated these skills in shallow water (<60 fsw) to the satisfaction of the UDS or designee;
    - 5) Shall not be permitted to dive or be exposed to hyperbaric conditions for the duration of any medical condition or temporary physical impairment or condition that is known to NOAA and is likely to adversely affect the safety or health of a dive team member; and
    - 6) Shall not be exposed to hyperbaric conditions against their will.
  - B. Hours of Operation.

- 1) The normal work schedule for personnel engaged in diving activities shall not exceed 12 hours during any 24-hour period.
- 2) A minimum rest period of eight (8) continuous hours is required for all divers prior to each diving day.
- 3) This standard is waived for watch standers on vessels with schedules of six (6) hours on-duty and six (6) hours off-duty; however, they shall have a minimum rest period of eight (8) hours during each 24-hour period.

C. Consecutive Days of Diving.

- 1) The DM or LD in charge of the dive operations has full authority to institute a mandatory day of rest (i.e., 24-hours without diving or strenuous activity) for individual divers, or the entire dive team, if in their opinion, continued diving would compromise the safety of the divers.
- 2) Unless approved by the LODO, a mandatory day of rest for each diver will be instituted after ten (10) consecutive days of open-circuit, no-decompression diving.
- 3) Unless approved by the NDCSB, a mandatory day of rest for each diver will be instituted after five (5) consecutive days of closed-circuit or decompression diving.

6.1.7 Participation in Non-NOAA Diving Operations.

- A. NOAA divers may participate in an official capacity in non-NOAA diving operations with agencies with which NOAA has established diving reciprocity agreements pending approval from their UDS, receipt of a letter of reciprocity, and LO program authorization.
- B. NOAA divers may also participate in an official capacity in non-NOAA diving operations with agencies without established diving reciprocity agreements with NOAA provided the divers comply with the NOAA diving regulations, policies, and procedures specified in this Manual and the operation is approved by the NDCSB.

6.1.8 Unit Inspections.

- A. All NOAA diving units will conduct an annual self-inspection using [NOAA Form 57-03-03 Diving Unit Inspection Checklist](#). An exemption is granted from the annual self-inspection when a triennial external inspection is scheduled within six (6) months of the due date for the self-inspection.
- B. NOAA diving units will be inspected by the NOAA Diving Safety Officer or designee as part of the Diving Unit Safety Assessment (DUSA) program every three (3) years.

- C. A DUSA inspection will include all unit specific applicable items listed in the NDP Unit Diving Assessment Checklist.
  - D. The NDCSB will approve all items included on the NDP Unit Diving Assessment Checklist.
  - E. Units found with deficiencies during this inspection will be subject to corrective actions, which may include temporary suspension until deficiencies are resolved, in accordance with the DUSA manual.
- 6.1.9 Pay for Performing Dive Duties.
- A. NAO 202-532A, Pay for Performing Dive Duties, establishes guidance for paying NOAA employees additional compensation for performing dive duties.
  - B. NOAA employees are entitled to receive dive pay for official dives performed.
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## 6.2 Pre-Dive Procedures

### 6.2.1 General.

The requirements outlined in this section shall be completed prior to each diving operation, unless otherwise specified.

### 6.2.2 Dive Planning and Approval.

- A. A formal written dive plan shall be completed and submitted to the appropriate UDS, or designee, for approval and signature prior to each separate on-duty dive operation.
- B. All dive planning shall be recorded on [NOAA Form 57-03-20 Pre-Dive Planning](#). Once a dive plan is approved by the UDS, or designee, it is to be submitted electronically to the following address: [ndp.diveplans@noaa.gov](mailto:ndp.diveplans@noaa.gov). This form includes, but not limited to, the following elements:
  - 1) Diving mode(s) and gas(es)
  - 2) Divers' authorizations
  - 3) Approximate number of proposed dives
  - 4) Location(s) of proposed dives
  - 5) Estimated depth(s) and bottom time(s) anticipated
  - 6) Proposed work, equipment, and boats to be employed
  - 7) Any hazardous conditions anticipated



- 8) Verify the Diving Emergency Action Plan (DEAP see 6.2.3)
- 9) In water details such as:
  - a. Discussion of dive buddy assignments and tasks
  - b. Purpose and objectives
  - c. Gas management plan
  - d. Dive details such as max depth(s), bottom time(s), entries/exits
  - e. Emergency and diver recall procedures
  - f. Perceived environmental and operational hazards and mitigations
- C. If a dive operation is deemed “intensive” based on time to chamber, depth, dives per day, and consecutive days of diving as outlined in the NOAA Dive Operations Plan Review Algorithm (see Appendix 3), then the UDS shall submit a copy of the dive plan to the LODO to determine the need for an on-site chamber or other safety considerations.
- D. The plan should include all tasks to be conducted during the dive. Tasks will be assigned to dive team members based on their individual skill levels, along with consideration for divers with the least experience relating to the dive or dive tasks.
- E. The UDS shall keep a copy of the dive plan on file for 24 hours after conclusion of the dive operation, and shall provide a copy of the approved dive plan to the DM or LD responsible for overseeing the dive, who shall ensure a copy is present at the dive site.
- F. Multi-day operations with similar purposes and tasks, dive teams, and locations may be combined on one (1) dive plan.
- G. Minor changes in dive plans may be made on-site by the DM or LD; however, any significant changes must be re-approved by the UDS or designee.
- H. Dive plans involving breathing mixtures other than air or Nitrox, or decompression dive profiles must be pre-approved by the NDCSB. The UDS shall complete and submit [NOAA Form 57-03-28 Decompression Diving Request](#) and/or [NOAA Form 57-03-29 Closed Circuit Rebreather \(CCR\) Decompression Diving Request](#) to the appropriate LODO who will forward them to the NDCSB. These forms include, but are not limited to, the following elements:
  - 1) Overview of the operations;
  - 2) Goals, objectives, and tasks to be accomplished;
  - 3) Description and location of dive site;

- 4) Names, affiliations, roles/responsibilities, and qualifications of all participants;
  - 5) Schedule of operations;
  - 6) Description of equipment and facilities;
  - 7) Logistical arrangements and considerations;
  - 8) Normal and emergency diving procedures;
  - 9) Diving Emergency Assistance Plan (DEAP); and
  - 10) Supporting documents, permits, and required forms.
- I. No-Decompression Tables and Procedures. NOAA-approved no-decompression tables shall be at the dive location.
- 6.2.3 Diving Emergency Assistance Plan (DEAP).
- A. All DEAPs shall be prepared using [NOAA Form 57-03-30 Dive Mission Execution](#).
  - B. The UDS is responsible to ensure an appropriate DEAP for each dive plan is on file at NDC.
  - C. The DEAP shall be available to all divers and support personnel at the site of the diving operation.
  - D. A DEAP must be submitted to the NDC on an annual basis and when any information on the DEAP has changed.
  - E. The UDS shall keep the DEAP on file for the duration of the dive operation.
  - F. A DEAP can be used for extended periods of time or large geographic areas as long as the chamber locations and evacuation protocols remain valid.
- 6.2.4 Pre-Dive Safety Briefings.
- A. Prior to any dive, a dive safety briefing shall be conducted by the DM or LD.
  - B. At a minimum the briefing shall include:
    - 1) General goals and objectives;
    - 2) The tasks to be undertaken;
    - 3) Dive plan (maximum depth, maximum bottom time, and 500 psi ending cylinder pressure);
    - 4) Gas management plan;
    - 5) Buddy assignments;

- 6) Safety procedures for the diving mode;
- 7) Evaluation of environmental conditions at the site;
- 8) Any unusual hazards or environmental conditions likely to affect the safety of the diving operation and any mitigations needed;
- 9) Any modifications to operating procedures necessitated by the specific diving operation;
- 10) Entry and exit location and procedures;
- 11) Descent, on-bottom, and ascent procedures; and
- 12) Emergency and accident management procedures, including diver recall procedures.

#### 6.2.5 Fitness to Dive.

- A. Prior to commencement of dive operation, the DM or LD shall:
  - 1) Assess each dive team member's current state of physical and mental readiness to dive and deny diving privileges to anyone deemed unfit to dive.
  - 2) Inform the dive team members that physical problems or adverse physiological effects should be verbally reported to the DM or LD.
  - 3) Confirm each diver is properly trained for the type of diving planned.
- B. Divers should refrain from alcohol consumption for a minimum of 12 hours prior to diving and 4 hours after diving.
- C. Divers exhibiting any effects of alcohol or substance abuse shall not be permitted to dive and will have their diving certification temporarily suspended or permanently revoked from diving pending review by the NDCSB.

#### 6.2.6 Pre- and Post-Dive Checklist.

- A. [NOAA Form 57-03-30 Dive Mission Execution Checklist](#) must be completed by the on-site DM or LD for each diving day.
- B. The checklist will be kept at the dive site or unit level for 24 hours following the dive, unless an incident has occurred in which case it will be kept for the duration of the statutory requirement. See Section 11.1.4(Retention of Records) for details.

#### 6.2.7 Emergency Equipment and Supplies.

- A. All emergency and support equipment shall only be operated by trained and currently certified personnel.

- B. It is the responsibility of the UDS (or designee) to ensure that all emergency equipment is well maintained and kept in operational condition.
- C. The following items shall be available at the dive location:
  - 1) First Aid Kit.
    - a. An NDMO-approved first aid kit, appropriate for the diving or chamber operation, and with appropriate medications (Appendix 4); and
    - b. A first aid handbook from the American Red Cross, American Heart Association or equivalent.
  - 2) Oxygen resuscitator.
    - a. Positive pressure ventilator and a bag-type manual resuscitator with transparent mask capable of ventilating an unconscious victim.
    - b. Sufficient quantity of oxygen to supply one (1) diver for:
      - i. The time required to transport them to a higher-level medical care facility; or
      - ii. 12 hours, whichever occurs first.
    - c. Oxygen cylinders shall be maintained within current hydrostatic test date.
    - d. Oxygen kits shall be stowed in a clean, protected and clearly labeled space.
    - e. Oxygen kits shall be checked prior to each day of diving.
  - 3) Automated External Defibrillator (AED). An AED, in good working condition, shall be available at the dive site.
  - 4) Backboard. A backboard and cervical collar, in good working condition, shall be available at the dive site when practical.

#### 6.2.8 Equipment Inspection.

- A. All support equipment and systems shall be inspected and tested for functionality prior to each dive by the dive team members.
- B. Each diver shall conduct a functional check of their diving equipment in the presence of their dive buddy or tender prior to each dive.
- C. Each diver must have the capability of achieving and maintaining positive buoyancy at the surface.
- D. The DM or LD shall conduct a final safety check of each diver's gear before allowing divers to enter the water.

- E. Any equipment in questionable condition shall be removed from service immediately and clearly labeled in order to preclude its use.
- F. Unless approved by the LODO, all dive equipment shall be suitable for the diving conditions and worn in a similar fashion as the configurations depicted in Appendix 5.

#### 6.2.9 Warning Signals.

- A. For all OSHA-exempt dives (e.g. scientific dives), when operating in areas capable of supporting marine traffic, a red and white “diver down” sport diving flag, appropriately sized for meeting local legal requirements, shall be displayed at the dive location in a manner which allows all-round visibility, and shall be illuminated during night diving operations.
- B. For all OSHA-subject dives (e.g., working or commercial dives) conducted from surfaces other than vessels and at the discretion of the DM or LD for all other dives, the code flag “Alpha” shall be displayed at the dive location in a manner which allows all-round visibility, and shall be illuminated during night diving operations.

#### 6.2.10 Hyperbaric Chamber Requirement.

- A. NOAA hyperbaric chambers shall be equipped and operated in accordance with Sections 4.19 and 5.7 of this Manual.
- B. No-Decompression Dives.
  - 1) Dive operations conducted within the U.S. Navy (USN) no-decompression limits may require access to a hyperbaric chamber within six (6) hours of the dive location if deemed “intensive” in nature. See Section 4.2.2.C.
  - 2) If a dive operation is deemed “intensive,” as outlined in the NOAA Dive Operations Plan Review Algorithm (Appendix 3), then the UDS shall submit a copy of the dive plan to the LODO to determine the need for an on-site chamber. See Section 4.2.2.C of this Manual.
  - 3) OSHA-subject working dives to less than 100 fsw, require access to a chamber within six (6) hours of the dive location.
  - 4) OSHA-subject working dives to more than 100 fsw, require access to a chamber within five (5) minutes of the dive location.
- C. Decompression dives must be pre-approved by the NDCSB and conducted per Sections 8, 9, and 10 of this Manual.

#### 6.2.11 Diver Recall Capability.

- A. Topside personnel must have the capability of recalling divers during all diving operations and brief the divers on the recall method prior to each dive.

- B. Shore-based OSHA-exempt dives for which the topside support requirement has been waived by the UDS are exempt from this requirement.
- 

### 6.3 Diving Procedures and Requirements

#### 6.3.1 Water Entry and Exit.

- A. A water entry and exit point, with at least one (1) alternative for each, should be identified before diving operations commence.
- B. A means shall be provided to extract an unconscious diver from the water.
- C. The means provided for exiting the water shall extend below the water surface.
- D. A small boat and qualified operator shall be used to deploy or retrieve divers when dives are conducted beyond a comfortable swimming distance from shore, in areas of strong current, and/or arduous egress.
- E. The propulsion system (e.g., propeller, jet drive) of the vessel shall be disengaged before divers enter or exit the water.

#### 6.3.2 Communications.

- A. An operational, two-way surface communication system (e.g., VHF radio, cell phone) shall be available at the dive location to obtain emergency assistance.
- B. An operational, hard-wired, two-way, underwater voice communication system shall be used when:
  - 1) Diving in surface-supplied mode, between each surface-supplied diver and a dive team member at the dive location, and
  - 2) Diving in tethered scuba mode, between solo tethered diver, standby diver and a topside tender.
- C. Diving operations shall be coordinated with other activities in the vicinity which are likely to interfere with the diving operation.

#### 6.3.3 Descent and Ascent Rates.

- A. Descent rates should not exceed 60 feet per minute (fpm).
- B. Ascent rates should not exceed 30 feet per minute (fpm).

#### 6.3.4 Supervisor Dive Log.

A dive log will be kept at the dive location in accordance with Section 11.1.4.

### 6.3.5 No-Decompression Tables.

- A. A set of NOAA-approved no-decompression tables (as appropriate for the breathing gases used) shall be at the dive location during air and nitrox (EAN28 – EAN40) no-decompression dives.
- B. A NOAA-approved decompression computer shall be at the dive location during decompression and mixed gas dives.
- C. During any dive, buddy teams must follow the most conservative dive profile.

### 6.3.6 Buddy System for Scuba Diving.

- A. All diving activities shall adhere to accepted standards of the buddy system for scuba diving, which requires a minimum of two (2) comparably equipped divers to remain in constant visual or physical contact with one another.
- B. Exceptions to the buddy system requirement apply to emergency situations (see section 1.1.7), and OSHA subject dives including the use of solo line-tended standby divers and solo tethered dives with hardwired communications.
- C. The buddy system is based upon mutual assistance, especially in the case of an emergency; therefore, scuba divers shall remain close enough to each other during dives to render immediate assistance in an emergency.
- D. When conditions are such that the probability of separation of divers is high, such as low visibility, some form of direct physical contact between divers should be maintained (Section 6.12).
- E. If separated during a dive, divers shall try to re-establish contact for no more than one (1) minute and if unsuccessful, immediately begin a controlled ascent to the surface, omitting a safety stop. Upon surfacing and reuniting with their buddy, the buddy pair can choose to resume the dive, provided there is sufficient remaining breathing gas and allowable bottom time.

### 6.3.7 Safety Stops.

- A. All safety stops are precautionary and an extra step for added safety. In the event of an emergency, any safety stop should be omitted in favor of getting safely back to the surface.
- B. For all no-decompression dives conducted deeper than 30 fsw, a precautionary safety stop is recommended at a depth between 15 feet and 20 feet for 3-5 minutes.
- C. For all no-decompression dives conducted deeper than 100 fsw, a precautionary safety stop is mandatory (except in an emergency) at a depth between 15 and 20 feet for 3-5 minutes

- D. If sea conditions or breathing gas supply are such that safety stops cannot be performed safely, they may be omitted.
- E. The time spent at a safety stop need not be added to the diver's total bottom time.

#### 6.3.8 Reserve Air Supply System Requirement.

- A. A diver-carried reserve breathing gas supply consisting of an independent reserve cylinder with a separate regulator (and pressure gauge for depths >30 fsw) shall be worn by each diver for all OSHA-subject dives and all OSHA-exempt dives which are:
  - 1) Outside the no-decompression limits;
  - 2) In overhead environments where direct ascent to the surface is prevented by a natural or man-made obstruction;
  - 3) In conditions of low visibility where the diver cannot read his cylinder pressure gauge;
  - 4) In enclosed or physically confined spaces;
  - 5) Deeper than 130 feet (recommended at depth below 100 feet);
  - 6) When diving against a current of greater than one (1) knot;
  - 7) By solo divers being line-tended; and
  - 8) When deemed appropriate by the DM or LD.
- B. The reserve supply shall be of sufficient quantity to allow the diver to reach the surface while maintaining an ascent rate of 30 feet per minute (fpm) and kept in the closed position when not in use during the dive.
- C. Systems that may be used to meet the above requirement include:
  - 1) NOAA Reserve Air Supply System (RASS) for depths to 130 fsw;
  - 2) Any cylinder containing one (1) cubic foot of gas at 3000 psi for every ten (10) feet of depth.
- D. The NOAA RASS shall be mounted and configured in a similar fashion as shown in in Appendix 5. Deviations from the mounting and configuration diagram must be approved by the diver's LODO and must comply with the following minimum standards:
  - 1) The tank valve must be easily accessible and not be blocked by any other diver-worn equipment;
  - 2) The high-pressure hose must be of sufficient length to allow the diver to easily read the submersible pressure gauge (SPG);



- 3) The second-stage hose must be of sufficient length to easily reach the mouth and to allow for head movement (rotation) from shoulder to shoulder.
- 4) If a longer hose is used for the second stage, it must be either:
  - a. Stored where it can be accessed easily;
  - b. Worn on a necklace (Tech style); or
  - c. Fastened with a proven quick release mechanism (octo-holder, etc.) to the Buoyancy Compensator Device (BCD).
- 5) The RASS cylinder must be securely mounted in a manner that allows for easy removal underwater;
- 6) The RASS cylinder valve must remain in the 'off' position during the dive, unless the second-stage regulator hose is equipped with an in-line shutoff valve and over-pressure relief valve;
- 7) Buoyancy Compensator Device (BCD) cam-bands are used for securing the primary cylinder only. If a RASS cylinder is mounted alongside the primary cylinder, a separate cam-band must be used for the RASS bracket assembly;
- 8) The RASS cylinder on/off valve must be uniquely identified and/or configured so that it is easily distinguished, visually or tactually, from the cylinder yoke screw; and
- 9) Unless authorized by the LODO, RASS cylinders shall be mounted either on the diver's right side (e.g., BCD or cylinder) or in front at belt level.

#### 6.3.9 Cylinder Pressure Requirement.

- A. All divers shall frequently check the pressure remaining in their scuba cylinders during dives and periodically compare the amounts with those of their dive buddies.
- B. All pre- and post-dive scuba cylinder pressures will be logged.
- C. Any recorded pressure of less than 500 psi will result in temporary suspension of dive privileges for that individual diver until the on-site DM or LD investigates the matter.
- D. If it is determined that the infraction is an unjustified violation of the 500 psi rule, the individual will not be permitted to resume diving until cleared by the diver's UDS.
- E. If it is determined that the cause of the infraction is justified (e.g., to render emergency assistance to a dive buddy), then the DM or LD may lift the suspension and allow the individual to resume diving.
- F. Repeated violation of the minimum pressure rule, even if justified, may result in temporary suspension pending review by the UDS.

- G. The UDS will report all violations of the 500 psi minimum policy to the LODO.

#### 6.3.10 Topside Support.

- A. A topside support person (Designated Person in Charge – DPIC) must be available at the dive site and ready, willing and able to render assistance in an emergency. This person must be currently certified in CPR, First Aid and oxygen administration, familiar with the dive activities being conducted and physically able to assist in the recovery of an injured diver.
- B. For operations from a small boat:
  - 1) When liveboating, a separate vessel operator and DPIC are required;
  - 2) When anchored (or moored), a single vessel operator can also serve as the DPIC, provided they can devote their full attention to the diving operations. Exceptions include areas of high vessel traffic or current, which may require a separate vessel operator and DPIC.
- C. The DM/LD may require additional topside support personnel based on the conditions anticipated.
- D. Operations from NOAA owned or contracted small boats shall be in accordance with the NOAA Small Boat Standards and Procedures Manual.
- E. The UDS may waive the topside support requirement for OSHA-exempt dives where the ingress and egress are from shore.

#### 6.3.11 Support Vessels

- A. General
  - 1) All NOAA-owned and operated small boats must conform with all policies outlined in the NOAA Small Boat Program Standards and Procedures Manual.
  - 2) The means provided for exiting the water shall extend below the water surface.
- B. Primary Support Boats

A support boat and qualified operator is required to be in the immediate vicinity of the dive location and ready to render assistance as needed. A support boat should be used for dives with the following conditions:

  - 1) Conducted beyond a comfortable swimming distance from shore;
  - 2) In areas of strong current or low visibility;
  - 3) Requiring difficult water entry or exit (e.g., ladders, steep shores, heavy surf);
  - 4) Dive operations conducted from ships.
- C. Chase Boats
  - 1) In cases where dive teams have a greater likelihood of separation (e.g., high current, low visibility, long decompression, large dive teams) the UDS, DM, or LD may require a second support vessel.

- 2) The NDCSSB may require chase boats in certain complex dive missions.
- 3) Chase boats shall have the same support and medical response equipment on board as primary support boats.

#### 6.3.12 Standby Diver(s).

- A. Standby diver(s) shall be configured in a similar fashion to Appendix 5 and ready to enter the water within one (1) minute of notification for all OSHA-subject dives and for OSHA-exempt dives:
  - 1) Conducted outside the no-decompression limits; or
  - 2) Conducted in overhead environments where direct ascent to the surface is limited (e.g., hulls of ships, wreck penetrations, ice); or
  - 3) Involving tethered/line-tended scuba diving by a solo diver; or
  - 4) When an operational risk assessment deems it appropriate.
- B. Depending on the situation, options for standby divers include:
  - 1) A buddy team of scuba divers;
  - 2) A solo line-tended scuba diver; or
  - 3) A solo tethered scuba diver with voice communications.
- C. Unless called to action, the standby diver must remain on the surface during dives.
- D. DMs may serve as standby divers, but if they are deployed, another topside support person must take their place.
- E. All efforts should be taken to minimize physical and environmental stressors on the standby diver(s) as they perform their duties.
- F. In certain situations, the NDCSB may approve the use of on-bottom safety diver(s) in lieu of standby divers for OSHA-exempt dives.

#### 6.3.13 Termination of Dive.

- A. It is the responsibility of the diver to terminate the dive, without fear of penalty, whenever they feel it is unsafe to continue the dive, unless to do so compromises the safety of another diver already in the water.
- B. A dive shall be terminated when:
  - 1) Scuba cylinder pressure approaches a level below which the diver and their buddy would be unable to safely reach the dive platform with at least 500 psi in their cylinder(s);
  - 2) A diver, DM, LD, or vessel operator requests termination;

- 3) A diver fails to respond correctly to communications or signals from a dive team member;
  - 4) A diver loses visual or physical contact with his dive buddy for more than one (1) minute;
  - 5) A diver begins to use a reserve breathing gas supply, other than during a drill;
  - 6) A diver begins to use an alternate air source, other than during a drill;
  - 7) A diver begins buddy breathing, other than during a drill;
  - 8) An emergency recall is activated from the surface;
  - 9) There is an equipment failure that may compromise the safety of the diving operation;
  - 10) Conditions become unsafe for divers or support personnel; or
  - 11) The standby diver(s) has been deployed to assist any diver.
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## 6.4 Post-Dive Procedures

### 6.4.1 Precautions.

#### A. After the completion of any dive, the DM or LD shall:

- 1) Check the physical condition of each diver;
- 2) Instruct the divers to report any physical problems or adverse physiological effects including symptoms of decompression sickness along with any equipment malfunctions; and
- 3) Remind divers to remain in the vicinity of each other for 30 minutes and monitor their dive buddies.

#### B. For any dive outside the no-decompression limits, DMs or LDs shall instruct the divers to remain awake and in the vicinity of each other for at least one (1) hour after the dive (including decompression or treatment as appropriate).

### 6.4.2 Post-Dive Debriefing and Checklist.

#### A. Following each dive a debriefing shall be conducted including at a minimum, but not limited to:

- 1) Dive profile information (maximum depth, bottom time and ending cylinder pressure);
- 2) Completion of goals and objectives;

- 3) Suggestions for next team of divers;
  - 4) Location and contact information of a hyperbaric chamber which is ready for use; and
  - 5) Potential hazards regarding flying or ascending to altitudes in excess of 1000 feet within 30 hours after completion of a dive. Reference section 4.4.3 for details.
- B. Post-Dive Checklist. Complete the Post Dive section of the NOAA Pre- and Post-Dive Checklist and keep on file for 24 hours following the completion of dive operations, unless there is an incident in which case it shall be kept for the duration of the statutory requirement.
- 6.4.3 Flying After Diving or Ascending to Altitude (Over 1000 feet/304 meters)
- A. Following a Single No-Decompression Dive: Divers should have a minimum preflight surface interval of 12 hours.
  - B. Following Multiple Dives per Day or Multiple Days of Diving: Divers should have a minimum preflight surface interval of 18 hours.
  - C. Following Dives Requiring Decompression Stops: Divers should have a minimum preflight surface interval of 24 hours.
  - D. Before Ascending to Altitude Above 1000 feet (304 meters): Divers should follow the appropriate guideline in Appendix 6 for preflight surface intervals unless the decompression procedure used has accounted for the increase in elevation.
- 6.4.4 Dive Incident Reporting and Investigation.
- A. Dive-related injuries requiring medical treatment beyond basic first aid shall be reported, investigated and documented as prescribed in Section 13 of this Manual.
  - B. All “near-miss” or “close call” incidents that could have resulted in a fatality or serious injury to a dive team member shall be reported and documented in accordance with the policies and procedures outlined in Section 13 of this Manual.
- 6.4.5 Post-Dive Health Considerations.
- A. Divers shall limit post-dive exertion due to the potential of bubble formation that could lead to decompression sickness.
  - B. Report all injuries, and signs or symptoms of hyperbaric maladies to the DM or LD as soon as they are experienced.

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## 6.5 Open Circuit Scuba Diving

### 6.5.1 General.

- A. Scuba diving mode consists of two (2) methods: free-swimming and tethered (with communications).

- B. Divers trained in specialized diving techniques and equipment (e.g., tethered comms scuba diving, drysuits) must maintain annual proficiency in the types of equipment and procedures for which they are authorized. Failure to maintain proficiency may result in loss of authority to perform such dives.
- C. Special Task Endorsement (STE) for one (1) or more specific tasks, which are above or beyond the fundamentals of scuba diving.
- D. Divers may encounter environments with unique hazards and require additional consideration for planning.

#### 6.5.2 Equipment.

Equipment considerations are thoroughly described in Sec 5.4. At a minimum, all divers should be outfitted with the following equipment:

- 1) A primary breathing gas supply and regulator;
- 2) A redundant second stage regulator on the primary cylinder(s) for air sharing;
- 3) A pressure gauge for each independent cylinder;
- 4) A buoyancy compensation device;
- 5) A weight system capable of quick release;
- 6) A knife or other cutting device;
- 7) A mask, snorkel and fins;
- 8) A timekeeping device;
- 9) A compass;
- 10) A depth gauge;
- 11) Thermal protection appropriate for the conditions; and
- 12) A whistle or other sound-producing device.

#### 6.5.3 Personnel Requirements.

The minimum personnel required to conduct a scuba dive. Small boat operations have additional requirements as noted in Sec. 6.3.10:

Dive Type	Personnel	Free swimming divers to <100 fsw	Free swimming divers 100 - 130 fsw	Free swimming divers to >130 fsw	Tethered divers with communications to <100 fsw
<b>OSHA-subject dives</b>	Divers	2	2	n/a	1
	Standby Divers	2 <sup>A</sup>	2 <sup>A</sup>	n/a	1
	Topside Support	1	1	n/a	1
	<b>TOTAL</b>	<b>5</b>	<b>5</b>	<b>n/a</b>	<b>3</b>

<b>OSHA-exempt dives</b>	Divers	2	2	2	1
	Standby Divers	0 <sup>B</sup>	0 <sup>B</sup>	2 <sup>D</sup>	1
	Topside Support	1 <sup>C</sup>	1	1	1
	<b>TOTAL</b>	<b>3</b>	<b>3</b>	<b>5</b>	<b>3</b>

<sup>A</sup> A line-tended standby diver may be substituted for two (2) free swimming standby divers.

<sup>B</sup> The UDS/DM or LD may require standby divers on any dive.

<sup>C</sup> The UDS may waive the topside support for shore-based dives.

<sup>D</sup> An on-bottom safety diver may be substituted for free swimming standby divers.

#### 6.5.4 Operational Limits.

Scuba diving shall not be conducted:

- A. At depths down to 100 fsw if the dive is OSHA-subject unless a hyperbaric chamber is accessible within six (6) hours of the dive site.
- B. At depths deeper than 100 fsw if the dive is OSHA-subject unless a hyperbaric chamber is accessible within five (5) minutes of the dive site.
- C. At depths deeper than 130 fsw or outside the no-decompression limits unless the dive is OSHA-exempt, a hyperbaric chamber is accessible within two (2) hours of the dive site and with pre-approval of the NDCSB.
- D. Against currents exceeding three (3) knots.
- E. Against currents of one to three (1-3) knots unless the following conditions are met:

- 1) All divers are equipped with line reels and surface marker buoys (SMBs) and have the requisite training to safely deploy them;
- 2) All dives are planned to minimize swimming into the current;
- 3) All divers return to the exit point with a minimum cylinder pressure of 500 psi;
- 4) A vessel (either the dive support vessel or chase boat) is operating in a live boat mode at the dive site; and
- 5) Divemasters and Lead Divers brief all dive teams on the importance of gas management and buddy communication.
- 6) All divers must carry a RASS or other appropriate alternate gas cylinder.

F. When sea state or weather prevent safe deployment, retrieval or tracking of divers.

#### 6.5.5 Breathing Gas Supplies.

A. Diver-carried breathing gas supplies shall only be used for:

- 1) Breathing purposes;
- 2) Inflating BCDs and variable-volume drysuits; and
- 3) Surface marker buoys of 50 lbs. or less positive buoyancy.

B. Lift-bags exceeding 50 lbs. of positive buoyancy may only be inflated from a separate diver carried gas source not used for life support.

C. A diver-carried reserve air supply system of sufficient quantity to allow the diver to reach the surface or another appropriate gas supply shall be worn as specified in Section 4.3.7.

#### 6.5.6 Use of Dive Computers.

- A. Any commercially available dive computer may be used for no-decompression diving after completing a [NOAA Form 57-03-68 Dive Computer User Agreement](#).
- B. Dive computers for decompression dives must be CE approved and capable of running the Bühlmann decompression algorithm.

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## 6.6 Nitrox diving.

### 6.6.1 General

- A. The following guidelines address the use of Nitrox by divers working under NOAA auspices. For these standards, Nitrox is defined as any gas mixture being comprised of an oxygen concentration between 22 and 40 percent by volume. The maximum allowable PO<sub>2</sub> for any NOAA dive is 1.40 ATA.



### 6.6.2 Prerequisites.

- A. Divers must be certified to use Nitrox by NOAA or another nationally or internationally recognized diver training organization defined by RSTC/WRSTC standards.

### 6.6.3 Requirements for Authorization to Use Nitrox.

#### A. Approval.

- 1) Successful completion of a NOAA Nitrox training course, or;
  - a. Presentation of a Nitrox certification from a nationally or internationally recognized diver training organization defined by RSTC/WRSTC standards;
  - b. Endorsement from the UDS, and;
  - c. Receipt of a Letter of Authorization with a Nitrox endorsement from the NDPM.

#### B. Minimum Activity to Maintain Authorization.

- 1) The diver should log at least one (1) Nitrox dive per year. Failure to meet the minimum activity level may be cause for restriction or revocation of Nitrox authorization.

### 6.6.4 Nitrox Diving Personnel Requirements.

#### A. Diver.

- 1) NOAA Divers who have completed the requirements of Section 4.3.1B may be authorized by the NDPM to use Nitrox.
- 2) Depth authorization to use Nitrox should be the same as that specified in the diver's authorization, as described in Section 4.4, or equivalent to the depth rating of advanced certifications (i.e. advanced nitrox diver).

#### B. Divemaster / Lead Diver.

- 1) On any dive during which Nitrox will be used by any team member, the DM/LD shall be authorized to use Nitrox, and hold appropriate authorizations required for the dive, as specified in this Manual.
- 2) DM/LD authorization for Nitrox dives by the UDS (or designee) should occur as part of the approval process for the diving project.
- 3) In addition to responsibilities listed in Section 2.10.2, the DM/LD shall:
- 4) As part of the planning process for the dive, verify that all divers using Nitrox are properly qualified and authorized.

- 5) As part of the pre-dive procedures, confirm with each diver the oxygen percentage of the gas the diver is using, and establish maximum depth and time limits, according to the shortest time limit or shallowest depth limit among the team members.
- 6) Reduce the maximum allowable PO<sub>2</sub> exposure limit for the diving team if indicated by on-site conditions.

#### 6.6.5 Nitrox Diving Parameters.

##### A. Oxygen Exposure Limits.

- 1) The inspired oxygen partial pressure experienced at depth should not exceed 1.40 ATA. All dives using Nitrox should comply with the current NOAA Diving Manual "Oxygen Partial Pressure Limits for 'Normal' Exposures."
- 2) The maximum allowable exposure limit should be reduced in cases where cold or strenuous diving conditions, or extended exposure times are expected. The UDS should consider this in the review of any dive plan application that proposes to use Nitrox.

##### B. Bottom Time Limits.

- 1) Maximum bottom time should be based on the depth of the dive and the Nitrox gas being used.
- 2) Bottom time for a single dive should not exceed the NOAA maximum allowable "Single Exposure Limit" for a given oxygen partial pressure, as listed in the most recent edition of the NOAA Diving Manual.

##### C. Dive Tables and Gases.

- 1) NDCSB-approved Nitrox dive tables shall be available at the dive site.
- 2) When using the EAD method, dives should be conducted using air dive tables approved by the NDCSB.
- 3) If Nitrox is used to increase the safety margin of air-based dive tables, MOD and oxygen exposure for Nitrox gases used on a dive shall not be exceeded.
- 4) Nitrox breathing gases used while performing in-water decompression, or for bail-out purposes, should contain the same or greater oxygen content as that being used during the dive, within the confines of depth limitations and oxygen partial pressure limits set forth in Section 6.6.5 of this Manual.

##### D. Nitrox Dive Computers

- 1) Any commercially available Nitrox dive computer may be used for no-decompression diving by completing NOAA Form 57-03-68 Dive Computer User Agreement.

- 2) Prior to using a Nitrox dive computer, users shall demonstrate, to the satisfaction of the UDS or designee, a clear understanding of the display, operations, and manipulation of the unit being used.
- 3) Dive computers capable of PO<sub>2</sub> limit (1.40 ATA) and FO<sub>2</sub> adjustment should be checked by the diver prior to the start of each dive to assure conformity with the gas being used.

#### E. Repetitive Diving

- 1) Repetitive dives using Nitrox gases should comply with procedures required by the specific dive tables used or as prescribed by the manufacturer of a Nitrox dive computer.
- 2) When determining residual nitrogen times using EAD calculations, the time shall be based on the Nitrox gas mixture to be used on the repetitive dive, and not that from the previous dive.
- 3) The total cumulative exposure for PO<sub>2</sub> shall remain within Repetitive Excursion (REPEX) limits as provided in the NOAA Diving Manual.

#### F. Oxygen Parameters

- 1) Authorized Nitrox Gases. Gases meeting the criteria outlined in this section may be used for Nitrox diving operations.
- 2) Purity. Oxygen used for Nitrox-breathing gas shall meet the purity levels for Medical Grade (according to the United States Pharmacopeia, or U.S.P.), Technical Diving Grade, or Aviator Grade standards.
- 3) In concurrence with the Air Quality Guidelines (Section 5.3.5), the following standard shall be met for breathing air that is either: placed in contact with oxygen concentrations greater than 40 percent or used in Nitrox production by the partial pressure blending method with gases containing greater than 40 percent oxygen as the enriching agent.

Constituent	Membrane Systems	Partial Pressure Systems
Oxygen	20 - 22	20 - 22
Carbon Dioxide (ppmv)	1000	1000
Carbon Monoxide (ppmv)	10	10
Condensed Hydrocarbons (mg/m <sup>3</sup> )	25	25
Oil Mist and Particulate (mg/m <sup>3</sup> )	0.1	0.1
Odor (Objectionable)	None	None

G. Only NDCSB mixes and mixing methods may be used. For basic Nitrox diving this includes:

- 1) Nitrox mixtures up to 40% O<sub>2</sub>
- 2) Nitrox membrane systems, continuous flow mixing, and partial pressure mixing

H. Diver Responsibility for Gas Analysis

- 1) Individuals responsible for producing and/or analyzing Nitrox gases shall be trained and have experience in all aspects of the technique.
- 2) In situations where NOAA owns or operates the compressors, only those trained individuals approved by the UDS shall be responsible for blending Nitrox gases.
- 3) It is the responsibility of the UDS to approve the specific Nitrox production method used.
- 4) Prior to the dive, it is the responsibility of each diver to analyze the oxygen content of their scuba cylinder and acknowledge in writing the following information for each cylinder:
  - a. FO<sub>2</sub>;
  - b. MOD;
  - c. Cylinder pressure;
  - d. Date of analysis; and
  - e. User's name.
- 5) Individual dive log reporting forms should report FO<sub>2</sub> of Nitrox used, if different than 21 percent.

#### 6.6.6 Nitrox Diving Equipment.

A. General.

- 1) All designated equipment and scuba equipment requirements in this Manual apply to Nitrox scuba operations.
- 2) Additional minimal equipment necessary for Nitrox diving operations includes properly labeled scuba cylinders and oxygen analyzers.

B. Oxygen Cleaning and Maintenance Requirements.

- 1) All equipment exposed to oxygen concentrations greater than 40 percent by volume at pressures above 200 psi shall be cleaned and maintained for oxygen clean service.
- 2) Oxygen systems over 125 psig shall have slow-opening shut-off valves.

C. Scuba Cylinder Identification.

- 1) Cylinders shall be marked "NITROX," "EANx," or "Enriched Air."
- 2) For identification, Nitrox cylinders should be color-coded with a 4-inch wide green band around them. If the cylinder is not yellow, the green band should be bordered above and below by a 1-inch yellow band.
- 3) The alternate marking of a yellow cylinder by painting the cylinder crown green and printing the word "NITROX" parallel to the length of the cylinder in 2-inch green letters is acceptable.
- 4) Other markings, which identify the cylinder as containing gases other than air, may be used with the approval of the NDCSB.
- 5) A label should be affixed with the contents of each cylinder, to include the current FO<sub>2</sub>, MOD, date of analysis, cylinder pressure and name or initials of the person who analyzed the gas.
- 6) The cylinder should be labeled to indicate whether the cylinder is prepared for gases containing greater than 40 percent oxygen. This includes oxygen cleaning for the cylinder and valve and the use of oxygen compatible O-rings and lubricants.
- 7) Scuba cylinders specifically designated for use with Nitrox breathing gases should only be filled with appropriate Nitrox gases or oxygen compatible air and should be analyzed and labeled appropriately.

D. Other Support Equipment.

- 1) All Nitrox mixtures shall be analyzed using an oxygen analyzer capable of reading a scale of 0 to 100 percent oxygen, within 1 percent accuracy.
- 2) Oxygen analyzers shall be calibrated with air delivered at the same flow rate as the nitrox to be analyzed and should be span calibrated with 100% oxygen before use.
- 3) Galvanic oxygen sensors in oxygen analyzers shall be replaced in accordance with the manufacturer's guidelines. If no guidelines are provided, they shall be replaced after 12 months of use, 18 months after manufacture or sooner if the analyzer cannot be calibrated with air.

- 4) All diver and support equipment should be suitable for the fraction of oxygen (FO<sub>2</sub>) being used.
- E. Nitrox Mixing Equipment and Procedures.
- 1) All equipment and procedures used for the mixing of Nitrox breathing gases shall comply with standards outlined in the latest version of this Manual.
  - 2) An oil-lubricated compressor placed in service for a nitrox system should be checked for oil and hydrocarbon contamination at least quarterly
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## 6.7 Full Face Mask

### 6.7.1 General.

- A. NOAA divers wanting to use full face masks must complete formal training in the equipment and have a full face mask endorsement added to their Authorization to Dive letter by the NDPM.
- B. Such training may be obtained from a number of sources including, but not limited to: NOAA, US military, academic institutions, and recreational agencies.
- C. Experience may be substituted for formal training as determined by the NDPM.

### 6.7.2 Training.

At a minimum, formal full face mask training shall include

#### A. Academic instruction:

- 1) Full face mask components;
- 2) Equipment preparation and maintenance;
- 3) Donning and doffing procedures;
- 4) Emergency procedures.

#### B. Practical instruction:

- 1) Pool:
  - a. Equipment preparation such as hose rerouting
  - b. Donning and doffing procedures;
  - c. Mask use with and without a hood; and
  - d. Emergency procedures.

2) Confined or open-water dives with an instructor:

Full face mask authorization requires a minimum of two (2) open-water dives wearing a full face mask for a cumulative bottom time of at least 120 minutes.

6.7.3 Equipment.

- A. Divers must carry a spare mask on their person while diving full face masks.
- B. Rerouting hoses may be required depending on the brand of full face mask used.

6.7.4 Emergency Procedures.

Initial and proficiency training for full face masks shall include:

- A. Clearing mask;
- B. Replacing mask underwater;
- C. Removing mask and bailing out to alternate air source; and
- D. Removing mask and bailing out to RASS.

6.7.5 Proficiency.

Proficiency with full face masks is maintained by the following:

- A. Two (2) dives per year with full face mask;
- B. Emergency procedures must be demonstrated on at least one (1) dive per year; and
- C. If proficiency lapses, the following reauthorization procedures will be followed:
  - 1. 3-6 month lapse in proficiency requires a training-only checkout dive with the UDS or designee.
  - 2. 6-12 month lapse in proficiency requires LODO approval prior to a training-only checkout dive with the UDS or designee.
  - 3. More than 12 month lapse in proficiency requires a LODO determined refresher training program.

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## 6.8 Drysuit Diving

### 6.8.1 General.

- A. NOAA divers wanting to use drysuits must complete formal training in the equipment and have a drysuit endorsement added to their Authorization to Dive letter by the NDPM.
- B. Such training may be obtained from a number of sources including, but not limited to: NOAA, US military, academic institutions, and recreational agencies.
- C. Experience may be substituted for formal training as determined by the NDPM.

#### 6.8.2 Training.

At a minimum, formal drysuit training shall include:

- A. Academic instruction:
  - 1) Drysuit components;
  - 2) Equipment preparation and maintenance;
  - 3) Donning and doffing procedures;
  - 4) Weighting systems and usage; and
  - 5) Emergency procedures.
- B. Practical instruction:
  - 1) Pool:
    - a. Equipment preparation;
    - b. Donning and doffing procedures;
    - c. Disconnecting and reconnecting drysuit inflator hose;
    - d. Buoyancy control; and
    - e. Emergency procedures.
  - 2) Confined or open-water dives with an instructor:
    - a. Emergency management for excess positive buoyancy;
    - b. Ditching of weights; and
    - c. Disconnecting and reconnecting drysuit inflator hose.
  - 3) Drysuit certification requires a minimum of five (5) open-water dives wearing a drysuit for a cumulative bottom time of at least 120 minutes.

#### 6.8.3 Equipment.



- A. NOAA drysuit divers shall wear a weight-harness system with a quick-release mechanism requiring the use of only one (1) hand in lieu of the weight system described in Section 5.4.1.
- B. Ankle weights are optional.
- C. A drysuit diver's buoyancy should be controlled by the suit itself while underwater; whereas, the BCD should only be used for surface flotation or as a back-up in case of drysuit failure.
- D. The use of non-SEP-issued drysuits must be pre-approved by the LODO.
- E. Each drysuit must be equipped with an exhaust valve.
- F. Inflator and exhaust valves shall be inspected and tested for functionality before each use and replaced as needed.
- G. Drysuits must not be used as a lifting device in lieu of lift bags.

#### 6.8.4 Emergency Procedures.

- A. Loss of positive buoyancy:
  - 1) The diver should ditch one (1) or both of his harness weight pouches, terminate dive, and swim to the surface; and
  - 2) Once at surface, inflate the BCD.
- B. Excess positive buoyancy. The diver should, in order of preference:
  - 1) Swim down to compress air in suit to help reduce excess buoyancy;
  - 2) Roll to head-up position;
  - 3) Dump air from suit using exhaust valve;
  - 4) Dump air from suit at wrist or neck seals; or
  - 5) Flare-out to increase surface area to help slow ascent and exhale.
- C. Free-flowing suit inlet valve:
  - 1) Manually disconnect the inflator hose from suit; and
  - 2) If ascending too quickly, follow procedure for excess positive buoyancy.

#### 6.7.5 Proficiency.

Proficiency with drysuits is maintained by the following:

- A. Two (2) dives per year with a drysuit;

- B. Emergency procedures must be demonstrated on at least one (1) dive per year; and
  - C. If proficiency lapses, the following reauthorization procedures will be followed:
    - 1. 3-6 month lapse in proficiency requires a training-only checkout dive with the UDS or designee.
    - 2. 6-12 month lapse in proficiency requires LODO approval prior to a training-only checkout dive with the UDS or designee.
    - 3. More than 12 month lapse in proficiency requires a LODO determined refresher.
- 

## 6.9 Line-Tended Scuba Diving

### 6.9.1 General.

- A. Line-tended SCUBA diving is a specialized diving technique whereby divers are connected to the surface via a strength member (line) managed by a trained individual topside.
- B. In this mode, a line tended standby diver is used only in an emergency.
- C. Training consists of completing the Line-Tending Standby Divers training module at the Commerce Learning Center (CLC) website and the skills portion under the direction of a UDS or designee.
- D. As defined by NOAA, line-tended diving does not utilize voice communications, and therefore, can only be used by standby divers.
- E. Each line-tended SCUBA diver must be tended by a separate tender.
- F. D. All scuba operations conducted using tethered divers or line-tended standby divers shall be conducted from a moored or fixed platform (i.e., no live boating).

### 6.9.2 Training.

All initial and proficiency training shall be referenced in the Unit Log.

- A. Academic instruction shall include, but not be limited to:
  - 1) Specialized equipment;
  - 2) Tending procedures;
  - 3) Communication procedures (line pull signals);
  - 4) Diving procedures; and

- 5) Emergency procedures.
- B. Practical instruction shall include, but not be limited to two (2) dives demonstrating the following skills:
- 1) Dressing procedures;
  - 2) Tending procedures; and
  - 3) Emergency procedures.
- C. Non-divers may be may be trained as tenders and shall participate in the entire training session, minus the actual diving portion, outlined in this section.

#### 6.9.3 Equipment.

In addition to standard SCUBA diving equipment, divers shall be tended with a strength member (line) capable of lifting the diver from the water.

#### 6.9.4 Personnel Requirements (Refer to Section 4.5.2).

#### 6.9.5 Limits.

Line-tended SCUBA diving is restricted to the same limits as non-tethered, free-swimming SCUBA mode (Section 4.5.3).

#### 6.9.6 Tender Responsibilities.

- A. It is the tender's responsibility to ensure the diver receives proper care while topside and underwater.
- B. While the diver is submerged, the tender handles the tending line and communicates with the diver via line-pull signals.
- C. Line-tended divers and tenders may develop additional line pull signals, but all divers and tenders must know standard line signals adapted from the USN.

#### 6.9.7 Emergency Procedures.

##### A. Entanglement.

1. The diver will notify topside personnel via line-pull signals and attempt to clear the entanglement.
2. If unable to clear the entanglement, the diver will notify topside personnel via line-pull signals, detach

#### 6.9.8 Proficiency.

- 1) the tending line and ascend to the surface.

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## 6.10 Tethered Scuba with Voice Communications

### 6.10.1 General.

- A. When conducting tethered scuba diving operations the diver shall be equipped with a life-line and two-way voice communications.
- B. In this mode, line tending is required.
- C. Training consists of completing an NDP tethered SCUBA diver course.
- D. Standby diver(s) shall be outfitted with the same gear configuration as the primary diver(s) including two-way communications.
- E. C. All scuba operations conducted using tethered divers or line-tended standby divers shall be conducted from a moored or fixed platform (i.e., no live boating).

In order to maintain tethered scuba diving authorization, all trained divers and tenders must perform/tend at least two (2) tethered scuba dives every twelve (12) months. Dives will be documented using the standard online dive log.

### 6.10.2 Training.

All initial and proficiency training shall be referenced in the Unit Log.

- A. Academic instruction shall include, but not be limited to:
  - 1) Tether equipment;
  - 2) Tending procedures;
  - 3) Communication procedures;
  - 4) Diving procedures; and
  - 5) Emergency procedures.
- B. Practical instruction shall include, but not be limited to:
  - 1) Pool or confined-water conditions:
    - a. Dressing procedures;
    - b. Diving procedures;
    - c. Tending procedures; and
    - d. Emergency procedures.
  - 2) Open-water instruction shall include, but not be limited to a minimum of five (5) dives with a cumulative bottom time of 150 minutes for authorization.

- C. Non-divers may be trained as surface tenders and shall participate in the entire training session, minus the diving portion. Academic instruction for line-tended training can be found at the [Commerce Learning Center](#) (CLC) website.

#### 6.10.3 Equipment Requirements.

- A. In addition to standard scuba diving equipment, the following minimum items shall be included in a tethered scuba diving assembly:
  - 1) Lightweight full-face mask with demand regulator;
  - 2) Strength member tether with quick release snap shackle;
  - 3) Hardwired voice communications;
  - 4) Surface communications unit; and
  - 5) Man-rated safety harness for lifting the diver from the water.
- B. Any deviation from the above requirements must be approved by the LODO.

#### 6.10.4 Emergency Procedures.

- A. Loss of primary gas supply. The diver will switch to the reserve breathing supply, notify topside, terminate the dive and follow their tether back to the surface.
- B. Loss of voice communication. The diver will stop all activity, signal topside personnel via line-pull signals and begin ascent to the surface.
- C. Entanglement.
  - 1) The diver will notify topside personnel via voice communications or line-pull signals and attempt to clear the entanglement.
  - 2) If unable to clear the entanglement, the diver will notify topside via voice comms or line-pull signals and wait for assistance from the standby diver.
  - 3) If the standby is delayed or the diver is in jeopardy of running out of air, the diver can disconnect themselves from the tether and swim to the surface.
- D. Flooded mask. If the diver is unable to purge a flooded mask, they will switch to the reserve breathing supply, notify topside personnel via line-pulls, terminate the dive and ascend to the surface.

#### 6.10.5 Personnel Requirements. (Refer to Section 6.5.3)

#### 6.10.6 Limits.

In addition to the limits for Open Circuit scuba (Section 4.5.3), tethered scuba diving cannot be conducted from a vessel under power.

#### 6.10.7 Tender Responsibilities.

- A. It is the tender's responsibility to ensure the diver receives proper care while topside.
- B. While the diver is submerged, the tender handles the tether, maintains communications, and monitors diver's air usage by periodically requesting pressure readings from the diver.
- C. The usual means of communications between diver and tender is by voice intercom. However, it is important that basic line signals be memorized and practiced so they will be recognized instantly in the event of intercom failure.
- D. Dive teams may develop additional line pull signals, but all divers and tenders will know standard line signals adapted from the USN.

#### 6.10.8 Proficiency for tethered scuba with voice comms is maintained by the following:

- A. Two (2) dives per year with tethered gear;
- B. Emergency procedures must be demonstrated on at least one (1) dive per year; and
- C. If proficiency lapses, the following reauthorization procedures will be followed:
  - 1. 3-6 month lapse in proficiency requires a training-only checkout dive with the UDS or designee.
  - 2. 6-12 month lapse in proficiency requires LODO approval prior to a training-only checkout dive with the UDS or designee.
  - 3. More than 12 month lapse in proficiency requires a LODO determined refresher training program.

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### 6.11 Special Task Endorsement

#### 6.11.1 General.

- A. NOAA divers may apply to their UDS for a Special Task Endorsement (STE) for one (1) or more specific tasks which are above or beyond the fundamentals of scuba diving (e.g., use of lift bags to move >100 lbs. underwater).
- B. Such requests must include a rationale/justification for the endorsement, a detailed outline of the training to be conducted including, but not limited to, the number of hours of classroom and practical instruction, location, and number of training dives to be performed; topside and underwater skills to be performed; and the name and credentials of instructors involved in the training.

### 6.11.2 Responsibilities.

- A. Unit Diving Supervisor. The UDS will review the request and, if deemed appropriate, forward it with a recommendation to the appropriate LODO for review and approval.
- B. If approved, the LODO will issue the STE to the diver with a copy to the UDS. The UDS will then be responsible to update the STE in both the Unit Log and the NOAA Diver Database.

### 6.11.3 Limitations.

- A. STEs are valid for 12 consecutive months from the date of award and may be renewed at the discretion of the UDS and LODO. Divers interested in renewing their STE shall submit a request through their UDS to their LODO listing the number and types of STE dives performed during the previous award period. The UDS will review the request and, if deemed complete and appropriate, forward it with a recommendation to the appropriate LODO for review and approval.
- B. Once awarded, STE divers are expected to perform the specific task(s) for which the STE was granted at least twice per year. Failure to do so may result in the temporary suspension or revocation of the STE as determined by the LODO, or their designee.
- C. Tasks associated with certain STEs shall be conducted as working dives under the provisions outlined in 29 CFR 1910, Subpart T and shall not be conducted under the Scientific Exemption. Divers receiving STEs requiring adherence to OSHA standards shall be notified as such when the STE is awarded.

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## 6.12 Diving in Low Visibility

### 6.12.1 General.

- A. NOAA diving operations conducted in low visibility, defined as conditions in which visual contact with the dive buddy cannot be maintained, shall comply with the standards outlined below.
- B. Where conditions are such that visual contact cannot be maintained, physical contact, either directly (touch contact) or indirectly (buddy line with quick-release on both ends), may be used to maintain buddy contact.
- C. If the DM/LD determines line tending is necessary, one (1) diver of a buddy pair may be line tended from the surface and the other diver shall maintain contact with the tended diver via a buddy line as described below.

### 6.12.2 Requirements.

- A. All NOAA divers shall:

- 1) Be accompanied by another diver in the water and in continuous visual or physical contact; or
  - 2) Use tethered communications during the diving operations.
- B. Physical contact may include either direct physical touching or the use of a short buddy-line with quick-releases on both ends.
- C. If line tending or tethered diving modes are used, all members of the dive team, including topside tenders, must be trained and proficient in those modes.

#### 6.12.3 Responsibilities.

- A. NOAA Divemaster / Lead Diver.
- 1) Determines when procedures for diving in low visibility must be initiated.
  - 2) Ensures dive team members have the minimum required equipment to perform low-visibility diving.
  - 3) Determines which deployment protocol (Section 6.9) to use to conduct low-visibility dives.
- B. NOAA UDS: Appoints DMs/LDs to oversee and direct diving operations.

#### 6.12.4 Equipment.

- A. Equipment used for line-tending diver(s) in zero visibility shall comply with standards described here: [Procedures for Tending Standby Scuba Divers](#).
- B. Buddy lines used to maintain tactile contact between two (2) divers shall be limited to a maximum length of six (6) feet and be secured to each diver in a manner that can be quickly released if required.

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### 6.13 Blue-Water and Over-Bottom Diving

#### 6.13.1 General.

- A. Blue-water diving is defined as diving conducted in any body of water in which there is no physical bottom within diving depth ranges, depth is deeper than diver certification, depth is greater than breathing gas Maximum Operating Depth (MOD) and there is no visual reference to allow divers to detect unintended descent.
- B. Over-bottom diving has the same depth considerations as blue-water diving, but is a mode in which a clear visual reference exists which allows divers to detect unintended descent.
- C. Diving in blue-water presents a number of unique challenges including:
- 1) Increased chances of vertigo;



- 2) Exceeding depth limits;
- 3) Exceeding allowable bottom times; and
- 4) Increased breathing gas consumption due to the depth.

D. Blue-water diving must be carefully planned and executed and LODO approved.

#### 6.13.2 Training.

At a minimum, blue-water and over-bottom dive training should include procedures for:

- A. Deploying and using any specialized harnesses or rigging that may be utilized; and
- B. Deploying a lift-bag via a line reel.

#### 6.13.3 Equipment Requirements.

- A. All divers diving in blue-water or over-bottom conditions shall have a means to compensate for catastrophic loss of buoyancy (e.g., ditching weights, drysuit with BCD, or line reel with safety sausage) and a surface signaling device if un-tethered.
- B. No blue-water dives shall be made unless some direct reference with the surface is maintained.

#### 6.13.4 Emergency Procedures.

- A. Loss of positive buoyancy:
  - 1) Notify buddy diver of problem;
  - 2) Ditch weights or weight belt; or
  - 3) Deploy lift-bag using line-reel and pull self up the line.
- B. Loss of spatial orientation or vertigo. Notify buddy diver of problem and with their assistance, terminate dive, and ascend to surface.

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## 6.14 Overhead Obstruction Diving

### 6.14.1 General.

This section covers any diving environment where the diver cannot easily reach the surface in the event of equipment failure or a compromised breathing supply due to an overhead physical obstruction. (This does not include ship husbandry diving.) This section also does not cover planned penetration dives into caverns, caves or wrecks, which is addressed in section 9.

- A. A dive team shall be considered to be overhead obstruction diving if at any time during the dive they find themselves in a position where they cannot complete a direct, unobstructed vertical ascent to the surface, e.g., rock formations, ice, or manmade structures.
- B. Overhead obstruction diving shall not be conducted at depths greater than 100 feet.
- C. Dive teams shall perform a safety drill prior to commencing overhead obstruction (overhead) diving operations that includes locating and rescuing a trapped diver.
- D. Each team within the overhead obstruction zone shall utilize a continuous guideline appropriate for the environment leading to a point from which an uninterrupted vertical ascent to the surface may be made.

#### 6.14.2 Training and Proficiency Requirements.

- A. The requirement for overhead obstruction dive training will be left to the discretion of the LODO.
- B. Dive experience in lieu of training may be approved by the LODO.
- C. When diving of this type is not performed on a routine basis, 'work-up' dives shall be completed prior to the dive mission.

#### 6.14.3 Equipment Requirements.

- A. Equipment used for scuba in an overhead environment is based on the concept of redundancy.
- B. In addition to standard scuba diving equipment, the following equipment is required when diving in an overhead environment:
  - 1) A diver-carried, independent reserve breathing gas supply with separate scuba regulator and sufficient gas volume to allow the diver to safely return to the surface;
  - 2) A slate and pencil; and
  - 3) Redundant underwater lights, knives, and line reels as deemed appropriate by the LODO.

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## 6.15 Cold-Water Diving

### 6.15.1 General.

- A. Definition. Dives conducted in water temperatures colder than 50° F.
- B. Address the increased risks of equipment malfunction associated with diving in cold water during dive planning.

- C. Dives conducted in water temperatures colder than 50° F have the potential for regulator freeze-up.
- D. Specific cold-water dive training is strongly recommended.
- E. This section applies only to diving equipment in cold water, personal thermal protection is diver dependent.

#### 6.15.2 Required Procedures.

When conducting cold water dives, divers shall adhere to the following:

- A. Refill scuba cylinders only at filling stations equipped with an efficient filtering and moisture removal system.
- B. When preparing for a cold-water dive, keep scuba cylinders and regulators in a place sheltered from the cold until just before starting the dive.
- C. Open the scuba cylinder control valve for one (1) or two (2) seconds prior to attaching the regulator to make sure there are no water droplets or small ice crystals on the valve face. Also check the inlet opening of the regulator.
- D. For repetitive dives, take particular care to ensure the scuba regulator is completely dry before starting the second dive.
- E. Avoid breathing from the regulator prior to immersion.
- F. As much as possible, try to prevent water from entering the second stage during the dive.
- G. Never operate the purge button unless underwater.
- H. Use the purge button as little as possible. In any case, never hold it down for more than two (2) or three (3) consecutive seconds; pressing it for longer may cause ice to form.
- I. Breathe normally in order to minimize the cooling effect produced by the higher air velocity during overbreathing.

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## 6.16 Snorkeling/Breath-Hold Diving

### 6.16.1 Scope.

This section applies only to NOAA divers who conduct snorkeling as part of their official duties.

### 6.16.2 Limits.

Unless specifically authorized by the UDS, snorkeling/breath-hold diving shall not be conducted:

- A. At depths greater than 30 feet;
- B. In areas with potential underwater entanglements;
- C. In seas greater than 3-5 feet; or
- D. In current greater than 0.5 knots.

#### 6.16.3 Requirements.

- A. Unless specifically authorized by the UDS, each snorkeler/breath-hold diver shall be equipped with:
  - 1) Mask;
  - 2) Fins;
  - 3) Snorkel;
  - 4) Flotation vest capable of providing positive buoyancy; and
  - 5) Cutting device.
- B. The UDS may also require a buddy snorkeler/breath-hold diver.

6.16.4 For non-NOAA divers who participate in snorkeling/breath-holding operations, contact your local Safety Officer for guidance on establishing and developing a snorkeling/breath-holding safety program specific to your needs.

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## 6.17 Diving Near Unexploded Ordnance

### 6.17.1 General.

Interacting with unexploded ordnance is outside the scope of the NDP. NOAA divers shall not intentionally touch, move, bury, or in any other fashion interact with unexploded ordnance. This section only addresses the safety buffer zones NOAA divers shall maintain in the vicinity of unexploded ordnance and the reporting of the discovery of unexploded ordnance.

### 6.17.2 Safety Buffer Zones.

- A. Divers shall maintain a minimum distance of at least 10 feet from unexploded ordnance with non-explosive projectiles (i.e., pistol, rifle, or machine gun ammunition); and

- B. Divers shall maintain a minimum distance of at least 100 feet from all known unexploded ordnance with explosive projectiles or warheads (i.e., bombs, artillery shells, rockets, missiles, mines, or grenades).
- 6.17.3 NDCSB approved Specialized Task Endorsement (STE) for diving near historic munitions (Historic is defined as over 50 years old).
- A. NOAA divers occasionally have a mission need to access archaeological sites with historic munitions. In these cases, NOAA divers must follow the NDCSB approved STE ([link to STE library](#)) which allows:
    - 1) STE authorized divers to approach non-explosive projectiles closer than 10 feet and place plastic photo scale references near the material.
    - 2) Maintain a 10 foot buffer from all UXO with explosive projectiles or warheads.

#### 6.17.4 Reporting.

When found during a dive, divers should signal their dive buddies to the presence of unexploded ordnance and immediately proceed outside the appropriate buffer zone. Once on the surface, divers should notify the DM or LD of the location and type of unexploded ordnance present at the dive site.

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### 6.18 Contaminated Water Diving

Diving in water known or suspected to be contaminated with hazardous biological, chemical, or radioactive pollutants requires specialized training, equipment, and diving protocols and is outside the scope of the NDP. Until such time that these elements are established, NOAA divers are prohibited from diving in contaminated water. Qualified contract divers should be hired to dive in these conditions.

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### 6.19 Surface Supplied Diving

Diving in surface supplied mode is outside the scope of the NDP. Until such time that these elements are established, NOAA divers are prohibited from diving in surface supplied mode. Qualified contract divers should be hired to dive in these conditions.

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### 6.20 Decompression Diving

- A. OSHA-subject dives conducted beyond the US Navy No-Decompression Limits shall be conducted in accordance with standards outlined in 29 CFR 1910, Subpart T.

- B. Dives falling under OSHA's scientific diving exemption conducted beyond the US Navy No-Decompression Limits shall be conducted in accordance with standards outlined in Sections 7 and 8 of this Manual.
- 

## 6.21 Specialized Tools

### 6.21.1 General.

- A. The tools described in the following section must be designed and intended for underwater use.
- B. Use of these tools requires a STE.

### 6.21.2 Hand-Held Pneumatic and Hydraulic Power Tools.

Hand-held power tools and equipment shall be:

- A. De-energized before being placed into or retrieved from the water; and
- B. Only supplied with power from the dive location when specifically requested by the diver.

### 6.21.3 Spear Guns and Powerheads.

- A. The use of spear guns, power heads or similar devices must be pre-approved by the LODO.

### 6.21.4 Welding and Burning Equipment.

- A. A current supply switch to interrupt the current flow to the welding or burning electrode shall be:
  - 1) Tended by a dive team member in voice communication with the diver performing the welding or burning; and
  - 2) Kept in the open (off) position except when the diver is welding or burning.
- B. The welding machine frame shall be grounded.
- C. Welding and burning cables, electrode holders, and connections shall be capable of carrying the maximum current required by the work, and shall be properly insulated.
- D. Insulated gloves shall be provided to divers performing welding and burning operations.
- E. Prior to welding or burning on closed compartments, structures or pipes, which contain a flammable vapor or in which a flammable vapor may be generated by the work, they shall be vented, flooded, or purged with a mixture of gases which will not support combustion.

## 6.22 Hyperbaric Chamber Operations

### 6.22.1 General.

- A. All hyperbaric chambers used by NOAA personnel shall meet established operational policies and training requirements outlined in 29 CFR 1910, Subpart T.
- B. A dual-lock, multi-place hyperbaric chamber shall be located within five (5) minutes of the dive location for all OSHA-compliant dives which include any of the following:
  - 1) Require decompression;
  - 2) Are deeper than 100 fsw; or
  - 3) Use surface supplied mixed-gas.

### 6.22.2 Personnel Levels.

The minimum personnel requirements and positions for conducting chamber operations are as follows:

Supervisor/Operator	1
Inside Tender	1
Systems Operator	1
Diving Medical Officer	1
<b>TOTAL</b>	<b>4</b>

### 6.22.3 Personnel Responsibilities and Qualifications.

#### A. Chamber Supervisor.

- 1) Responsibilities:
  - a. Assigns and supervises chamber personnel;
  - b. Supervises and directs all chamber and chamber-related operations;
  - c. Ensures operations are conducted and documented properly in accordance with established standards; and
  - d. Coordinates treatment procedures with medical personnel and vessel operator.
- 2) Qualifications:

- a. Demonstrated proficiency in the supervision and operation of hyperbaric chambers during operations and treatment procedures;
- b. Demonstrated knowledge in diving accident management;
- c. Must be a current NOAA-Certified Diver Medical Technician (DMT) or have equivalent knowledge and experience as determined by the NDPM; and
- d. Must be approved by the NDPM.

3) Authority Level:

- a. The designated Chamber Supervisor is responsible for the operation of the hyperbaric chamber and has the final decision making authority for all aspects related to operation of the chamber.
- b. Emergency conditions may warrant actions contrary to the dictates of this document. The Chamber Supervisor is authorized to deviate as necessary to prevent or minimize harm to human life.
- c. Any deviation from these standards and procedures must be reported to the NDPM within 24 hours of the occurrence.

B. Chamber Operator.

1) Responsibilities:

- a. Controls and maintains all gases entering and exiting the chamber;
- b. Pressurizes and de-pressurizes chamber;
- c. Monitors and regulates inside chamber atmosphere; and
- d. Communicates with personnel inside the chamber.

2) Qualifications:

- a. Demonstrated knowledge of the hyperbaric chamber and related systems;
- b. Demonstrated proficiency in the operation of the hyperbaric chamber and related systems; and
- c. Must be approved by the Chamber Supervisor.

C. Inside Tender.

1) Responsibilities:



- a. Provides normal and emergency assistance as required inside and outside the hyperbaric chamber;
- b. Communicates with outside personnel;
- c. Administers medical aid and therapeutic breathing gases as directed by the Chamber supervisor; and
- d. Monitors the condition of personnel in the chamber.

2) Qualifications:

- a. Demonstrated knowledge in diving accident management and emergency medical care;
- b. Must be a current NOAA-certified DMT or equivalent; and
- c. Must be approved by the Chamber Supervisor.

D. Systems Operator.

1) Responsibilities:

- a. Maintains, monitors, and controls compressed gas supplies to the chamber; and
- b. Keeps Chamber Supervisor and/or Operator informed of treatment and supply gas status.

2) Qualifications:

- a. Demonstrated knowledge of the chamber and support systems;
- b. Demonstrated proficiency in the operation of the chamber support systems; and
- c. Must be approved by the Chamber Supervisor.

E. Time/Log Keeper.

1) Responsibilities:

- a. Records data during chamber operations (e.g., depths, times, significant treatments, responses, events, communications, chamber atmosphere); and
- b. Keeps Chamber Supervisor and/or Operator informed of depth, time, and breathing periods.

2) Qualifications:

- a. Familiarity with chamber treatment tables, dive log, and timekeeping devices;
  - b. Ability to follow instructions and record information precisely and neatly; and
  - c. Must be approved by the Chamber Supervisor.
- F. Diving Medical Officer.
- 1) Responsibilities:
    - a. Must be a Licensed health care provider
    - b. Prescribes and administers as necessary, hyperbaric chamber treatment procedures; and
    - c. Prescribes and administers appropriate medications and advanced life saving techniques in a hyperbaric environment.
  - 2) Qualifications:
    - a. Successful completion of a NOAA-approved DMO course;
    - b. Must be able to perform duties in a hyperbaric environment;
    - c. Must maintain medical clearance to dive in accordance with the NOAA Medical Standards and Procedures Manual; and
    - d. Must be approved by the Chair, NDMRB.

#### 6.22.4 Operating Requirements.

- A. Pre-dive.
- 1) Prior to operation of the chamber, a NDP chamber pre-dive checklist shall be completed.
  - 2) Prior to commencement of recompression treatment, the Chamber Supervisor shall consult with a NOAA-approved DMO.
  - 3) If unable to reach the DMO, the Chamber Supervisor or designee shall contact the NDPM at the first appropriate opportunity to inform him of the situation and the planned course of action.
- B. During Chamber Treatment. Should recompression treatment be required, the Chamber Supervisor shall regularly consult with a NOAA-approved DMO at appropriate times throughout the treatment.
- C. Post-dive.

- 1) Upon completion of chamber operations, the patient should be seen by a NOAA-approved DMO.
- 2) The chamber team shall be available at the dive location for a minimum of 1 hour after the dive to operate the chamber.
- 3) Patient shall remain near the hyperbaric chamber for a minimum of 1 hour post-dive.
- 4) A NDP chamber post-dive checklist shall be completed at the conclusion of chamber operations.
- 5) The hyperbaric chamber shall be maintained in a state of readiness prior to, during and following all dives for a minimum of 1 hour.

## Section 7: OPEN CIRCUIT DECOMPRESSION AND MIXED GAS DIVING

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### 7.1 General

Decompression and mixed gas diving is not allowed on OSHA-subject dives conducted by NOAA. This standard specifies minimum requirements for conducting scientific decompression diving operations using open circuit scuba. It applies to all personnel engaged in diving activities under the auspices of the NOAA Diving Program. Exceptions to this standard may be approved by the NDCSB if such exceptions are deemed as safe as, or safer, than those listed in this document. This section contains three sub-categories of open circuit diving: Tech Lite, Air/Nitrox Decompression, and Mixed Gas Decompression.

Decompression diving is defined as any diving during which the diver cannot perform a direct return to the surface without performing a mandatory stop to allow the release of inert gas from the diver's body. Tech Lite is decompression diving under stricter depth and decompression limits. Air/Nitrox decompression diving is similar to Tech Lite with longer allowable decompression obligations. Mixed gas diving is defined as dives conducted while breathing mixtures of gas containing proportions greater than one (1) percent by volume of any inert gas other than nitrogen.

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### 7.2 Qualifications

#### 7.2.1 Prerequisites

- A. Nitrox certification and authorization.
- B. Minimum of 100 logged dives, with experience near the depth range where decompression dives will be conducted.
- C. Demonstration of the ability to safely plan and conduct dives deeper than 100 feet.

#### 7.2.2 Certification, Authorization, and Approval.

- A. Certifications by a NOAA-approved certification agency (e.g., IANTD, SDI-TDI, NAUI) for Advanced Nitrox and Decompression Procedures to 150 fsw.
- B. Mixed Gas divers must also have certification by a NOAA-approved certification agency for mixed gas diving appropriate for the level authorized (i.e. normoxic or hypoxic trimix).
- C. Divers must be trained and authorized by the NDP for the proposed equipment, exposure, and gas mixtures.
- D. Divers must be currently authorized NOAA divers or have a valid LOR from a current reciprocity partner.

- E. The NDCSB shall review each application package to begin on-duty decompression training and make a determination concerning the diver's eligibility and aptitude for this diving modality.
- F. The NDCSB will review each application for decompression diving, and may include any further requirements deemed necessary beyond those listed here on a case-by-case basis.

### 7.2.3 Operational Limits

#### A. General

- 1) The maximum depth for decompression diving using open circuit scuba equipment shall be such that the PN<sub>2</sub> does not exceed 4.00 ATA
- 2) The PO<sub>2</sub> of any gas mixture breathed during a dive shall not exceed 1.40 ATA, except during the decompression phase when a PO<sub>2</sub> of 1.60 is allowed
- 3) Combined bottom and decompression times will not exceed the maximum allowable exposure time, as measured by Oxygen Toxicity Units (OTUs), for a given partial pressure of oxygen as listed in the latest edition of the NOAA Diving Manual

#### B. Tech Lite:

- 1) Maximum depth shall not exceed 144 fsw or 150 ffw.
- 2) Maximum decompression obligation shall not exceed fifteen (15) minutes.
- 3) All operations shall be conducted within four (4) hours of a hyperbaric chamber, unless there is a Hyperlite on site.

#### C. Air/Nitrox Decompression:

- 1) The maximum depth for required decompression using air as the bottom gas is 134 fsw or 138 ffw.
- 2) The maximum allowable depth for nitrox mixes is 144 fsw or 150 ffw
- 3) A fully staffed and operational Class A or Class B hyperbaric chamber shall be accessible within four (4) hours of the dive site.

#### D. Mixed Gas Decompression:

- 1) Maximum depth shall not exceed 330fsw.
- 2) A fully staffed and operational Class A or B hyperbaric chamber shall be accessible within two (2) hours of the dive site.

- E. Any repetitive decompression dives may be approved by the TDS, if appropriate and all other standards are followed.

#### 7.2.4 Depth Authorizations.

##### A. General.

- 1) Minimum of 100 logged dives, with experience in the depth range where decompression dives will be conducted.
- 2) Decompression depth progressions require prior approval from the NDCSB.
- 3) The diver must also demonstrate knowledge of the special problems of deep diving and of special safety requirements.
- 4) A diver may be authorized to the next depth level after successfully completing the requirements for that level. A diver may exceed his/her depth authorization when accompanied and supervised by a dive buddy holding a depth authorization greater or equal to the intended depth, provided it is within the scope of their certification.

##### B. Dives required for progression to next depth authorization:

- 1) Six (6) operational dives at the previous depth authorization level;
- 2) Three (3) training dives to the new depth level without any scientific or other non-life support gear and
- 3) Three (3) training dives with ancillary gear but with no data collection or scientific activities.

##### C. Depth Authorizations for OC Deco and Mixed Gas Diving:

- 1) 150 fsw
- 2) 190 fsw
- 3) 250 fsw
- 4) 300 fsw
- 5) 330 fsw

#### 7.2.5 Proficiency Requirements for all OC and Decompression and Mixed Gas Diving.

- A. To participate in any decompression diving operations, divers must have performed a minimum of twelve (12) dives in the last six (6) months.

#### 7.2.6 Mode Specific Proficiency Requirements

- A. Tech Lite: To participate in Tech Lite diving operations, an authorized diver shall make at least six (6) dives over the course of twelve (12) months near the planned operational depth, practicing open-circuit decompression protocols.

##### B. Air/Nitrox & Mixed Gas:

- 1) Divers must also have completed one (1) dive within the previous 30-day period wearing the minimum equipment configuration to be used on the planned decompression dive, practicing open-circuit decompression protocols.

- 8) 2) Task-free work-up dive(s) may be completed at the beginning of a project to meet the proficiency requirements.

#### 7.2.7 Proficiency Lapse

- A. If a period of more than six (6) months has elapsed since the last decompression dive to the authorized depth, a series of progressively deeper workup dives shall be completed to regain depth authorization proficiency prior to conducting operational dives.
  - B. The minimum requirement shall be one (1) task-free work-up dive to each depth authorization level until the desired depth level is reached.
  - C. The NDCSB may exceed the minimum work-up dive requirements based upon the complexities of planned operational dives.
- 

### 7.3 Training Requirements

#### 7.3.1 General

Training must be appropriate for the conditions and each of the three modes of open circuit decompression diving in which dive operations are to be conducted. Minimum Training must include the following:

#### 7.3.2 Classroom Training

- A. Air/Nitrox Decompression (including Tech Lite)
  - 9) A minimum of 6 hours of classroom training to ensure theoretical knowledge shall include, but not be limited to:
    - 1) Review of topics and issues previously outlined in Nitrox and staged decompression diving training as pertinent to the planned operations;
    - 2) Physics and physiology of decompression;
    - 3) Equipment configurations and modifications;
    - 4) Decompression planning and procedures;
    - 5) Decompression methods;
    - 6) Gas management planning;
    - 7) Omitted decompression;
    - 8) Mission planning and logistics;
    - 9) Emergency procedures;

- 10) Gas Analysis;
- 11) Equivalent Narcotic Depth (END) determination;
- 12) Methods of gas handling and cylinder filling; and
- 13) Oxygen exposure management.

#### B. Mixed Gas

- 1) Review of topics listed above in Air/Nitrox Decompression Diving;
- 2) Mixed gas physics and physiology;
- 3) Mixed gas decompression planning;
- 4) The use of helium or other inert gases, and the use of multiple decompression gases;
- 5) Thermal considerations; and
- 6) Mixed gas production/mixing methods.

#### 7.3.3 Practical Training

Shall include, but not be limited to:

- A. Confined water session(s) in which divers demonstrate proficiency in required skills and techniques for proposed diving operations, including gas consumption rates, emergency procedures, equipment familiarization, and buoyancy.
- B. A minimum of six (6) open water training dives simulating/requiring decompression must be conducted, emphasizing planning and execution of required decompression dives, and including practice of emergency procedures.
- C. At least one (1) initial dive shall be in 130 fsw or less to practice equipment handling and emergency procedures.
- D. No training dives requiring decompression shall be conducted until the diver has demonstrated acceptable skills under simulated conditions.
- E. The following are the minimum skills the diver must demonstrate proficiently during dives simulating and requiring decompression:
  - 1) Buoyancy control;
  - 2) Proper ascent rate;
  - 3) Proper depth control;
  - 4) Equipment manipulation;
  - 5) Stage/decompression cylinder use;



- 6) Buddy skills;
  - 7) Gas management;
  - 8) Time management;
  - 9) Task loading; and
  - 10) Emergency skills.
- F. Divers must demonstrate to proficiency in planning and executing required decompression dives appropriate to the conditions in which diving operations are to be conducted.
- G. Tech Lite: Dives are limited to a maximum of 145 fsw.
- H. Subsequent training dives for Air/Nitrox & Mixed Gas will gradually increase in depth following the depth progression protocols described in Section 7.2.6 which requires six (6) dives at each authorized depth prior to progressing to the next authorized depth. A majority of the training dives shall occur between 130 fsw and the depth authorization level being sought.

## 7.4 Equipment

### 7.4.1 Regulators

- A. Regulators will be configured for the planned operations and equipment used;
- B. The primary regulator shall be configured with a hose of adequate length to facilitate effective emergency gas sharing in the intended environment.
- C. Tech Lite: If gas management plan allows for the use of a single primary cylinder, a single first stage and dual second stage regulator set is acceptable.
- D. Regulators used with gas supplies containing an oxygen fraction with an MOD shallower than the operating depth of the dive shall be secured in a way (e.g., pouch or bungee) that reduces the possibility of inadvertent use at depths that would result in a hyperoxic exposure.

### 7.4.2 Buoyancy Compensator Device

- A. Tech Lite: single bladder with wetsuit or drysuit;
- B. Air/Nitrox & Mixed Gas: dual bladder with a wetsuit, single bladder with a drysuit. When a dual bladder is used:
- C. Each bladder must be capable of achieving positive buoyancy at all depths of the dive;
  1. Each bladder must have a separate inflator hose;

2. Each bladder must have an over pressurization relief valve;
3. Primary bladder must have top and bottom dump valves; and
4. Secondary bladder must have top dump valve.

#### 7.4.3 Scuba Cylinders and Valves

- A. Divers must carry adequate breathing gas volumes for the planned dive. See Section 3.4.3
- B. Scuba cylinders used on dives >130 fsw should be equipped with DIN valves.
- C. Dual cylinders shall be:
  1. Connected with an isolation manifold (unless in sidemount configuration), which allows the regulators on either cylinder to access the entire gas supply and the supplies of each cylinder to be separated in case of a failure in the other cylinder; and
  2. All valves must be accessible by the diver without removing the scuba unit.
- D. If using a single cylinder as the primary gas supply, an auxiliary gas supply is required. This must have adequate volume to reach the depth of the next gas switch or the surface, with a 500 psi reserve, whichever matches the requirements of the dive.
- E. Scuba cylinders used for decompression should be color-coded and shall be marked in accordance with the following standards:

Gas	Cylinder Color	Marking
Air	Any color	None
Oxygen	White or Green	"Oxygen" stenciled in 3-inch high color-contrasting letters
Nitrox	Yellow  Other	4-inch green band with "NITROX" or "Enriched Air" stenciled in 2-inch high letters  Non-yellow cylinders have an additional 1-inch yellow band above and below the green label
Trimix	Any color	'Custom Gas' or 'Trimix' stickers Identifying the contents
All cylinders shall be labeled with the Maximum Operating Depth, and if appropriate the Minimum Operating Depth.		

#### 7.4.4 Cylinder Pressure Gauges

- A. Each gas supply shall have its own dedicated submersible pressure gauge and must be readable by the diver during the dive without removing any gear.
- B. The gauge may be analog or integrated into a dive computer, but it must have a HP hose connecting it directly to the first stage of the regulator.
- C. Button gauges are not allowed.

#### 7.4.5 Dive Computers

- A. All Dive Computer requirements in Sec 5.4.6 must be followed. In addition, the following requirements must be met:
- B. Each diver shall have redundant means of tracking dive time and depth through two (2) NOAA-approved dive computers;
- C. Dive computers used for decompression diving must use the approved algorithms: Buhlmann 16 or the ZH-L16 GF algorithm. If another algorithm is preferred, NDCSB must approve on a case by case basis;
- D. All dive computers and/or computer-based decompression schedule generating software programs shall be set to a conservative gradient between 50/70 and 50/85;
- E. All dive computers and/or computer-based decompression schedule generating software programs must be approved by the NDCSB; and
- F. Hardcopies of the decompression schedule for the planned dive with contingencies for next longer/deeper dives and loss of gas must be taken on the dive.

#### 7.4.6 Signaling Devices

- A. Each diver shall carry the following surface signaling devices:
  - 1) One (1) daytime visual device such as a signal mirror, SMB, etc.; and
  - 2) One (1) audible device such as a whistle, power horn, etc.
- B. If dives are conducted within two (2) hours of sunset, each diver shall also carry a flashlight and/or strobe light.

- C. If diving in an area in which separation from surface support vessels is more likely or would present a more significant risk than typical conditions (e.g., poor surface visibility, high current, far from shore), each buddy team shall also carry a DSC enabled handheld VHF marine radio, a Personal Locator Beacon (PLB) or a Personal Emergency Position-Indicating Radio Beacon (PEPIRB).

#### 7.4.7 Other Required Equipment

- A. Two (2) SMBs or lift bags (one must be  $\geq 50$  lbs. buoyancy);
- B. Two (2) line reels that have sufficient line length to reach the surface from the maximum depth anticipated during a dive;
- C. Two (2) cutting devices, one must be either shears or a seatbelt cutter;
- D. One spare mask;
- E. Slate and pencil;
- F. Compass; and
- G. Diver location devices (e.g. VHF/EPIRB) adequate for planned operation and environment

#### 7.4.8 Support Boat(s)

- A. A Support Boat should be used for dives with the following conditions:
  - 1) Conducted beyond a comfortable swimming distance from shore;
  - 2) In areas of strong current or low visibility;
  - 3) Requiring difficult water entry or exit (e.g., ladders, steep shores, heavy surf); or
  - 4) Dive operations conducted from ships.
- B. If required, a Support Boat must:
  - 1) Be crewed by a qualified operator and comply with all NOAA Small Boat Program requirements;
  - 2) Remain in the immediate vicinity of the dive location and ready to render assistance as needed;
  - 3) Provide a means of extracting an unconscious victim from the water during all phases of decompression diving operations.
  - 4) Carry onboard a minimum of one (1) spare cylinder of each type of decompression gas mixture used on the dive.
- C. A secondary Support Boat, referred to as a Chase Boat, may be required in cases where dive teams have a greater likelihood of separation (e.g., high current, low visibility, long decompression, large dive teams).
  - 1)
  - 2) The NDCSSB, UDS, DM or LD may require chase boats in certain complex dive missions.

- 3) Chase boats shall have the same support and medical response equipment on board as primary support boats.
- 4) A chase boat must be able to fit half of the deployed dive team on board.

#### 7.4.9 Hyperbaric Chamber(s)

- A. A plan to transport an injured diver to a hyperbaric chamber within the required time frame shall be prepared and disseminated to all members of the dive team via the DEAP and discussed during the pre-dive briefing.
- B. Hyperbaric chambers (excluding the Hyperlite) shall be multi-place, multi-lock, and certified by ASME, ABS, or equivalent authority for human occupancy.
- C. Distance/Accessibility to chambers is defined in Section 7.2.3 B above.

### 7.5 Breathing Gases and Gas Management

#### 7.5.1 General

- A. A maximum  $PO_2$  of 1.40 ATA will be utilized during the descent and bottom phases of the dive and a maximum  $PO_2$  of 1.60 ATA may be used during the decompression phase of the dive evolution.
- B. The maximum depth for decompression diving using open circuit scuba equipment shall be such that the  $PN_2$  does not exceed 4.00 ATA.
- C. All gases used for diving must be of breathing quality (e.g., Medical, Technical or Aviator Grade).
- D. All decompression diving shall follow the 'rule of thirds' for gas management at a minimum.
- E. For each phase of the dive evolution, divers shall carry appropriately sized cylinders based on the dive plan and the divers' SAC and RMV rates.

#### 7.5.2 Gas Analysis and Labeling

- A. All mixed gases must be analyzed by the diver using the mixture.
- B. Gases must test within acceptable parameters (+/- 1%) as specified in the dive tables or computers used.
- C. Gas analysis must be accomplished by analyzing the fractions of each individual gas component in the mixture, less one. Thus, if Heliox or Nitrox is used, this requirement is met by measuring the  $FO_2$ . If Trimix ( $O_2$ , He,  $N_2$ ) is used, at least two (2) components must be analyzed, typically oxygen and helium.

D. It is the responsibility of each diver to confirm and verify in writing the contents of his/her scuba cylinder(s) prior to commencing diving and label the cylinder(s) with the following:

- 1) Oxygen percentage ( $FO_2$ );
- 2) Maximum Operating Depth (MOD),
- 3) Cylinder pressure;
- 4) Date; and
- 5) Initials of diver.

Mixed Gas dives must also include:

- 7) Mixed Gas: Helium percentage ( $FH_2$ ); and
- 8) Mixed Gas: Minimum Operating Depth (MinOD) – if applicable;

### 7.5.3 Oxygen

- A. Breathing gases used while performing in-water decompression shall contain the same or greater oxygen content as that used during the bottom phase of the dive. Interruption of high oxygen partial pressure decompression may be conducted with appropriate back gas mixtures or air, as approved in the dive plan.
- B. All gas systems, components, and storage containers used with oxygen mixtures above 40 percent by volume, must be formally cleaned in accordance with the most recent edition of the NOAA Diving Manual and this Manual.
- C. Central Nervous System (CNS) Oxygen Toxicity. Hyperoxia can occur at a  $PO_2 > 1.40$  ATA. Dive planning should ensure  $PO_2$  during all phases of the dive, except decompression, remains significantly below 1.60 ATA.
- D. Combined bottom and decompression times will not exceed the maximum allowable exposure time, as measured by Oxygen Toxicity Units (OTUs), for a given partial pressure of oxygen as listed in the latest edition of the NOAA Diving Manual.

### 7.5.4 Air

Compressed air used with oxygen concentrations greater than 40 percent or when used in the preparation of Nitrox breathing mixtures with greater than 40 percent oxygen as the enriching agent shall meet or exceed oxygen compatible air standards outlined in Section 6.6.5 F of this manual.

### 7.5.5 Helium and Nitrogen

- A. The maximum depth for decompression diving using open circuit scuba equipment shall be such that the  $PN_2$  does not exceed 4.00 ATA.
- B. The quality of helium used to produce breathing mixtures shall be no less than Prepurified Grade 4.5 (99.997% He) as well as meet the other requirements found in Military Specification MIL-PRF-27407B.
- C. If pure nitrogen is used to produce breathing mixtures, the quality shall be no less than Class I Oil Free, Grade B (99.50% N<sub>2</sub>) as well as meet the other requirements found in Federal Specification A-A-59155.

## 7.6 Personnel Requirements

### 7.6.1 Minimum Diving Positions and Capabilities

#### A. Definitions

- 1) Bottom Diver: Primary operational diver conducting science on the bottom team.
- 2) Safety Diver: Accompanies bottom divers during the entire dive
- 3) Standby Diver: Equipped to reach bottom divers during any phase of the dive. Remains at surface until needed.
- 4) Support Diver: Equipped to reach the first decompression stop of the bottom divers. Remains at surface until needed.

#### B. Bottom divers.

- 1) A minimum of two (2) divers, functioning as a buddy team, are required for all decompression scuba diving operations.
- 2) Divers shall remain in sufficient proximity to each other at all times during the dive in order to render immediate assistance to each other if necessary.

#### C. Standby, Safety and Support Divers

- 1) A minimum of one (1) on-bottom safety diver and two (2) support divers, capable of reaching the deepest decompression stop of the bottom divers and functioning as a buddy team, OR two (2) standby divers, capable of reaching the maximum depth of the bottom divers and functioning as a buddy team, will be on site for all decompression diving operations (When diving under 'tech-lite' procedures support divers are recommended but may be waived by the TDS).
- 2) On-bottom safety diver(s) must have no responsibilities other than to monitor and assist all other bottom divers in an emergency.

- 3) Standby divers shall be similarly equipped and configured as the bottom divers and ready to enter the water within two (2) minutes of notification.
- 4) During the ascent / decompression phase of the dive and at the discretion of the TDS, the standby/ support divers may enter the water and to assist the bottom divers.
- 5) All support divers will have the capacity and resources on-site to deliver decompression gases to the bottom divers.
- 6) All standby divers will have the capacity and resources on-site to deliver bottom and decompression gases to the bottom divers.

#### 7.6.2 Minimum Topside Support

##### A. Technical Diving Supervisor (TDS):

- 1) Must meet the qualifications described in Section 2.9 of this Manual, or be approved by the NDCSB;
- 2) Must remain at the surface during diving operations; and

##### B. Vessel Operator:

- 1) Must meet all NOAA Small Boat Program requirements.
- 2) Must remain on the vessel during diving operations; and
- 3) Must concur with the TDS on the commencement of diving operations and can terminate diving due to weather, vessel-related operational problems, or any other factors that may jeopardize the safety of the operation.

### 7.7 Operational Requirements

#### 7.7.1 General

##### A. Tech Lite:

- 1) All dive units approved for 'Tech Lite' decompression diving will undergo a one (1) year trial period to conduct 'Tech Lite' operations after which the NDCSB will reevaluate the unit's performance. At that time, the NDCSB will either approve the unit to conduct 'Tech Lite' operations without NDCSB pre-approval of dive plans, or the unit will have to continue their trial period until the NDCSB is satisfied with the unit's performance.

##### B. Air & Nitrox/ Mixed Gas:



- 1) Diving projects involving the use of gas mixtures other than air or Nitrox, depths greater than 144 fsw or 150 ffw, or decompression obligations exceeding 15 minutes must be approved by the NDCSB before diving activities begin.
- 2) In order to evaluate the proposed diving activities, a detailed dive plan using NF 57-03-28 (Decompression Diving Request) and DEAP must be submitted to the NDCSB for review a minimum of 30 days prior to the commencement of diving operations.

#### 7.7.2 Submission and Review Requirements

The dive plan shall include, but not be limited to, the following elements:

- A. Overview of the operations;
- B. Goals, objectives, and tasks to be accomplished;
- C. Description and location of dive site;
- D. Names, affiliations, roles/responsibilities, and qualifications of all participants;
- E. Schedule of operations;
- F. Dive schedules indicating breathing gases, volumes and decompression schedules for maximum planned and contingency depths and times;
- G. Logistical arrangements and considerations;
- H. Normal and emergency diving procedures;
- I. Diving Emergency Assistance Plan (Stand alone form 57-03-21); and
- J. Any supplemental/supporting documents, permits, and forms.

#### 7.7.3 Dive Procedures

- A. Pre-Dive.
  - 1) Diving condition limits: The Technical Diving Supervisor (TDS) and the vessel operator shall assess conditions including but not limited to current speed and direction, sea state, vessel traffic and weather predictions to decide whether or not diving can be safely initiated.
  - 2) Complete a pre-dive brief and document on [NOAA Form 57-03-30 Dive Mission Execution](#).
  - 3) Diver communications.

- a. Bottom divers must be able to signal topside personnel at all times during the dive.
  - b. Signaling protocols must be established that allow the differentiation between routine and emergency situations.
- B. Deployment.
- 1) The procedures involved with descending to the bottom (e.g., use of down-line versus “free dropping”) will be determined by the TDS.
  - 2) If the members of the bottom team are separated during descent and cannot locate each other within five (5) minutes of reaching the bottom, all divers will terminate the dive and begin ascent/decompression.
  - 3) No additional dives may be started until all members of the previous diving team have completed their in-water decompression and have been on the surface for a minimum of 30 minutes.
- C. Ascent.
- 1) The procedures involved with ascending to the surface (e.g., use of ascent-line versus “drift decompression”) will be determined by the TDS.
  - 2) Cylinders containing gases used during deeper phases of the dive may be removed during ascent and taken to the surface by support divers.
  - 3) Divers decompressing on high-oxygen concentration mixtures shall closely monitor one another for signs of CNS oxygen toxicity (i.e. when divers are breathing gases greater >1.40 ATA).
  - 4) Mixed Gas: Divers should plan gas switches which minimize DCS concerns due to Isobaric Counter Diffusion (ICD) by following the Rule of Fifths which limits the increase in nitrogen percentage in a decompression gas mixture to no more than one fifth the decrease in helium percentage from the previous gas.

#### 7.7.4 Contingency Protocols

- A. The following contingency protocols shall be established, practiced, and reviewed by all participants prior to commencement of diving. This is a general listing and does not include all possible scenarios or environmental conditions:
- 1) Vessel response to emergencies. If an emergency situation results in separate ascents, the primary support vessel will stay with the team having the problem. The chase boat will follow the remaining team members.

- 2) Out of gas – Bottom mix. Gas share with dive buddy(ies) and abort the dive, observe decompression schedule during ascent. Communicate problem with surface and/or support divers.
- 3) Out of gas - Decompression mix (nitrox/trimix/oxygen) cylinder. Switch to appropriate breathing gas based on contingency plan. Divers shall communicate any problem to the surface and/or support divers who shall retrieve and deliver additional spare stage mix cylinder(s) to divers as needed.
- 4) Gas failure – Source of problem unknown. Bottom divers with an unknown gas failure shall reach back and close the isolation valve then determine the cause of failure. The diver shall notify their dive buddy(ies) of the problem, abort the dive, and follow decompression schedule during ascent.
- 5) Aborted dive procedures. If the dive is aborted for any reason, follow the decompression schedule on the diver's computer and reassess impacts to subsequent dives with the guidance of the TDS. Deploy a SMB to notify topside if it will not delay time to surface.
- 6) Skipped Stop. Refer to table in Section 8.9.6 C. If during ascent a diver discovers a missed required decompression stop and remains asymptomatic, the diver must descend to the deepest stop omitted and resume decompression. The diver shall increase the stop times for the 40 fsw and all shallower stops by 1.5. Once on the surface, monitor closely for DCS symptoms and consult with DMO for guidance.
- 7) Omitted Decompression. Refer to table in Section 8.9.6 C. If a diver reaches the surface and remains there for more than one (1) minute having omitted decompression, place the diver on surface O<sub>2</sub> (demand preferred) and begin transporting to nearest appropriate hyperbaric facility for further evaluation. Monitor for symptoms and notify the DMO for guidance.
- 8) Central Nervous System (CNS) Oxygen Toxicity. In the event of any CONVENTID symptoms, an asymptomatic diver (support diver or diver without a decompression obligation) shall immediately gain control of the symptomatic diver and begin ascent. Maintain diver's airway and prevent loss of regulator.
- 9) Divers separated during deployment or bottom phase. If divers are separated during decent they should return to the surface after one (1) minute. If divers find themselves separated from their buddy(ies) on the bottom, the divers should abort the dive after searching for team members for no more than five (5) minutes if gas reserves allow and return to the surface. Deploy a SMB to notify topside if it will not delay time to surface.

- 10) Dive team swept off dive site or unable to locate ascent-line. Divers stay together; attempt to regain position on dive site for no more than five (5) minutes if gas reserves allow. If unable to return to the dive site, abort the dive, deploy a SMB, and safely ascend as a team. Exercise appropriate decompression procedures.
- 11) Diver entanglement on bottom. Evaluate the nature of entanglement and attempt to free self or signal buddy(ies) for assistance. If using the standby diver mode and situation cannot be resolved, deploy SMB to alert topside to deploy standby divers for assistance.
- 12) Dive team ascends to surface and support vessel is gone. Divers stay together upon reaching surface. Use appropriate signaling device to signal support boat. Consider ditching weights in prolonged drifting situations.
- 13) Change in environmental conditions during the dive.
  - a. Current Strength - If there is a significant increase in current strength during a dive and using a fixed down-line, divers should consider switching to drift decompression and notifying support vessel(s) via a note on a SMB.
  - b. Surface Waves or Swell Height - In instances where there is significant movement of the ascent line, divers should employ one or more lengths of "Jon line" to dampen the motion.
  - c. Visibility - If decreased visibility compromises appropriate buddy contact or the ability to complete the task, the divers should terminate the dive.
  - d. Water Temperature - Divers should wear adequate thermal protection for the coldest portion of a dive. If water temperature decreases significantly, the dive should be terminated.

#### 7.7.5 Post Dive Review

- A. Following the actual occurrence of any of the above scenarios, a post-dive "stand down" will be initiated to thoroughly review the event. After review, mitigation protocols will be established to prevent a reoccurrence. The "stand down" may be lifted by the TDS once they are satisfied with the mitigation steps.
- B. If deemed a reportable incident, diving shall be suspended. The incident will be reported in accordance with NOAA Diving Program and SECO requirements listed in Section 12.3.

## Section 8: REBREATHERS

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### 8.1 Closed Circuit Rebreather Diving and Decompression

#### 8.1.1 General

- A. Semi-closed circuit and closed-circuit rebreathers cannot be used in NOAA for OSHA-subject dives. This section defines specific requirements for the use of rebreathers, including: training and/or experience verification, equipment, and safety protocols. There are five separate levels of rebreather diving and each have unique requirements: No-Deco, Tech Lite, and Advanced Mixed Gas Air Dil Deco, Normoxic, and Hypoxic. All pertinent requirements in other sections of this Manual must be applied in addition to this standard. For rebreather dives that also involve staged decompression and/or mixed gas diving, all requirements for each of the relevant diving modes shall be met. No-Deco and Tech Lite allow divers authorized by the NDCSB to conduct dives using rebreathers without mission-specific pre-approval after a probationary period.

#### 8.1.2 Definitions

- A. Rebreathers are defined as any device that recycles some or all of the exhaled gas in the breathing loop and returns it to the diver. Rebreathers maintain levels of oxygen and carbon dioxide that support life by metered injection of oxygen and chemical removal of carbon dioxide. These characteristics fundamentally distinguish rebreathers from open-circuit life support systems, in that the breathing gas composition is dynamic rather than fixed.
- B. There are three classes of rebreathers:
- 1) **Oxygen Rebreather:** Oxygen rebreathers recycle breathing gas, consisting of pure oxygen, replenishing the oxygen metabolized by the diver. Oxygen rebreathers are generally the least complicated design but are limited in depth of use due to the physiological limits associated with oxygen toxicity.
  - 2) **Semi-Closed Circuit Rebreather:** Semi-closed circuit rebreathers (SCR) recycle the majority of exhaled breathing gas, venting a portion into the water and replenishing it with a constant or variable amount of a single oxygen-enriched gas mixture. Gas addition and venting is balanced against diver metabolism to maintain safe oxygen levels.

- 3) Mixed-Gas Closed-Circuit Rebreather: Closed-circuit mixed gas rebreathers (CCR) recycle all of the exhaled gas. Electronically controlled CCRs (eCCR) replace metabolized oxygen via an electronically controlled valve, governed by oxygen sensors. Manually controlled CCR (mCCR) rely on mechanical oxygen addition and diver monitoring to control oxygen partial pressure (PO<sub>2</sub>). Systems are equipped with two (2) cylinders; one (1) with oxygen, the other with a diluent gas used to make up gas volume with depth increase and to dilute oxygen levels. CCR systems operate to maintain a constant PO<sub>2</sub> during the dive, regardless of depth.

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## 8.2 Qualifications

### 8.2.1 Prerequisites.

- A. Currently authorized NOAA Diver.
- B. Completion of a minimum of 100 open water dives on open circuit scuba.
- C. A minimum 130 fsw depth qualification to ensure the diver is sufficiently conversant with the complications of deeper diving. If the sole expected application for the use of rebreathers is shallower than this, a lesser depth qualification may be allowed.
- D. Nitrox training.
  1. Basic nitrox training in the use of mixtures containing 25 percent to 40 percent oxygen is required.
  2. Advanced nitrox training in the use of mixtures containing greater than 40 percent oxygen may also be required, depending upon the planned application and rebreather system. Nitrox training may be provided as part of rebreather training.

### 8.2.2 Certification, Authorization, and Approval.

- A. Rebreather training shall be approved by the NDCSB with specific training requirements for each rebreather model, and on a case-by-case basis.
- B. Instructors shall be qualified for the type of training to be provided. Training shall be conducted by agencies or instructors approved by the NDCSB.
- C. Instructors shall use the same model rebreather the students are using.
- D. Training shall include manufacturer-recommended requirements, but may exceed these to prepare divers for the type of mission intended (e.g., staged decompression or Heliox/Trimix Closed-Circuit Rebreather diving).

- E. Successful completion of training does not in itself authorize the diver to use rebreathers. The diver must demonstrate to the NDCSB or its designee that the diver possesses the proper attitude, judgment, and discipline to safely conduct rebreather diving in the context of planned operations.
- F. No diver shall conduct planned decompression or mixed-gas diving operations using rebreathers without prior review and approval of the NDCSB.
- G. NDCSB approval for the No-Deco and Tech Lite programs is not needed after a Dive Unit has completed the probationary period.
- H. The NDCSB will review each application for rebreather use in specialized diving conditions (e.g. ice, cave, shipwreck), and may require divers to follow additional guidelines beyond those listed here.

#### 8.2.3 No-Deco.

- A. Upon successful completion of initial rebreather training and evaluation dives, the NDCSB-approved evaluator will contact the diver's respective LODO with a recommendation as to whether the diver is capable, confident and ready to conduct operational rebreather dives without continued supervision.
- B. If the LODO concurs with the evaluator, LODO will make a recommendation to the NDCSB to approve the rebreather diver for operational dives in water shallower than 130 fsw that do not incur decompression, using an air diluent mixture. If approved by the NDCSB, the relevant endorsement shall be added to the diver's profile in the ND.

#### 8.2.4 Air Diluent Decompression (encompassing Tech Lite).

- A. All dive units approved for Tech Lite rebreather diving will undergo a probationary period of either one (1) year or until the completion of 25 dives and 35 hours of bottom time, whichever is longer.
- B. After the probationary period, the NDCSB will reevaluate the unit's performance and will either approve the unit to conduct no-deco rebreather operations without NDCSB pre-approval of dive plans, or the unit will have to continue their probationary period until the NDCSB is satisfied with the unit's performance.

#### 8.2.5 Advanced Mixed Gas.

- A. All dives with planned decompression (over 15 minutes) or mixed-gas diving operations using rebreathers must have prior review and approval from the NDCSB

- B. Rebreather dives involving operational depths in excess of 130 fsw, requiring staged decompression, or using diluents containing inert gases other than nitrogen are subject to additional training requirements as determined by NDCSB. Prior experience with required decompression and mixed gas diving using open circuit scuba is desirable, but is not sufficient for transfer to dives using rebreathers without additional training.
1. As a prerequisite for training in staged decompression on rebreathers using air diluent and not exceeding 130 fsw, the diver shall have logged a minimum of 25 hours of underwater time on the rebreather system to be used, with at least 10 rebreather dives in the 100 fsw to 130 fsw range.
  2. As prerequisites for training for use of rebreathers with normoxic trimix diluents (He, O<sub>2</sub>, N<sub>2</sub> with  $\geq 17\%$  O<sub>2</sub>), the diver shall have logged a minimum of 50 hours of underwater time on the rebreather system to be used and shall have completed training in decompression methods using rebreathers. The diver shall have completed at least 12 dives requiring staged decompression on the rebreather model to be used, with at least four (4) dives between 130 fsw and 150 fsw.
  3. As prerequisites for training for use of rebreathers with hypoxic trimix diluents (He, O<sub>2</sub>, N<sub>2</sub> with  $< 17\%$  O<sub>2</sub>), the diver shall have logged a minimum of 100 hours of underwater time on the rebreather system to be used of which 40 hours where on dives requiring decompression. The Diver shall have completed training in decompression methods using rebreathers. The diver shall have completed at least 12 dives requiring staged decompression on the rebreather model to be used, with at least four (4) dives between 180 fsw and 235 fsw.
  4. Training shall be in accordance with standards for decompression and mixed gas diving, as applicable to rebreather systems, starting at the 130 fsw level.
- C. Depth progressions require prior approval from the NDCSB and require a minimum of six (6) operational dives at the previous depth level, two (2) training dives to the new depth level without any scientific gear and two (2) training dives with scientific gear but with no data collection

#### 8.2.6 Previously Certified or Crossover Rebreather Divers.

- A. Crossover rebreather divers are previously certified on a specific rebreather and are looking to switch over to a different rebreather model. Each rebreather unit requires specific training to use the model.
- B. To be considered to dive with a rebreather for NOAA, rebreather divers must have completed the requirements in Section 8.2.2, and if not certified on a NOAA-approved model, must complete a crossover course that certifies them on the unit they will be diving.



- C. Crossover training to a new rebreather model requires a minimum of 4 training dives for a minimum cumulative dive time of 240 min.
- D. With approval from the NDCSB and the crossover instructor, crossover rebreather divers may be authorized to maximum depth and gas mixtures they were previously certified to on a different model of rebreather.

#### 8.2.7 Operational Limits.

##### A. All rebreather diving must:

1. A maximum  $PO_2$  set point of 1.30 ATA will be utilized during the bottom phase of the dive and maximum  $PO_2$  of 1.60 ATA may be used during the decompression phase of the dive evolution.
2. Oxygen exposures should not exceed the NOAA oxygen single exposure limits or the REPEX limits for the dive operations. Both CNS and pulmonary (whole-body) oxygen exposure indices should be tracked for each diver.
3. Gradient factors: All dive computers and/or computer-based decompression schedule generating software programs will be set to a conservative gradient factor between 50/70 and 50/85.
4. Respired gas densities should be less than  $5 \text{ g}\cdot\text{L}^{-1}$ , and should not exceed  $6 \text{ g}\cdot\text{L}^{-1}$  under normal circumstances.

##### B. Air diluent use only;

1. Maximum depth shall not exceed 130 fsw or certified depth whichever is shallower;

##### C. Tech Lite:

1. Maximum decompression obligation shall not exceed fifteen (15) minutes;
2. Diluent contents should not exceed  $6 \text{ g}\cdot\text{L}^{-1}$  under normal circumstances.
3. Maximum depth shall not exceed 150 fsw;
4. All operations shall be conducted within four (4) hours of a hyperbaric chamber, unless there is a Hyperlite on site.

##### D. Mixed gas CCR.

1. Maximum depth shall not exceed 330'.
2. All operations shall be conducted within two (2) hours of a Class A or Class B hyperbaric chamber, unless otherwise specified by the NDSCB or there is a Hyperlite on site.

#### 8.2.8 Depth Authorizations.

## A. General.

1. Minimum of 100 logged dives with experience in the depth range where decompression dives will be conducted.
2. Depth progressions require prior approval from the NDCSB.
3. The diver must also demonstrate knowledge of the special problems of deep diving and of special safety requirements.
4. A diver may be authorized to the next depth level after successfully completing the requirements for that level. A diver may exceed his/her depth authorization when accompanied and supervised by a dive buddy holding a depth authorization greater or equal to the intended depth.

## B. Dives required for progression to next depth authorization:

1. Six (6) operational dives at the previous depth authorization,
2. Three (3) training dives to the new depth level without any scientific gear and
3. Three (3) training dives with scientific gear but with no data collection

## C. Depth Authorizations:

1. 130 fsw
2. 150 fsw
3. 190 fsw
4. 250 fsw
5. 300 fsw
6. 330 fsw

## 8.2.9 Proficiency Requirements.

- A. To maintain authorization to dive with rebreathers, a diver shall make at least one (1) dive using a rebreather per quarter. For divers authorized to conduct decompression or mixed-gas diving, at least one (1) dive should be made annually to a depth near 130 fsw, practicing decompression protocols.
- B. The minimum Annual rebreather diving activity should be 12 rebreather dives, with a minimum of 12 hours underwater time.
- C. To count, dives should be no less than 30 min in duration. A required element of maintaining proficiency is the periodic performance and reevaluation of skills related to in-water problem recognition and emergency procedures.

D. Divers authorized to conduct decompression or mixed-gas diving shall complete at least one (1) training dive annually, which includes an ascent from 100 fsw on bailout gases. A decompression obligation need not be incurred, but simulated decompression stops and gas switches shall be conducted.

E. Tech Lite:

1. An authorized diver shall make at least one (1) dive using a rebreather every eight (8) weeks, or twelve (12) dives over the course of twelve (12) months. At least six (6) of these dives should be made to a depth near 130 feet, practicing decompression protocols.
2. If a period of more than six (6) months has elapsed since the last 'Tech Lite' decompression dive, a series of progressive workup dives to return the diver(s) to proficiency status prior to the start of project diving operations is required. The NDCSB shall approve a program of remedial knowledge and skill tune-up training and a course of dives required to return the diver to full authorization.

#### 8.2.10 Proficiency Lapse.

- A. For a diver with lapsed proficiency, a Technical Diving Supervisor shall approve a program of remedial knowledge and skill tune-up training with a course of dives required to return the diver to full authorization.
- B. At minimum demonstrated skills included in the required training elements for the level of rebreather operation must be performed and reevaluated.

### 8.3 Training Requirements

#### 8.3.1 Entry Level Training.

- A. The training area for O<sub>2</sub> Rebreather should not exceed 20 fsw in depth.
- B. Entry level CCR and SCR training is limited in depth of 130 fsw and shallower.
- C. Entry level CCR and SCR training is limited to nitrogen/oxygen breathing media.
- D. Divers at the CCR and SCR entry level may not log dives that require a single decompression stop longer than 10 minutes.
- E. Maximum Student/Instructor Ratio: 4 to 1. This ratio is to be reduced as required by environmental conditions or operational constraints.
- F. Upon completion of practical training, the diver must demonstrate proficiency in pre-dive, dive, and post-dive operational procedures for the particular model of rebreather to be used.

<b>Rebreather Entry Level Training Requirements</b>			
Key: X = include, IA = If Applicable, ISE = If So Equipped			
	O <sub>2</sub>	SCR	CCR
<b>Required Training Topic</b>			
<b>Academic</b>			
<b>History of technology</b>	X	X	X
<b>Medical &amp; physiological aspects of:</b>			
Oxygen toxicity	X	X	X
Chemical burns & caustic cocktail	X	X	X
Hypoxia – insufficient O <sub>2</sub>	X	X	X
Hypercapnia – excessive CO <sub>2</sub>	X	X	X
Arterial gas embolism	X	X	X
Middle Ear Oxygen Absorption Syndrome (oxygen ear)	X	X	X
Hygienic concerns	X	X	X
Nitrogen absorption & decompression sickness		X	X
CO <sub>2</sub> retention	X	X	X
Hyperoxia-induced myopia	X	X	X
<b>System design, assembly, and operation, including:</b>			
Layout and design	X	X	X
Oxygen control systems	X	X	X
Diluent control systems		IS E	IS E
Use of checklists	X	X	X
Complete assembly and disassembly of the unit	X	X	X
Canister design & proper packing and handling of chemical absorbent	X	X	X
Decompression management and applicable tracking methods		IS E	X

Oxygen and high pressure gas handling and safety	X	X	X
Fire triangle	X	X	X
Filling of cylinders	X	X	X
Pre-dive testing & trouble shooting	X	X	X
Post-dive break-down and maintenance	X	X	X
Trouble shooting and manufacturer authorized field repairs	X	X	X
Required maintenance and intervals	X	X	X
Manufacturer supported additional items (ADV, temp stick, CO2 monitor, etc.)	IS E	IS E	IS E
<b>Dive planning:</b>			
Operational planning	X	X	X
Gas requirements	X	X	X
Oxygen exposure and management	X	X	X
Gas density calculations		X	X
Oxygen metabolizing calculations	X	X	X
Scrubber limitations	X	X	X
Mixed mode diving (buddies using different dive modes)	X	X	X
Mixed platform diving (buddies using different rebreather platforms)	X	X	X
<b>Problem Recognition &amp; Emergency Procedures:</b>			
Applicable open circuit emergency procedures for common gear elements	X	X	X
Loss of electronics	IS E	IS E	X
Partially flooded loop	X	X	X
Fully flooded loop	X	X	X
Cell warnings		IS E	X
Battery warnings	IS E	IS E	X
High O2 warning	IS E	IS E	X

Low O <sub>2</sub> warning	IS E	IS E	X
High CO <sub>2</sub> warning	IS E	IS E	IS E
Recognizing issues as indicated by onboard scrubber monitors	IS E	IS E	IS E
Recognizing hypercapnia signs and symptoms in self or buddy	X	X	X
Excluded O <sub>2</sub> cell(s)	IS E	IS E	IS E
Loss of Heads Up Display (HUD)	IS E	IS E	IS E
Loss of buoyancy	X	X	X
Diluent manual add button not functioning		IS E	IS E
O <sub>2</sub> manual add button not functioning	IS E	IS E	IS E
Exhausted oxygen supply	X	X	X
Exhausted diluent supply		IS E	IS E
Lost or exhausted bailout	IS E	IS E	IS E
Handset not functioning	IS E	IS E	IS E
Solenoid stuck open	IS E	IS E	IS E
Solenoid stuck closed	IS E	IS E	IS E
ADV stuck open	IS E	IS E	IS E
ADV stuck closed	IS E	IS E	IS E
Isolator valve(s) not functioning	IS E	IS E	IS E
Oxygen sensor validation	IS E	IS E	X

CO2 sensor validation	I A	I A	I A
Gas sharing	X	X	X
Diver assist and diver rescue	X	X	X
Other problem recognition and emergency procedures specific to the particular unit, environment, or diving conditions	X	X	X
<b>Practical Training and Evaluations</b>			
<b>Demonstrated skills must include, at a minimum:</b>			
Use of checklists	X	X	X
Carbon dioxide absorbent canister packing	X	X	X
Supply gas cylinder analysis and pressure check	X	X	X
Test of one-way valves	X	X	X
System assembly and breathing loop leak testing	X	X	X
Oxygen control system calibration	IS E	IS E	X
Proper pre-breathe procedure	X	X	X
In-water bubble check	X	X	X
Proper buoyancy control during descent, dive operations, and ascent	X	X	X
System monitoring & control during descent, dive operations, and ascent	X	X	X
Proper interpretation and operation of system instrumentation	X	X	X
Proper buddy contact and communication	X	X	X
Use of a line reel or spool to deploy an SMB from planned dive depth and while controlling buoyancy in the water column	X	X	X
Proper management of line reel or spool, and SMB during ascents and safety or required stops	X	X	X
Unit removal and replacement on the surface	X	X	X
<b>Bailout and emergency procedures for self and buddy including:</b>			
System malfunction recognition and solution	X	X	X

Manual system control	IS E	IS E	IS E
Flooded breathing loop recovery	I A	I A	I A
Absorbent canister failure	X	X	X
Alternate bailout options	X	X	X
Manipulation of onboard and off board cylinder valves	X	X	X
Manipulation of bailout cylinders (removal, replacement, passing and receiving while maintaining buoyancy control)	IS E	IS E	IS E
Manipulation of quick disconnects, isolator valves, and manual controls specific to the unit and gear configuration	IS E	IS E	IS E
<b>Proper system maintenance, including:</b>			
Breathing loop disassembly and disinfection	X	X	X
Oxygen sensor replacement	IS E	IS E	IS E
Battery removal and replacement or recharging	IS E	IS E	IS E
Other tasks as required by specific rebreather models	X	X	X
<b>Written Evaluation</b>	X	X	X
<b>Supervised Rebreather Dives</b>	X	X	X
<b>Entry Level Training – Minimum Underwater Requirements</b>			
	<b>Pool/Confined Water</b>	<b>Open water</b>	<b>Supervised Dives</b>
<b>O2</b>	1 Dive, 90 – 120 minutes	4 dives, 120 minute cumulative	2 Dives, 120 minute cumulative
<b>SC R</b>	1 Dive, 90 – 120 minutes	4 dives, 120 minute cumulative	4 dives, 120 minute cumulative
<b>CC R</b>	1 Dive, 90 – 120 minutes	8 dives, 380 minute cumulative	4 dives, 240 minute cumulative

## 8.3.2 Rebreather Required Decompression, Normoxic, and Hypoxic Mix Training.



- A. Required Decompression and Normoxic Training may be taught separately or combined.
- B. Prerequisites:
  - 1. Required Decompression 25 rebreather dives for a minimum cumulative dive time of 25 hours
  - 2. Mixed Gas:
    - a. Normoxic Mixes – 25 dives for a minimum cumulative dive time of 25 hours.
    - b. Hypoxic Mixes – Rebreather Required Decompression Certification and Normoxic Certification and 25 decompression CCR dives for a minimum cumulative dive time of 40 hours on dives requiring decompression.
- C. Maximum Student/Instructor Ratio: 2 to 1. This ratio is to be reduced as required by environmental conditions or operational constraints.
- D. Upon completion of practical training, the diver must demonstrate proficiency in pre-dive, dive, and post-dive operational procedures for the particular model of rebreather to be used.
- E. Supervised dives target activities associated with the planned science diving application. Supervisor for these dives is the DSO or designee, experienced with the make/model rebreather being used.

<b>Required Decompression, Normoxic &amp; Hypoxic Mix Training Requirements</b>			
Key: X = include, IA = If Applicable, ISE = If So Equipped			
	Deco	Normoxic	Hypoxic
<b>Required Training Topic</b>			
<b>Academic</b>			
Review of applicable subject matter from previous training	X	X	X
<b>Medical &amp; physiological aspects of:</b>			
Hypercapnia, hypoxia, hyperoxia	X	X	X
Oxygen limitations	X	X	X
Nitrogen limitations	X	X	X
Helium absorption and elimination		X	X

High Pressure Nervous Syndrome (HPNS)			X
<b>System design, assembly, and operation, including:</b>			
Gear considerations and rigging	X	X	X
Gas switching	X	X	X
<b>Dive planning:</b>			
Decompression calculation	X	X	X
Gradient Factors	X	X	X
Scrubber duration and the effects of depth on scrubber function	X	X	X
Gas requirements including bailout scenarios	X	X	X
Bailout gas management – individual vs team bailout	X	X	X
Gas density calculations	X	X	X
Operational Planning	X	X	X
Equivalent narcosis depth theory		X	X
Gas selection, gas mixing and gas formulas		X	X
<b>Problem Recognition &amp; Emergency Procedures:</b>			
Applicable open circuit emergency procedures for common gear elements	X	X	X
Flooded loop	X	X	X
Cell warnings	X	X	X
Battery warnings	X	X	X
Hypercapnia, hypoxia, hyperoxia	X	X	X
<b>Practical Training and Evaluations</b>			
<b>Demonstrated skills must include, at a minimum:</b>			
Proper demonstration of applicable skills from previous training	X	X	X
Proper manipulation of DSV and/or BOV	X	X	X
Proper descent and bubble check procedures	X	X	X
Proper monitoring of setpoint switching and PO2 levels	X	X	X

Proper interpretation and operation of system instrumentation	X	X	X
System monitoring & control during descent, dive operations, and ascent	X	X	X
Demonstrate the ability to manually change setpoint and electronics settings during the dive	IS E	ISE	I S E
Demonstrate buoyancy control; ability to hover at fixed position in water column without moving hands or feet	X	X	X
Demonstrate controlled ascent with an incapacitated diver including surface tow at least 30 meters / 100 feet with equipment removal on surface, in water too deep to stand	X	X	X
Onboard and off board valve manipulation for proper use, and reduction of gas loss	X	X	X
Diagnosis of proper reactions for a flooded absorbent canister	X	X	X
Diagnosis of and proper reactions for CO2 breakthrough	X	X	X
Diagnosis of and proper response to Cell Errors	X	X	X
Diagnosis of and proper reactions for Low oxygen drills	X	X	X
Diagnosis of and proper reactions for Flooded Loop	X	X	X
Diagnosis of and proper reactions for High Oxygen Drills	X	X	X
Diagnosis of and proper reactions for electronics and battery failure	X	X	X
Operation in semi-closed mode	X	X	X
Properly execute the ascent procedures for an incapacitated dive buddy	X	X	X
Proper buddy contact and communication	X	X	X
Use of a line reel or spool to deploy an SMB from planned dive depth and while controlling buoyancy in the water column	X	X	X
Proper management of line reel or spool, and SMB during ascents and safety or required stops	X	X	X
Demonstrate the ability to maintain minimum loop volume	X	X	X
Demonstrate comfort swimming on surface and at depth carrying a single bailout/decompression cylinder/bailout rebreather	X		

Demonstrate ability to pass and retrieve a single bailout/decompression cylinder or bailout rebreather while maintaining position in the water column	X		
Demonstrate ability to pass and receive multiple bailout/decompression cylinders or bailout rebreather while maintaining position in the water column	I A	X	X
Demonstration of the ability to perform simulated decompression stops at pre-determined depths for scheduled times	X	X	X
Demonstration of the ability to perform decompression stops at pre-determined depths for scheduled times	X	X	X
Demonstrate competence managing multiple bailout cylinders, including drop and recovery while maintaining position in the water column	I A	X	X
Demonstrate appropriate reaction to simulated free-flowing deco regulator	X	X	X
Gas share of deco gas for at least 1 minute	X	X	X
Demonstrate oxygen rebreather mode at appropriate stop depth		X	X
Complete bailout scenarios from depth to include decompression obligation on open circuit	X	X	X
<b>Written Evaluation</b>	X	X	X
<b>Supervised Rebreather Dives</b>	X	X	X
<b>Minimum Underwater Requirements</b>			
	<b>Pool/Confined Water</b>	<b>Openwater</b>	<b>Supervised Dives**</b>
<b>Deco</b>	1 Dive / 60 min	7 Dives / 420 min	4 Dives / 240 min.
<b>Normoxic</b>	1 Dive / 60 min	7 Dives / 420 min	4 Dives / 240 min.
<b>Deco/Normoxic Combined</b>	1 Dive / 60 min	7 Dives / 420 min 3 Normoxic Dives / 180 min	4 Dives / 240 min.
<b>Hypoxic Mixes</b>		7 Dives / 420 min	4 Dives / 240 min.
**A minimum of three supervised dives should comply with authorization parameters			

## 8.4 Equipment

### 8.4.1 General Requirements.

- A. Only those models of rebreathers specifically approved by NDCSB shall be used.
- B. Prior to approval, the manufacturer shall supply the NDCSB with supporting documentation by a recognized third-party testing agency detailing the methods that were used to determine equipment specifications, including unmanned and manned testing. Test data should be from a recognized, independent testing facility.
- C. Rebreathers shall be manufactured according to acceptable Quality Control/Quality Assurance protocols, as evidenced by compliance with the essential elements of current ISO standards. Manufacturers should be able to provide to the NDCSB supporting documentation to this effect.
- D. Unit performance specifications shall be within acceptable levels as defined by the NDCSB.
- E. Rebreather modifications (including consumables and operational limits) that deviate from or are not covered by manufacturer documentation should be discussed with the manufacturer and approved by the NDCSB prior to implementation.
- F. A complete instruction manual is required, fully describing the operation of all rebreather components and subsystems as well as maintenance procedures.
- G. Model-specific build, deck and pre-dive checklists must be used with all rebreathers. The build checklists shall be retained in the maintenance log for each rebreather.
- H. Use and reuse of CO<sub>2</sub> scrubber media should be per manufacturer recommendations or as defined by the NDCSB.
- I. Maintenance Requirements:
  - 1. A maintenance log is required and will minimally include: dates of service, service performed, and individuals or company performing the service.
  - 2. The unit and subsystem component (i.e., regulators, computers, and cylinders) maintenance shall be up-to-date based upon the manufacturer's recommendations.
  - 3. Field repairs and replacement of components covered in rebreather diver training is not annual maintenance and may be performed by the rebreather diver in accordance with NOAA policy.

4. User replaceable consumable rebreather components should be replaced per manufacturer recommendations or as defined by the NDCSB.

#### 8.4.2 Individual Equipment Requirements

Individual Equipment Requirements			
Key: X = include, IA = If Applicable			
	O <sub>2</sub>	SC R	CC R
DCB approved rebreather make and model	X	X	X
Bottom timer, and depth gauge	X	X	X
Two dive computers (One computer autonomously powered)		X	X
Approved dive tables		I A	I A
SMB (surface marker buoy) and line reel or spool with sufficient line to deploy an SMB from the bottom in the training environment.	I A	I A	I A
Access to an oxygen analyzer	X	X	X
Two (2) cutting devices, one must be either shears or a seatbelt cutter	X	X	X
BCD capable of maintaining positive buoyancy with either a flooded loop or dry suit.	X	X	X
Open Circuit bailout gas with sufficient volume for planned activities	X	X	X
Approved CO <sub>2</sub> absorbent	X	X	X

#### 8.4.3 Minimum Equipment Required.

- A. Dive/Surface Valve (DSV) in the mouthpiece assembly, allowing the breathing loop to seal from the external environment when not in use.
- B. Automatic diluent addition valve (ADV) or equivalent, so that manual volumetric compensation during descent is unnecessary.
- C. Manual gas addition valves, so that manual volumetric compensation during descent and manual oxygen addition are possible at all times during the dive.
- D. The diver shall carry an alternate life support capability (e.g., open circuit bailout) sufficient to allow the solution of minor problems or allow ascent to the surface including all required decompression stops.
- E. Oxygen Rebreathers. Oxygen rebreathers shall be equipped with manual and automatic gas addition valves.
- F. SCRs. SCRs shall be equipped with at least one (1) manufacturer-approved oxygen sensor sufficient to warn the diver of impending hypoxia.

## G. CCRs.

1. CCRs must have an oxygen sensing system that has been demonstrated to be reliable through empirical testing, such as a minimum of three (3) un-validated oxygen sensors, or with an active validation system that has (2) two or more oxygen sensors, or other oxygen sensing technology with similarly demonstrated reliability.
2. A minimum of two (2) independent displays of oxygen sensor readings shall be available to the diver.
3. Two (2) independent power supplies in the rebreather design are desirable. If only one (1) is present, a secondary system to monitor oxygen levels without power from the primary battery must be incorporated.
4. CCRs shall be equipped with manual diluent and oxygen addition valves to enable the diver to maintain safe oxygen levels in the event of failure of the primary power supply or automatic gas addition systems.

H. Redundancies in onboard electronics, power supplies, and life support systems are highly desirable.

## 8.4.4 Regulators.

- A. Regulators will be configured for the planned operations and equipment used;
- B. Bailout cylinder regulators shall be configured with a hose of adequate length to facilitate effective emergency gas sharing in the intended environment.
- C. Regulators used with gas supplies containing an oxygen fraction with an MOD shallower than the operating depth of the dive shall be secured in a way (e.g., pouch or bungee) that reduces the possibility of inadvertent use at depths that would result in a hyperoxic exposure.
- D. Adequate breathing gas volumes. See Section 8.4.3.

## 8.4.5 Buoyancy Compensator Device;

- A. Tech Lite: single bladder with wetsuit or drysuit;
- B. Air/Nitrox & Mixed Gas:dual bladder with a wetsuit, single bladder with a drysuit;  
When a dual bladder is used:
  1. Each bladder must be capable of achieving positive buoyancy at all depths of the dive;
  2. Separate inflator hoses for each bladder;
  3. Each bladder must have an over pressurization relief valve;

4. Primary bladder must have top and bottom dump valves; and
5. Secondary bladder must have top dump valve.

#### 8.4.6 Scuba Cylinders and Valves.

- A. Scuba cylinders used on dives >130 fsw shall be equipped with DIN valves.
- B. Scuba cylinders used for decompression should be color-coded and shall be marked in accordance with the following standards:

Gas	Cylinder Color	Markings
Air	Any color	None
Oxygen	White or Green	“Oxygen” stenciled in 3-inch high color-contrasting letters
Nitrox	Yellow  Other	4-inch green band with “NITROX” or “Enriched Air” stenciled in 2-inch high letters  Non-yellow cylinders have an additional 1-inch yellow band above and below the green label
Trimix	Any color	‘Custom Gas’ or Trimix Stickers Identifying Contents

#### 8.4.6 Cylinder Pressure Gauges.

- A. Each gas supply, including bailouts, will have its own dedicated submersible pressure gauge and readable by the diver during the dive.
- B. The gauge may be analog or integrated into a dive computer, but it must have a HP hose connecting it directly to the first stage of the regulator.
- C. Button gauges are not allowed.

#### 8.4.7 Bailout Bottles.

- A. Bailout bottles shall be carried by every diver (e.g., no “team” bailout) on all rebreather dives and shall be of sufficient volume to complete the ascent phase of the dive, including all decompression with a 10% reserve. The calculations to determine the appropriate volume of gas to carry shall be based on actual Respiratory Minute Volumes (RMVs) for each individual diver.
- B. Divers will always carry at least one (1) bailout bottle with a gas mixture that can be breathed at any point during the dive (PO<sub>2</sub> between 0.20 and 1.60 ATA).
- C. All dive team members shall use the same bailout configuration.



- D. Each bailout first stage shall be configured with a low-pressure (LP) hose to the second stage of appropriate length to allow gas sharing and may be configured with an in-line isolation valve immediately adjacent to the second stage. An in-line isolation valve requires the installation of a LP over-pressurization relief valve (ORV).
- E. The first stage of each bailout regulator shall be fitted with an appropriate LP connector for connection to an offboard valve so that offboard gas can be piped into the CCR or can be provided to a buddy. All divers on a single mission shall have the ability to donate/receive gas from each team member.
- F. Each bailout bottle shall be configured with bungees or other appropriate straps that hold the hoses and second stage securely to the bottle at all times.
- G. Each bailout bottle shall be marked with tape. It is additionally recommended that a duplicate piece of tape be placed on the bottom of the cylinder so that buddies can easily read it from behind the diver.
- H. Bailout bottles shall never be staged and once attached to the diver's harness should not be removed until the diver has surfaced, the bottles need to be changed out, or the diver has ascended to a depth where a gas with a higher FO<sub>2</sub> is employed.

#### 8.4.8 Dive Computers.

- A. Follow Section 5.4.6 for general dive computer requirements.
- B. Each diver shall have redundant means of tracking dive time and depth through two (2) NOAA-approved dive computers.
- C. Dive computers used for decompression diving must use the approved algorithms: Buhlmann 16 or the ZH-L16 GF algorithm. If another algorithm is preferred, NDCSB must approve on a case by case basis.
- D. All dive computers and/or computer-based decompression schedule generating software programs will be set to a conservative gradient factor between 50/70 and 50/85.
- E. All dive computers and/or computer-based decompression schedule generating software programs must be approved by the NDCSB.
- F. Hardcopies of the decompression schedule for the planned dive with contingencies for next longer/deeper dives and loss of gas.
- G. Each diver will wear a NOAA-approved dive computer which is connected to the head of the CCR to serve as a primary decompression computer and a secondary PO<sub>2</sub> monitor unless an integrated computer is hard-wired to the head.

- H. Each diver will wear a NOAA-approved fixed PO<sub>2</sub> dive computer to calculate no-decompression times/decompression schedules in the event the primary dive computer fails.

#### 8.4.9 Signaling Devices.

- A. Two (2) lift bags. One (1) lift bag must have  $\geq 50$ lb buoyancy and should be yellow to communicate to the surface that the dive is proceeding normally. The other bag shall be red to indicate that the diver/team is having problems.
- B. Each lift bag shall be equipped with a clip which can be attached to the CCR to provide positive lift in the case of a total rig flood.
- C. Each diver shall carry the following surface signaling devices:
  - 1. One (1) daytime visual device such as a signal mirror, SMB, etc.; and
  - 2. One (1) audible device such as a whistle, power horn, etc.
- D. If dives are conducted within two (2) hours of sunset, each diver must also carry a flashlight and/or strobe light.
- E. If diving in an area in which separation from surface support vessels is more likely or would present a more significant risk than typical conditions (e.g., poor surface visibility, high current, far from shore), each diver should also carry a DSC enabled handheld VHF marine radio, a Personal Locator Beacon (PLB) or a Personal Emergency Position-Indicating Radio Beacon (PEPIRB).

#### 8.4.10 Other Required Equipment.

- A. Hardcopies of the decompression schedule for the planned dive with contingencies for next longer/deeper dives and the schedule for bailout gases;
- B. Two (2) line reels (one reel must have sufficient line length to reach the surface from the maximum depth anticipated during a dive);
- C. One spare mask (for required deco);
- D. Slate and pencil (for required deco); and
- E. Compass.

#### 8.4.11 Support Boat(s).

- A. A support boat and qualified operator is required to be in the immediate vicinity of the dive location and ready to render assistance as needed. A support boat should be used for dives with the following conditions:

1. Conducted beyond a comfortable swimming distance from shore;
  2. In areas of strong current or low visibility;
  3. Requiring difficult water entry or exit (e.g., ladders, steep shores, heavy surf);
  4. Dive operations conducted from ships.
- B. Provide a means of extracting an unconscious victim from the water during all phases of decompression diving operations.
- C. Carry onboard a minimum of one (1) spare cylinder of each type of decompression gas mixture used on the dive.
- D. Emergency procedures for vessel response must be reviewed before diving operations begin.
- E. Chase Boats.
1. Chase boats must comply with all NOAA Small Boat Requirements.
  2. In cases where dive teams have a greater likelihood of separation (e.g., high current, low visibility, long decompression, large dive teams) the UDS, DM, or LD may require a second support vessel.
  3. The NDCSSB may require chase boats in certain complex dive missions.
  4. Chase boats shall have the same support and medical response equipment on board as primary support boats.
  5. A chase boat must be able to fit half of the deployed dive team on board.

#### 8.4.12 Hyperbaric Chamber.

- A. A plan shall be prepared and verified to transport an injured diver to a hyperbaric chamber within the required time frame.
  - B. Hyperbaric chambers (excluding the Hyperlite) shall be multi-place, multi-lock, and certified by ASME, ABS, or equivalent authority for human occupancy.
- 

## 8.5 Breathing Gases and Gas Management

### 8.5.1 General.

- A. A maximum  $PO_2$  of 1.30 ATA will be utilized during the bottom phase of the dive and maximum  $PO_2$  of 1.60 ATA (achieved through manual addition of oxygen) may be used during the 20 fsw decompression stop of the dive evolution.

- B. Divers shall carry, at a minimum, a 40 cubic foot or larger bailout tank of decompression gas based on the divers SAC and RMV rates.
- C. Planned oxygen partial pressure in the breathing loop shall not exceed 1.40 ATA for SCRs, oxygen rebreathers and the bottom phase of dives with CCRs.
- D. Oxygen exposures should not exceed the NOAA oxygen single exposure limits or the REPEX limits for the dive operations. Both CNS and pulmonary (whole-body) oxygen exposure indices should be tracked for each diver.
- E. All gases used for diving must be of breathing quality (e.g., Medical, Technical or Aviator Grade).
- F. For each phase of the dive evolution, divers shall carry appropriately sized cylinders based on the dive plan and the divers' SAC and RMV rates.

#### 8.5.2 Gas Analysis and Labeling.

- A. All breathing gasses must be analyzed by the diver using the gas.
- B. Gases must test within acceptable parameters as specified in the dive tables or computers used.
- C. Gas analysis must be accomplished by analyzing the fractions of each individual gas component in the mixture, less one. Thus, if Heliox or Nitrox is used, this requirement is met by measuring the  $FO_2$ . If Trimix ( $O_2$ , He,  $N_2$ ) is used, at least two (2) components must be analyzed, typically oxygen and helium.
- D. It is the responsibility of each diver to confirm and verify in writing the contents of their scuba cylinder(s) prior to diving and label the cylinder(s) with the following:
  - 1. Oxygen percentage ( $FO_2$ );
  - 2. Maximum Operating Depth (MOD),
  - 3. Cylinder pressure;
  - 4. Date; and
  - 5. Initials of diver.
  - 6. Mixed Gas: Helium percentage ( $FH_2$ );
  - 7. Mixed Gas: Minimum Operating Depth (MinOD) – if applicable;

#### 8.5.3 Oxygen.

- A. The  $PO_2$  of any gas mixture breathed during a dive shall not exceed 1.40 ATA, except during the decompression phase when a  $PO_2$  of 1.60 is allowed.

- B. Breathing gases used while performing in-water decompression shall contain the same or greater oxygen content as that used during the bottom phase of the dive. Interruption of high oxygen partial pressure decompression may be conducted with appropriate back gas mixtures or air, as approved in the dive plan.
- C. All gas systems, components, and storage containers used with oxygen mixtures above 40 percent by volume, must be formally cleaned in accordance with the most recent edition of the NOAA Diving Manual and this Manual.
- D. Central Nervous System (CNS) Oxygen Toxicity. Hyperoxia can occur at a  $PO_2$  of  $> 1.40$  ATA. Dive planning should ensure  $PO_2$  during all phases of the dive, except decompression, remains significantly below 1.60 ATA.
- E. Combined bottom and decompression times will not exceed the maximum allowable exposure time, as measured by Oxygen Toxicity Units (OTUs), for a given partial pressure of oxygen as listed in the latest edition of the NOAA Diving Manual.

#### 8.5.4 Air.

- A. Compressed air used with oxygen concentrations greater than 40 percent or when used in the preparation of Nitrox breathing mixtures with greater than 40 percent oxygen as the enriching agent, shall meet or exceed oxygen compatible air standards outlined in Section 6.6.5 F of this manual.

#### 8.5.5 Helium and Nitrogen.

- A. The maximum depth for decompression diving using open circuit scuba equipment shall be such that the  $PN_2$  does not exceed 4.00 ATA.
- B. The quality of helium used to produce breathing mixtures shall be no less than Prepurified Grade 4.5 (99.997% He) as well as meet the other requirements found in Military Specification MIL-PRF-27407B.
- C. If pure nitrogen is used to produce breathing mixtures, the quality shall be no less than Class I Oil Free, Grade B (99.50%  $N_2$ ) as well as meet the other requirements found in Federal Specification A-A-59155.

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## 8.5 Personnel Requirements

### 8.5.1 Minimum Diving Positions and Capabilities.

- A. Bottom divers.
  - 1. A minimum of two (2) divers, functioning as a buddy team.

2. Divers shall remain in sufficient proximity to each other at all times during the dive so they can render immediate assistance to each other if necessary.
- B. Standby, Safety, and Support Divers.
1. Tech Lite:
    - a. A minimum of one (1) on-bottom safety diver is required. Two (2) standby / support divers, capable of reaching the deepest decompression stop of the bottom divers and functioning as a buddy team OR two (2) standby / support divers, capable of reaching the maximum depth of the bottom divers and functioning as a buddy team, are recommended to be on site for all decompression diving operations.
    - b. On-bottom safety diver(s) must have no responsibilities other than to monitor and assist all other bottom divers in an emergency.
    - c. All safety, standby, and support divers will be trained on how to respond to a rebreather diver in an emergency including procedures for adding offboard gasses into the rebreather.
    - d. The standby / support buddy team will carry at least one (1) cylinder of all bailout gas mixtures being carried by the bottom divers undergoing decompression and have the same bailout tank configuration as the bottom divers.
    - e. During the bottom phase of the dive, the standby / support divers will act as standby divers and be ready to enter the water within two (2) minutes.
    - f. During the ascent / decompression phase of the dive, the standby / support divers will enter the water and act as support divers for the bottom divers.
  2. Advanced Mixed Gas.
    - a. A minimum of two (2) standby divers, functioning as a buddy team, are required for all decompression scuba diving operations in which all members of the bottom team are involved in scientific activities. Standby divers shall be similarly equipped and configured as the bottom divers and ready to enter the water within two (2) minutes of notification.
    - b. The TDS may choose to utilize an on-bottom safety diver(s) in lieu of surface-based standby divers based on an operational risk assessment of the planned activities. If the decision is to use on-bottom safety diver(s), safety diver(s) must have no responsibilities other than to monitor and assist all other bottom divers in an emergency.
    - c. Support Divers. Two (2) support divers may be required by the onsite TDS to support the bottom divers during the decompression phase of a dive occurring at a depth shallower than 130 fsw.

### 8.5.2 Minimum Topside Support.

- A. For non-deco CCR dives defer to basic OC topside requirements in 6.5.3
  - B. Decompression CCR dives require a Technical Diving Supervisor (TDS) that must:
    - 1. Must meet the qualifications described in Section 2.9 of this Manual;
    - 2. Must remain at the surface during diving operations; and
  - C. Vessel Operator:
    - 1. Must meet all NOAA SBP requirements.
    - 2. Must remain on the vessel during diving operations; and
    - 3. Must concur with the TDS on the commencement of diving operations and can terminate diving due to weather, vessel-related operational problems, or any other factors that may jeopardize the safety of the operation.
  - D. 'Tech Lite' – Rebreather Operations
  - E. All other standards, policies and regulations pertaining to decompression diving and rebreather operations apply to the 'Tech Lite' – Rebreather program.
  - F. Repetitive dives may be approved by the TDS, if appropriate and all other 'Tech Lite' standards are followed.
- 

## 8.6 Oxygen Rebreathers

### 8.6.1 Depth Limits.

Oxygen rebreathers shall not be used at depths greater than 20 fsw.

### 8.6.2 Flushing of Breathing Loop.

- A. Breathing loop and diver's lungs must be adequately flushed with pure oxygen prior to entering the water on each dive. Once done, the diver must breathe continuously and solely from the intact loop, or re-flushing is required.
  - B. Breathing loop shall be flushed with fresh oxygen prior to ascending to avoid hypoxia due to inert gas in the loop.
  - C. If a repetitive dive is conducted on an oxygen rebreather following an open circuit air dive, the loop shall be flushed every 15 minutes during the dive for the first hour, to eliminate any dissolved inert gas diffusing from the body.
-

## 8.7 Semi-Closed Circuit Rebreathers

### 8.7.1 Oxygen Parameters and Considerations.

- A. The composition of the injection gas supply of a semi-closed circuit rebreather shall be chosen such that the partial pressure of oxygen in the breathing loop will not drop below 0.20 ATA, even at maximum exertion at the surface.
- B. The gas addition rate of active addition SCRs (e.g., Draeger Dolphin and similar units) shall be checked before every dive to ensure it is balanced against expected workload and supply gas FO<sub>2</sub>.
- C. The intermediate pressure of supply gas delivery systems in active-addition SCRs shall be checked periodically for compliance with the manufacturer's recommendations.
- D. Maximum operating depth shall be based upon the FO<sub>2</sub> in the active supply cylinder.

### 8.7.2 Flushing of Breathing Loop.

- A. Immediately prior to beginning an ascent to the surface, the diver shall flush the breathing loop with fresh gas or switch to an open circuit system to avoid hypoxia.
- B. During ascents from dives deeper than 60 fsw, a second loop flush shall be completed at 30 fsw.

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## 8.8 Mixed Gas Closed-Circuit Rebreathers

### 8.8.1 Oxygen Parameters and Considerations.

- A. The FO<sub>2</sub> of each diluent gas supply used shall be chosen so that, if breathed directly while in the depth range for which its use is intended, it will produce an inspired PO<sub>2</sub> greater than 0.20 ATA but no greater than 1.30 ATA, unless approved by the TDS in very limited circumstances during mixed gas diving operations.
- B. MOD shall be based on the FO<sub>2</sub> of the diluent in use during each phase of the dive, so as not to exceed a PO<sub>2</sub> limit of 1.30 ATA.
- C. The PO<sub>2</sub> setpoint shall not be lower than 0.50 ATA nor higher than 1.30 ATA during the bottom phase of the dive.

### 8.8.2 Monitoring Oxygen Parameters

- A. Divers shall monitor both primary and secondary oxygen display systems at regular intervals throughout the dive to verify; readings are within limits, redundant displays are providing similar values, and whether readings are dynamic or static (as an indicator of sensor failure).



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## 8.9 Operational Requirements

### 8.9.1 General.

- A. All dives involving rebreathers must comply with applicable operational requirements for open circuit scuba dives to equivalent depths and decompression schedules.
- B. No rebreather system shall be used in situations beyond the manufacturer's stated design limits (e.g., dive depth, scrubber duration, age of oxygen sensors and water temperature).
- C. Written approval must be received from the manufacturer and the NDCSB prior to making any modifications to the life support components of rebreather systems.
- D. Rebreather maintenance is to be in compliance with the manufacturer's recommendations including sanitizing, replacement of consumables (e.g., oxygen sensors, carbon dioxide absorbent, gas, batteries), and periodic maintenance.
- E. Dive Plan. In addition to specialized dive plan components stipulated in Section 4.2.2 of this Manual, all dive plans that include the use of rebreathers must include, at a minimum, the following details:
  - 1. Information about the specific rebreather, including make, model, and type of rebreather system to be used, and other specific details as requested by the NDCSB;
  - 2. Type of carbon dioxide absorbent material;
  - 3. Composition and volume(s) of supply gases; and
  - 4. Description of alternate bailout procedures to be employed, including manual rebreather operation and open circuit procedures.
- F. If the rebreather diver will be diving with an open-circuit buddy, the buddy must be trained and qualified according to the standards in Section 4 of this manual.;
- G. The rebreather diver will always complete a CCR assembly checklist and present it to the TDS/DM/LD for confirmation that the checklist has been completed.
- H. The rebreather diver will always conduct an immediate pre-dive check of the gear before entering the water in accordance with unit specific requirements and Section 8.9.7 D and E of this manual;
- I. The rebreather diver will routinely practice the skills necessary to be able to respond to any of the contingencies listed in Section 8.9.12;

- J. Bailout gas requirement will be planned with a minimum 1.0 RMV (recommend 1.6 up to first decompression stop) and have enough for each individual diver to complete all required decompression for maximum depth and bottom time (no team-bailout). TDS may require higher RMV's based on operational requirements.
- K. Any "near miss" contingencies according to Section 8.9.12 will be immediately reported to the UDS who will then notify the LODO so that a corrective action can be addressed. No further diving will occur on the CCR unit or by that diver until the LODO has completed their review of the incident;
- L. The rebreather diver will always discuss contingency plans with topside support personnel, including: the length of the planned dive, the exit point of the dive, and what to look for (floats or bags) if the dive must be aborted, especially when two (2) or more rebreather divers are a buddy team; and
- M. The divers will maintain proficiency for their level of certification.

#### 8.9.2 Advanced Mixed Gas

- A. Diving projects involving the use of gas mixtures other than air or Nitrox, depths greater than 150 fsw, or decompression obligations exceeding 15 minutes must be approved by the NDCSB before diving activities begin.
- B. In order to evaluate the proposed diving activities, a detailed dive plan using NF 57-03-29 (CCR Decompression Diving Request) and DEAP must be submitted to the NDCSB for review a minimum of 30 days prior to the commencement of diving operations.

#### 8.9.3 Submission and Review Requirements.

- A. The dive plan shall include, but not be limited to, the following elements:
  - 1. Overview of the operations;
  - 2. Goals, objectives, and tasks to be accomplished;
  - 3. Description and location of dive site;
  - 4. Description of diving platform;
  - 5. Names, affiliations, roles/responsibilities, and qualifications of all participants;
  - 6. Schedule of operations;
  - 7. Dive schedules indicating breathing gases, volumes and decompression schedules for maximum planned and contingency depths and times;

8. Scrubber size, planned set point, support divers, bailout procedures and volumes.
9. Logistical arrangements and considerations;
10. Normal and emergency diving procedures;
11. Diving Emergency Assistance Plan; and
12. Supporting documents, permits, and forms.

#### 8.9.4 Dive Procedures.

##### A. Pre-Dive.

1. Particular attention should be paid to using rebreathers under conditions where vibration or pulsating water movement could affect electronics or control switches and systems.
2. Particular attention should be paid to using rebreathers under conditions where heavy physical exertion is anticipated.
3. Diver carried off-board bailout (independent of the CCR) is required with reserves adequate to return the diver to the surface while meeting proper ascent rate and stop requirements. and the system is configured to allow access to onboard gas. These calculations must take into consideration mixed mode operations where an open circuit diver could require assistance in an out of gas situation.
4. Platform specific Build, Pre-Dive, and Post-Dive checklists will be used during all operations.
5. Pre-Dive briefing will include rebreather operation, alarm/ hazard identification, system messaging, and rescue procedures for rebreather diving.

##### B. Repetitive Dives.

1. Both CNS and Oxygen Tolerance Units (OTUs) should be tracked for each diver.
2. Repetitive dives will be planned taking into consideration remaining usable scrubber time and gas pressures.

##### C. Post Dive.

1. Divers monitored post dive in accordance with policy.

#### 8.9.5 Buddy Qualifications for Teams with Mixed Equipment.

- A. An open circuit diver whose buddy is diving with a rebreather shall be trained in basic rebreather operation, hazard identification, and assist/rescue procedures for a rebreather diver. At a minimum, this training should include:
1. How to operate a DSV;
  2. How to read the PO<sub>2</sub> on the CCR diver's handset, computer and Heads Up Display (HUD);
  3. How to change the rebreather's handset controller to an appropriate PO<sub>2</sub>;
  4. How to ensure that the rebreather's oxygen supply and diluent gas supply are turned on;
  5. How to pipe in offboard gas via an off-board gas connection system
  6. Location and operation of the rebreather's Over-pressurization Relief Valve (ORV);
  7. How to access and operate the Automatic Diluent Valve (ADV);
  8. How to perform an open-loop diluent flush;
  9. How to operate the dive surface valve (DSV) or bailout valve (BOV), if equipped
  10. How to access and breathe from the CCR diver's bailout bottle; and
  11. How to rescue an unconscious CCR diver.
  12. A rebreather diver whose buddy is diving with open circuit gear must be equipped with a means to provide the open circuit scuba diver with a sufficient supply of open circuit breathing gas to allow both divers to return safely to the surface.

#### 8.9.6 Decompression Management.

- A. The NDCSB shall review and approve the method of decompression management selected for a given diving application and project.
- B. Decompression management can be safely achieved by a variety of methods, depending on the type and model of rebreather to be used. The following is a general list of methods for different rebreather types:
1. Oxygen rebreathers: Not applicable.
  2. SCR (presumed constant FO<sub>2</sub>):
    - a. Use of any method approved for open circuit scuba diving breathing air, shallower than the maximum operational depth of the supply gas.

- b. Use of open circuit Nitrox dive tables based upon exertion level of 2.5 liters per minute oxygen consumption. In this case, contingency air dive tables may be necessary for active-addition SCRs in the event that exertion level is higher than expected.
  - c. Equivalent air depth correction to open circuit air dive tables, based upon exertion level of 2.5 LPM oxygen consumption for planned exertion level, gas supply rate, and gas composition. In this case, contingency air dive tables may be necessary for active-addition SCRs in the event that exertion level is higher than expected.
3. CCR:
- a. Constant PO2 monitor, with an integrated constant PO2 computer being desirable.
  - b. One (1) non-integrated constant PO2 dive computer or two (2) if there is no integrated constant PO2 dive computer with open circuit bailout capabilities.
  - c. Constant PO2 dive tables with contingencies for next deeper, next longer and next deeper & next longer times and depths.
  - d. Appropriate open circuit bailout tables with contingencies for next deeper, next longer and next deeper & next longer times and depths.

C. Initial Management of Asymptomatic Skipped or Omitted Decompression stop for CCR and OC Divers.

Deepest Decompression Stop Omitted	Decompression Status	Time at surface	Action
20 fsw	Decompression stop required	<1 min.	If asymptomatic, return to 20 fsw. Increase 20 fsw stop time by 1 minute. Resume planned decompression at the point of interruption.
		>1 min*	Place diver on surface O2, begin transport to chamber ASAP, consult with DMO.

Deeper than 20 fsw	Decompression stop required	Have not returned to surface	Descend to the deepest stop omitted. Multiply all stops 40 fsw and shallower by 1.5. Resume decompression.
		Any	Place diver on surface O2, begin transport to chamber ASAP, consult with DMO.

### 8.9.7 Logs and Checklists.

- A. Manufacturer recommended logs and checklists specific to the make and model of the rebreather will be used before and after every dive. Divers shall indicate by signing their initials on the checklist that an inspection was performed prior to the dive and shall be confirmed by the TDS or another rebreather diver. Divers shall indicate by signing their initials that checklists have been completed before and after each dive. Such documents shall be filed and maintained for a period of one (1) year.
- B. Records of all maintenance performed on any rebreather shall be maintained in a log book dedicated to that individual rebreather. This permanent record log book shall travel with the rebreather and be available for inspection upon request. Rebreathers lacking log books shall not be used.
- C. No dive shall be made using a rebreather which has failed any portion of the pre-dive check, or is found to not be operating in accordance with the manufacturer's specifications.
- D. Pre-dive checks shall include:
  1. Gas supply cylinders filled to adequate pressure for the anticipated dive, leaving a reserve gas supply of at least 500 psi in each individual gas cylinder upon surfacing;
  2. Composition of all supply and bailout gases analyzed and documented;
  3. Oxygen sensors calibrated;
  4. Computer handset settings confirmed;
  5. Carbon dioxide canister properly packed;
  6. Remaining duration of canister life recorded;
  7. Breathing loop assembled;

8. Positive and negative pressure leak checks;
  9. Automatic diluent addition system working;
  10. Automatic oxygen addition systems working;
  11. With unit turned on (i.e., electronics controlling the unit), pre-breathe system for an adequate duration to confirm operation of oxygen sensors and automatic oxygen addition for at least three (3) minutes for operations planned in water warmer than 40° F or five (5) minutes in water colder than 40° F to ensure proper oxygen addition and carbon dioxide removal (be alert for signs of hypoxia or hypercapnia);
  12. Other procedures specific to the model of rebreather used;
  13. Documentation of ALL components assembled; and
- E. Final operational verification immediately before entering the water to include:
1. A positive pressure check of the BC;
  2. Check of the BC inflator to ensure proper function;
  3. A negative pressure check of the loop;
  4. Bailout life support is functioning;
  5. Oxygen addition system is functioning;
  6. Volumetric diluent addition (ADV) is functioning;
  7. Controller and computers are attached and turned on;
  8. All gas cylinder valves are open;
  9. A negative pressure check of the bailout second stage;
  10. Bailout bottles are securely attached, turned on and isolated or shut off;
  11. Pre-breathe the unit for 3-5 minutes (longer for colder water) with mask on;
  12. PO<sub>2</sub> in the breathing loop is not hypoxic or hyperoxic; and
  13. Bubble check upon entering the water.

#### 8.9.8 Alternate Life Support System.

- A. The diver shall carry an alternate life support system designed to safely return the diver to the surface at normal ascent rates, including any required decompression in the event of primary rebreather failure.

- B. The complexity and extent of such systems are directly related to the depth/time profiles of the mission. Examples of such systems include, but are not limited to:
  - 1. Open circuit bailout cylinders or sets of cylinders; or
  - 2. Redundant rebreather (diver worn).
- C. Pre-positioned life support equipment with topside support may be added as an additional layer of safety, but divers will always carry appropriate bailout gas.

#### 8.9.9 Carbon Dioxide Absorbent Material.

- A. Carbon dioxide absorption canister shall be filled in accordance with the manufacturer's specifications.
- B. Carbon dioxide absorbent material shall be used in accordance with the manufacturer's specifications for expected duration of dive.
- C. Unspent carbon dioxide absorbent material remaining in the canister following a dive must be discarded after 48 hours from initial filling, or according to the manufacturer's specification, whichever comes first.
- D. Long-term storage of carbon dioxide absorbents shall be in a cool, dry location in a sealed container. Field storage must be adequate to maintain viability of material until use.

#### 8.9.10 Consumables.

- A. Oxygen sensors shall be replaced no longer than 12 months after installation, 18 months after production or in accordance with the manufacturer's specifications, whichever comes first.
- B. The Diver will verify:
  - 1. the age of all oxygen sensors within the rebreather being used
  - 2. That the individual sensors are within the annual/ shelf life cycle.
- C. Oxygen sensors deemed to not be responding normally during the annual use cycle will be replaced as needed
- D. Other consumables (e.g., batteries) shall be maintained, tested, and replaced in accordance with the manufacturer's specifications.

#### 8.9.11 Disinfecting Units.

- A. The entire breathing loop, including mouthpiece, hoses, counterlungs, and carbon dioxide scrubber canister, shall be disinfected periodically according to the manufacturer's specifications.
- B. The loop must be disinfected between each use of the same rebreather by different divers.



## 8.9.12 CCR Contingency Protocols.

- A. The following contingencies cover the most common rebreather equipment and operational problems. It is not an all-inclusive list and cannot account for specific situations. These protocols shall be established, practiced, and reviewed by all participants prior to commencement of diving. This is not a substitute for formal training or manufacturers guidelines for model specific operations.
- B. Applicable open circuit emergency procedures for equipment failure at depth related to common gear elements apply
- C. Close the DSV or BOV if equipped, prior to removing the breathing loop from the mouth. This fundamental procedure is mentioned here and will not be repeated under the individual equipment failures list below.
- D. In all of the following contingencies, which require termination of the dive: Notify buddy and adjust dive computers if needed, and begin ascent conducting all necessary decompression stops while monitoring the gas supply. Dive teams will remain in close proximity in case additional assistance is needed. Deploy a SMB to notify topside when it will not delay time to surface.
  - 1. Out of gas, diluent cylinder: Switch to depth-appropriate bailout cylinder, either connecting directly to loop or moving to open circuit.
  - 2. Out of gas, oxygen cylinder: If conducting no-decompression dives, switch to a depth-appropriate bailout cylinder. If conducting decompression dives, connect the oxygen bailout, manually add O<sub>2</sub>, and monitor the PO<sub>2</sub>.
  - 3. Out of gas, lost bailout: Abort the dive and remain close to buddy during ascent in case of additional failure.
  - 4. Gas leak, source of problem obvious: If the diver can see where the leak is occurring, secure the flow of the affected gas supply by either isolating or disconnecting the failing equipment. If the problem is not resolved, the diver will close the valve on the affected side. Either switch to open circuit or connect appropriate bailout gas to the loop.
  - 5. Gas leak, source of problem not obvious: Turn off both the diluent and oxygen valves. Immediately look at both pressure gauges and note on which gauge the pressure is falling. Leave the affected side closed, open the unaffected side, and check PO<sub>2</sub>. If diluent gas loss occurred, connect appropriate bailout cylinder or switch to open circuit. If oxygen gas loss occurred, switch to open circuit immediately. In either case, notify buddy of problem and abort the dive.

6. Gas leak, slow into loop: Leaks into loop may occur and may not be heard; instead, may increase buoyancy and create slow PO<sub>2</sub> changes. Consider feathering or switching to open circuit if buoyancy or PO<sub>2</sub> cannot be controlled. Notify buddy and abort the dive.
7. Stuck manual addition valves: Disconnect inflator hose to addition valve. Check the PO<sub>2</sub>. Notify buddy and abort the dive. If able to maintain stable PO<sub>2</sub>, remain on the loop. If unable to maintain stable PO<sub>2</sub>, switch to an appropriate open circuit gas.
8. Oxygen solenoid stuck open: If the oxygen solenoid is stuck open, immediately close the oxygen valve, conduct a diluent flush to bring down the PO<sub>2</sub>, and check PO<sub>2</sub>. Feather the oxygen valve to maintain an appropriate PO<sub>2</sub>. If a bailout cylinder of oxygen is available, manually connect it to the loop. If an appropriate PO<sub>2</sub> cannot be maintained, switch to an appropriate bailout gas. In either case, notify buddy of the problem and abort the dive.
9. Oxygen solenoid stuck closed: If the oxygen solenoid is stuck closed, first ensure that the oxygen valve on the tank is open. If it is, manually add oxygen to maintain an appropriate PO<sub>2</sub>. If a bailout cylinder of oxygen is available, it can be connected to the loop. If an appropriate PO<sub>2</sub> cannot be maintained, switch to open circuit. In either case, notify buddy and abort the dive.
10. Partially Flooded Loop: Close the loop and lift hoses above head to move water down to exhalation counterlung. Perform diluent flush if needed. If this does not resolve the problem, switch to an appropriate open circuit bailout gas, notify buddy, and abort the dive. Be aware of the potential for a caustic cocktail.
11. Totally Flooded Loop: A totally flooded loop is non-recoverable. Immediately switch to an appropriate open circuit gas, notify buddy, and abort the dive.
12. Total Electronics Failure: Immediately switch to an appropriate open circuit gas, notify buddy, and abort the dive.
13. Over-pressurization Relief Valve Failure (ORV): If the ORV fails and will not vent gas from the counterlungs on ascent, vent excess gas through the mouth around the mouthpiece or through the nose.
14. Low PO<sub>2</sub>: DO NOT ASCEND until the situation has been corrected. Immediately attempt to add oxygen via the manual addition valve. Check the PO<sub>2</sub>, cylinder pressures, and ensure that valves are open. If able to maintain stable PO<sub>2</sub>, remain on the loop. If unable to maintain stable PO<sub>2</sub>, switch to an appropriate open circuit gas, notify buddy, and abort the dive.

15. High PO<sub>2</sub>: DO NOT DESCEND until the situation has been corrected. Immediately perform a diluent flush. Check the PO<sub>2</sub>, cylinder pressures, and ensure that valves are open. If able to maintain stable PO<sub>2</sub>, remain on the loop. If unable to maintain stable PO<sub>2</sub>, switch to an appropriate open circuit gas, notify buddy, and abort the dive.
16. Hypercapnia: Immediately switch to an appropriate open circuit gas, notify buddy, and abort the dive. Do not go back on the loop.
17. Omitted decompression: Follow procedures outlined in Section 8.9.6.
18. Dive team unable to reach down-line: If a down-line is used and dive team is unable to reach the down-line during deployment, the divers shall abort the dive and return to the surface. The divers shall then be recovered to the primary support vessel and may elect to make a second drop.
19. Aborted dive procedures. If the dive is aborted for any reason, follow the decompression schedule on the diver's computer and reassess impacts to subsequent dives with the guidance of the TDS. Deploy a SMB to notify topside when it will not delay time to surface.
20. Dive team separated during deployment or bottom phase. If divers find themselves separated from their buddy(ies), the divers should abort the dive after searching for team members for no more than five (5) minutes if gas reserves allow and return to the surface. Deploy a SMB to notify topside when it will not delay time to surface.
21. Dive team separated on dive site: The Research (bottom) Divers will remain in constant contact (visual range and close enough to render immediate assistance) at all times during the dive. At no time during the dive (regardless of visibility), will the Bottom Divers be separated by more than fifteen (15) feet. Separated divers will perform a visual search for each other for one minute before returning to the base of the down-line or rendezvous point if a down-line is not used. Once at the down-line or rendezvous point, separated divers will allow no more than four minutes to reunite. If the divers have not found one another within five (5) minutes they will abort the dive and head to the surface using appropriate ascent techniques and decompression procedures.
22. Dive team swept off dive site or unable to locate ascent-line. Divers stay together; attempt to regain position on dive site for no more than five (5) minutes if gas reserves allow. If unable to return to the dive site, deploy a SMB, abort the dive, and safely ascend as a team. Exercise appropriate decompression procedures.

23. Diver entanglement on bottom. Evaluate the nature of entanglement and attempt to free self or signal buddy(ies) for assistance. If using the standby diver mode and situation cannot be resolved, deploy SMB to alert topside to deploy standby divers for assistance.
24. Dive team ascends to the surface, but the dive support vessel is gone: Divers stay together upon reaching surface. Use appropriate signaling device to signal support boat. Consider ditching weights in prolonged drifting situations.
25. Buoy or down-line breakaway: Divers shall shoot a bag to the surface on a line reel then decompress on the line in the same manner as if unable to locate the down-line.
26. Change in environmental conditions during the dive.
27. Current Strength - If there is a significant increase in current strength during a dive and using a fixed down-line, divers should consider drift decompression to be the preferred method.
28. Surface Waves or Swell Height - In instances where there is significant movement of the ascent line, divers should employ one or more lengths of "Jon line" to dampen the motion. Otherwise, consider drift decompression.
29. Visibility - If decreased visibility compromises appropriate buddy contact or the ability to complete the task, the divers should terminate the dive.
30. Water Temperature - Divers should wear adequate thermal protection for the coldest portion of a dive. If water temperature decreases significantly, the dive should be terminated.

#### 8.9.13 CCR Unconscious Diver Rescue and Emergencies.

- A. Divers should prioritize their own safety during all rescue attempts.
- B. Non-responsive under water
  1. Attempt to establish responsiveness. If non-responsive, gain positive control of the diver. Keep DSV in the diver's mouth if present to protect the airway. Verify PO<sub>2</sub> on the diver's hand set and attempt a diluent flush if possible. If the DSV is not in the diver's mouth, close the DSV. Bring the diver to the surface as fast as safely possible while venting expanding gas from counter lungs, BCD, and/ or dry suit. Once on the surface, position the diver face up, close the loop, and establish positive buoyancy.

2. If a decompression obligation exists and the diver regains consciousness consider lowering their set point. If the diver is unconscious, either send the diver to the surface by inflating the wing or attaching a lift bag; or consider bringing the diver to the surface and follow omitted decompression procedures outlined in 8.9.6 depending on available resources.
3. Refer to the flowchart located in the appendix.

C. Non-Responsive on the Surface

1. Position diver in a face up position. Close diver's DSV and establish positive buoyancy.
2. Position Refer to the flowchart located in Appendix.

D. Caustic Cocktail

1. If the caustic cocktail enters the mouth, rinse the mouth with surrounding water immediately. If the caustic cocktail was swallowed, drink fresh water, DO NOT attempt to neutralize with vinegar or other acids. If a caustic cocktail has been inhaled and/or burns are present, consider supplemental oxygen, and seek immediate medical treatment.

8.9.14 Post-dive review:

- A. Following the occurrence of any of the above scenarios, a post-dive "stand down" will be initiated to thoroughly review the event. After review, mitigation protocols will be established to prevent recurrence and the "stand down" may be lifted by the TDS.
- B. If deemed a reportable incident, diving shall be suspended. The incident will be reported in accordance with NOAA Diving Program and SECO requirements listed in Section 12.3.

## **Section 9: CAVE, CAVERN and WRECK PENETRATION DIVING STANDARDS and PROCEDURES**

### **9.1 General**

Operations in restricted overhead environments involve the penetration of natural (e.g. caves and cavern systems) or manmade (e.g. shipwrecks) structures. Such operations are a specialized technique requiring training and equipment beyond that used for other diving modes. In addition to training, divers must demonstrate that they possess the proper attitude, judgment, and discipline to safely conduct cave, cavern or wreck penetration diving operations. At this time NOAA is building capacity for these types of missions but is not operational in this mode; the following section describes established best practices for cave, cavern and wreck penetration diving.

### **9.2 Unique Hazards**

- A. Obstructed direct ascent to the surface because of rock formations or manmade structure.
- B. The absence of natural light.
- C. Surge, current or flow that vary in strength and direction. Of particular note is a condition known as siphoning. Siphoning caves have flow or current directed into the cave. This can cause poor visibility as a result of mud and silt being drawn into the cave entrance. Likewise, siphons present gas management considerations when a dive must be turned in response to a present or developing need to swim against the flow to exit.
- D. The presence of rust, silt, sand, mud, clay or other sediments that can cause visibility to be reduced to zero very quickly.
- E. Restrictions which make air sharing difficult. Restrictions are defined as passages through which two divers cannot easily pass side by side while sharing air.
- F. Cave-ins are a normal part of the geologic process. While the severity of a cave-in could be severe, the likelihood of occurrence during a diving operation is remote.
- G. Shipwrecks are considered less stable than cave-systems. Structural collapse or instability within a shipwreck is possible from diver movements and gas accumulation.
- H. Entanglement is a heightened hazard in wreck and cave diving. Guidelines are used for navigation which have the potential for fouling.
- I. Shipwrecks may present site-specific and unique hazards from the contents of its cargo to derelict net entanglement.

### **9.3 Combination with Other Diving Modes**

- A. If a cave, cavern or wreck dive also involves staged decompression, rebreathers, and/or mixed gas diving, all requirements for each of the relevant diving techniques, modes, or gases must also be met.
- B. If a conflict exists between this section and other sections in this Manual, the information set forth in this section only takes precedence when the diving being conducted takes place wholly or partly within an underwater cave, cavern or wreck.

## 9.4 Training

Instructors must be certified for the training provided and approved by the NDCSB.

### 9.4.1 Prerequisites

Activity / Status	Cavern	Open Circuit Cave	Closed Circuit Cave	Wreck
Currently authorized with depth qualification sufficient for proposed training location(s)	X	X	X	X
Completion of a minimum of 25 dives.	X	-	-	
Cavern Diver Authorization	-	X	X	X

### 9.4.2 Academic

Topic	Cavern	Open Circuit Cave	Closed Circuit Cave	Wreck
General				
Policy for diving overhead environments	X	X	X	X
Environment and environmental hazards	X	X	X	X
Accident analysis	X	X	X	X
Psychological considerations	X	X	X	X

Required equipment and equipment configuration				
Single cylinder with H or Y Valve	If applicable	If applicable	-	If applicable
Doubles with Isolation Manifold	If applicable	If applicable	-	If applicable
Side Mount	-	If applicable	If applicable	If applicable
No Mount	-	If applicable	If applicable	If applicable
Stage Cylinder(s)	-	If applicable	If applicable	If applicable
Off-board Bailout	If applicable	-	X	X
Communications	X	X	X	X
Diving Techniques				
Body control	X	X	X	X
Navigation and guidelines	X	X	X	X
Entry and Exit Protocols (Right of Way)	X	Review	Review	X
Use of line arrows and cookies	X	X	X	X
Line Systems Applicable to the Area and/or Cave System	X	Review	Review	If applicable
Line Jumps	-	X	X	-
Circuits	-	X	X	-
Dive Planning				
Rule of Sixths	X	Review	Review	X
Rule of Thirds	X	Review	Review	X
Gas Matching	If applicable	X	X	X
Decompression Theory	Review	Review	Review	Review
Dive Tables	Review	Review	Review	Review
Mixed Mode Diving	If applicable	If applicable	If applicable	If applicable
Cave geology	X	Review	Review	-
Unique Shipwreck Hazards	-	-	-	X



## 9.4.3 Practical

Topic	Cavern	Open Circuit Cave	Closed Circuit Cave	Wreck
Practical Training and Evaluation				
Land Drills				
Line Reel Use	X	Review	Review	X
Techniques and Considerations for Laying a Guideline	X	X	X	X
Guideline Following	X	Review	Review	X
Buddy Communication	X	Review	Review	X
Team Positioning for Normal Entry and Exit	X	X	X	X
Zero Visibility Drills				
Line Reel Use	X	Review	Review	X
Line and Line Arrow Identification and Following	X	Review	Review	X
Bump and Go (Skills description)		X	X	X
Emergency Procedures				
How far can you go out if out of gas? (Skills description)	X	X	X	X
Team Positioning for Emergency Situations	X	X	X	X
In Water				
Demonstrated skills must include a minimum of:				
A minimum of four (4) cavern dives, preferably to be conducted in a minimum of two (2) different caverns	X	-	-	-
A minimum of twelve (12) cave dives, preferably to be conducted in a minimum of four (4) different cave sites with differing conditions	-	X	X	-

A minimum of twelve (12) wreck dives, preferably to be conducted in a minimum of four (4) different wreck sites with different conditions and hazards	-	-	-	X
Safety drill (S-drill) – Performed on every dive	X	X	X	X
Review of Dive Plan and Turn Pressures	X	X	X	X
Essential Gear Identification, Positioning, and Function Check	X	X	X	X
Proper Valve Position Check	X	X	X	X
Bubble Check	X	X	X	X
Proper Buoyancy Compensator Use	X	X	X	X
Proper Trim and Body Positioning	X	X	X	X
Hovering and Buoyancy With Hand Tasks	X	X	X	X
Specialized Propulsion Techniques and Anti-Silting Techniques (modified flutter kick, modified frog kick, pull and glide, ceiling walk or shuffle)	X	X	X	X
Proper Light and Hand Signal Use	X	Review	Review	X
Proper Reel and Guideline Use	X	X	X	X
Ability to Deploy a Primary Reel and Tie Into a Main Line Under Different Conditions (Flow, Visibility, Bottom/Silt, etc.)	X	X	X	X
Proper Line Placement and Etiquette	X	X	X	X
Proper Use of Safety Reel	-	X	X	X
Proper Use of Jump/Gap Reel(s)	-	X	X	If applicable
Use of Drop/Stage Cylinders				
Proper Placement and Retrieval of Cylinder(s) With Minimal Disturbance of Environment and Visibility	-	If applicable	If applicable	If applicable
Ability to Deploy and Retrieve Cylinders With Minimal Loss of Forward Progress	-	If applicable	If applicable	If applicable
Surveying	If applicable	If applicable	If applicable	If applicable
Ability to Properly Critique Their Dives and Performance	X	X	X	X

Zero Visibility Drills	If applicable	X	X	X
Line Reel Use	X	Review	Review	X
Buddy Communication	X	-	-	X
Line and Line Arrow Identification and Following	X	Review	Review	X
Bump and Go (Skills Description)	-	X	X	X
Emergency Procedures				
Team Positioning for Emergency Situations	X	X	X	X
Lost Line (Skills Description)	-	X	X	X
Lost Buddy	X	X	X	X
Gas Sharing While Following Guideline (Conducted with and without visibility, As Donor and Receiver)	X	X	X	X
Gas Sharing in a Minor Restriction Using a Single File Method As Donor and Receiver	-	X	X	X
Valve Manipulation	X	X	X	X
Proper Attitude, Judgment, and Discipline To Safely Conduct Dives In An Overhead Environment	X	X	X	X
Written Examination				
A written evaluation approved by the NDCSB with a predetermined passing score, covering concepts of both classroom and practical training	X	X	X	X

## 9.5 Equipment

Equipment used in cave or cavern diving is based on the concept of redundancy. Redundant equipment must be carried whenever the planned penetration distances are such that an emergency swimming ascent is not theoretically possible.

Minimum Equipment	Open Circuit Cavern	Closed Circuit Cavern	Open Circuit Cave/Wreck	Closed Circuit Cave/Wreck
At a minimum, a single cylinder with adequate volume to allow divers to exit from farthest/deepest penetration while supporting self and dive buddy equipped with a "K" valve; standard reg configuration; and BCD	X	-	-	-
At minimum, a single cylinder equipped with an "H" or "Y" valve or an alternate gas supply with adequate volume and to allow divers to exit from farthest and deepest penetration while supporting self and dive buddy	-	-	If applicable	-
Off-board/bailout gas supply of sufficient volume and configured to allow diver to exit from farthest/deepest penetration	If applicable	X	-	X
BCD capable of being inflated from the cylinder	X	X	X	X
Slate and pencil	X	X	X	X
A functioning primary light with sufficient burn time for the dive	-	-	X	X
Two functioning battery powered secondary lights	X	X	X	X
Two cutting devices	X	X	X	X
One primary reel of at least 350 feet (106 m) for each team	X	X	X	X
Safety reel with at least 150 feet (45.6 m) of line	-	-	X	X
Directional Line Markers	-	-	X	X

Cylinders with dual orifice isolation valve manifold or independent SCUBA systems* with enough volume for the planned dive plus required reserve	-	-	X	-
Two completely independent regulators, at least one of each having submersible tank pressure gauge and a low pressure inflator for the BCD	-	-	X	-
One regulator to be configured with a five foot or longer second stage hose	-	-	X	-
Closed Circuit Rebreather	-	X	-	X
Off-board Bailout of sufficient capacity for the diver to exit	-	X	-	X
*Independent SCUBA systems must be able to monitor gas pressures in each cylinder				

## 9.6 Operational Requirements and Safety Protocols

Topic or Activity	Cavern	Cave	Wreck
Prior to accessing a wreck, a thorough historical assessment should be made to identify any unique hazards that may be present. When possible, a briefing should include a description of the design and layout of the wreckage to familiarize divers with expectations.	-	-	X
Diving must not be conducted at penetration distance into the overhead environment greater than 200 feet (60 m) from the water's surface, with a depth limit of 100 feet (30 m)	X	-	-
Dive teams must perform a safety drill prior to each dive that includes equipment check, gas management, and dive objectives	X	X	X
Each team within the overhead zone must utilize a continuous guideline appropriate for the environment leading to a point from which an uninterrupted ascent to the surface may be made	X	X	X
Gas management must be appropriate for the planned dive with special considerations made for; DPV's, siphon diving, rebreathers, etc.	X	X	X
The entire dive team is to immediately terminate the dive whenever any dive team choose to do so.	X	X	X

## Section 10: EMERGENCY PROCEDURES

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### 10.1 Diving Accident Management

#### 10.1.1 General.

- A. Diving accident management encompasses accident prevention and the development of a Diving Emergency Assistance Plan (DEAP) that includes procedures for the emergency care of victims after an accident.
- B. The activation of a DEAP includes, but is not limited to:
  - 1) Stabilization of life sustaining functions;
  - 2) Administering oxygen;
  - 3) Contacting medical personnel and suggested services for assistance and advice;
  - 4) Activating pre-planned methods of evacuation;
  - 5) Ensuring all divers are accounted for before departing the dive site; and
  - 6) Securing all gear of the affected diver(s) to assist in subsequent investigations:
    - a. Not disassembling gear beyond what is required to extricate diver(s);
    - b. Recording cylinder pressure from gear involved in incident;
    - c. Closing cylinder valve and record number of turns needed to fully close; and
    - d. Maintaining visual contact with incident gear until it can be secured in access-controlled location.
- C. The primary reference documents for NOAA Diving Accident Management are:
  - 1) [Diving Emergency Assistance Plan \(DEAP\)](#);
  - 2) [NOAA Diving Accident Management Field Reference Guide](#);
  - 3) [NOAA Diving Medical Standards and Procedures Manual](#); and
  - 4) [Operating Standards for NOAA Hyperbaric Chambers](#).

#### 10.1.2 Diving Emergency Planning.

- A. Unless a DMO or DMT is available on-site, the DM or LD shall have the ultimate on-site authority for management of diving related accidents and injuries until the patient is turned over to EMS or other advanced care providers.
- B. Each DM or LD will develop a DEAP.
  - 1) Use [NOAA Form 57-03-30 Dive Mission Execution](#) for this purpose.
  - 2) The DEAP shall be submitted to the UDS and once approved, to [ndp.diveplans@noaa.gov](mailto:ndp.diveplans@noaa.gov) as follows:
    - a. Annually; and
    - b. If the DEAP changes for any reason during the year (e.g., diving is conducted in a different geographic region, treatment facilities change).
  - 3) An approved copy of the DEAP shall be made available to all divers and support personnel at the diving location for the duration of the operation.

#### 10.1.3 Medical Consultation.

- A. Seek advice from a qualified healthcare provider at the first sign of any hyperbaric or other significant diving related injury or illness.
- B. Medical advice from a qualified healthcare provider shall only be changed or modified when:
  - 1) Contradicting instructions are received from a more highly qualified consulting DMO or healthcare provider with specialty training in undersea hyperbaric medicine; or
  - 2) In life threatening situations requiring immediate on-site deviation from standards. A written record of the deviation shall be made and the NDMO briefed as soon as possible after the change.
- C. Initial consultation for NOAA related diving maladies shall be attempted with the NDMO, unless there is another NOAA DMO onsite. The NDMO should be consulted via (855) 822-3483 for all NOAA related diving maladies.
- D. Types of secondary consultations for NOAA related diving maladies when the NDMO is not available include:
  - 1) NOAA ships may consult with the on-call DMO at the Navy Diving and Salvage Training Center (NDSTC) or Navy Experimental Diving Unit (NEDU), Panama City, FL; or
  - 2) All other units shall contact Divers Alert Network (DAN), Durham, NC.
- E. Contact information for both the primary and secondary consultations shall be listed on the DEAP and verified prior to commencing diving operations.

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## 10.2 Emergency Protocols

### 10.2.1 General Procedures for Treatment of Diving Maladies.

- A. Details on how to diagnose and report diving maladies can be found in the [NOAA Diving Accident Management Field Reference Guide](#).
- B. Treatment for diving maladies will be performed in accordance with current medical standards as prescribed by the NDMO.
- C. Qualified personnel, within the scope of their training and certification level/status, are authorized to perform the protocols listed in this section as indicated for signs or symptoms of decompression illness.

### 10.2.2 Medical Instructions for Conscious Patients.

The following procedures may be used for the treatment of a conscious diver when a DMO is not available at the diving location and they are within the scope of the attendant's training and certification level/status:

- A. Check circulation, airway, and breathing;
- B. Administer 100 percent oxygen;
- C. Remove exposure suit, dry patient, and keep warm;
- D. Place patient in position of comfort;
- E. Take vital signs every five (5) minutes if unstable and every 15 minutes if stable;
- F. Gather diving profile history information from the previous 48 hours for diver, buddy and/or eyewitnesses;
- G. Perform field neurological exam; and
- H. Contact the on-call DMO and Emergency Medical Services (EMS) as soon as possible.

### 10.2.3 Medical Instructions for Unconscious Patients.

The following procedures may be used for the treatment of an unconscious diver when a DMO is not available at the diving location and they are within the scope of attendant's training and certification level/status:

- A. Check circulation, airway, and breathing;
- B. Administer 100 percent oxygen via appropriate delivery device;
- C. Remove exposure suit, dry patient, and keep warm;



- D. Apply AED pads and follow AED instructions to analyze cardiac rhythm;
  - D. Unless CPR or rescue breathing is required, place patient on their left side with the right thigh and knee drawn up;
  - E. Take vital signs every five (5) minutes;
  - F. Gather diving profile history information from the previous 48 hours for from diving buddy and/or eyewitnesses;
  - G. Perform applicable components of field neurological exam and Glasgow Coma Scale evaluation; and
  - H. Contact the on-call DMO and EMS as soon as possible.

#### 10.2.4 No Hyperbaric Chamber at Diving Location.

If there is no hyperbaric chamber available at the diving location, initiate the following protocol:

- A. Administer 100 percent oxygen;
- B. Conduct field neurological exam and gather data for medical consultation;
- C. Contact medical personnel for assistance and advice as soon as possible as outlined in Section 11.1.3 Medical Consultation;
- D. Administer medications, drugs, and fluids as directed by the on-call DMO;
- E. Follow other specific directions, recommendations, and precautions concerning the treatment and/or evacuation of the diver as medically directed or within the scope of attendant's training and certification level/status;

#### 10.2.5 Hyperbaric Chamber at Diving Location.

The following procedures may be used for the treatment of decompression illness in the event a qualified DMO is not available at the chamber:

- A. Type I Decompression Sickness (DCS).
  - 1) Place diver on 100 percent oxygen and contact the on-call DMO for instructions prior to pressurizing the diver in a hyperbaric chamber.
  - 2) If unable to contact the on-call DMO immediately, or signs or symptoms indicate progression to Type II DCS, pressurize diver to 60 fsw (2.80 ATA) and begin a USN TT6. If still unable to contact the DMO, continue USN TT6 until completion and then inform the NDMO as soon as possible.
- B. Type II DCS or Arterial Gas Embolism (AGE).

- 1) Place diver on 100 percent oxygen and contact the on-call DMO immediately. Prepare to pressurize diver to 60 fsw (2.80 ATA) and begin a USN TT6.
  - 2) If unable to contact the on-call DMO, pressurize diver to 60 fsw (2.80 ATA) and begin a USN TT6.
- C. Treatment options based upon chamber type.
- 1) A multi-place, multi-lock hyperbaric chamber is suitable for the treatment of all hyperbaric injuries.
  - 2) A single-place, single-lock chamber (e.g., Hyperlite) is only suitable for conscious patients.

#### 10.2.6 Post-Treatment Procedures.

- A. Conduct repeat neurological exams at the conclusion of treatment, after one (1) and six (6) hours following treatment and at intervals of six (6) hours thereafter, or as advised by the consulting DMO, until diver is seen by a qualified healthcare provider.
- B. Patients treated for Type I decompression sickness symptoms with complete resolution will be advised to report to a medical facility for medical examination upon completion of the recompression treatment.
- C. Immediate transportation of the patient to a medical facility for medical examination following hyperbaric treatment is required when:
  - 1) Directed by the consulting DMO;
  - 2) Treatment was for Type II or AGE symptoms; or
  - 3) Residual symptoms continue after treatment.

#### 10.2.7 Temporary Suspension from Diving.

- A. Divers treated for any pulmonary barotrauma or decompression related illness shall not engage in diving activities involving hyperbaric exposures until approved in writing by the NDMO.
- B. For further guidance on returning to diving after decompression sickness, refer to the NOAA Diving Medical Standards and Procedures Manual.

#### 10.2.8 Other Emergency Considerations.

In addition to diving concerns, DMs and LDs should also consider emergency procedures for fighting fire, adverse environmental conditions, illness, and injury and include these in their dive planning and pre-dive briefing.

## Section 11: RECORDKEEPING AND REPORTING REQUIREMENTS

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### 11.1 Recordkeeping

#### 11.1.1 General.

- A. Nothing in this section allows for the disclosure of information in violation of the Privacy Act or destruction of documents unless that destruction is in accordance with applicable records retention schedules, regulations and laws.
- B. The NDC shall maintain records for each certified NOAA Diver, including, but not limited to:
  - 1) Evidence of certification level;
  - 2) Training;
  - 3) Dive logs;
  - 4) Results of current physical examination;
  - 5) Reports of disciplinary actions by the NDCSB;
  - 6) First aid, CPR, including adult AED, and oxygen delivery certifications; and
  - 7) Other pertinent information deemed necessary by the NDCSB.

#### 11.1.2 Unit Training Log.

The Unit Diving Supervisor at each unit shall maintain a current record of operational diving information, training accomplished, drills, and equipment service/testing conducted at the unit level that are not retained in the NOAA Dive Log, for ease of tracking and verification by DUSA inspectors.

#### 11.1.3 Availability of Records.

- A. Upon the request of the Assistant Secretary of Labor for OSHA (Assistant Secretary), or the Director of the National Institute for Occupational Safety and Health from the Department of Health and Human Services, or their designees; the employer shall make available for inspection and copying any record or document required by this standard.
- B. Records and documents required by 29 CFR 1910, Subpart T shall be provided upon request to employees, designated representatives, and the Assistant Secretary in accordance with 29 CFR 1910.1020 (a)-(e) and (g)-(i).

- C. Safe practices manuals (29 CFR 1910.420), depth-time profiles (29 CFR 1910.422), decompression procedure assessment evaluations (29 CFR 1910.423), and records of hospitalizations (29 CFR 1910.440) shall be provided in the same manner as employee exposure records or analyses using exposure or medical records.
- D. Equipment inspections and testing records that pertain to employees (29 CFR 1910.430) shall also be provided upon request to employees and their designated representatives.
- E. Except as prohibited by the Health Insurance Portability and Accountability Act of 1996 (HIPAA) or other laws, copies of NDC records are available for review by the NDSO, SECO, NDC personnel and NDCSB members.
- F. Medical records belonging to an individual diver or former diver shall be made available to that individual upon written request.
- G. Medical records may also be provided to other treating providers of a diver or former diver under HIPAA.

#### 11.1.4 Retention of Records.

- A. The following records shall be retained for the following minimum periods:
- B. After the expiration of the retention period of any record, the record may be further retained or destroyed at the discretion of the NDPM and in accordance with 29 CFR 1910.1020 (h) [Transfer of Records] and the appropriate NOAA Records Management Schedule.
- C. In the event NOAA ceases operations:
  - 1) The successor employer shall receive and retain all diving, equipment and employee medical records required by this standard; or
  - 2) If there is no successor employer, diving, equipment and employee medical records shall be forwarded to the National Institute for Occupational Safety and Health in the Department of Health and Human Services.

Record	Period at NDC	Period at Diving Units
Dive Plan and JHA	Indefinite maintenance via <a href="mailto:ndp.diveplans@noaa.gov">ndp.diveplans@noaa.gov</a>	Filed at <a href="mailto:ndp.diveplans@noaa.gov">ndp.diveplans@noaa.gov</a> .
GAR and DEAP (ORM Dive Execution)	DEAP: One (1) year, GAR not maintained at NDC. However, following a reportable diving injury both are included in the Diving Incident Report Case File and retained indefinitely.	48 hours post operation.
Rebreather build checklists	Not applicable unless included in a Diving Incident Report Case and retained indefinitely.	File Maintained for the life of the equipment
Diver medical records	Duration of diver's active service plus seven (7) years, then forwarded to the Federal Records Center and kept for 72 years before destruction.	Medical records covered by HIPAA are not to be maintained at unit sites.
NOAA Diving Standards and Safety Manuals	Permanent.	Current manual available.
On-site Supervisor's Dive Log	In the event of a reportable diving injury, shall be included in the Diving Incident Report Case File and retained indefinitely.	48 hours post operation.
On-line Dive Log	Permanent.	Not applicable.
Dive Incident Report	Permanent.	Not applicable.
Equipment inspection and testing	Current entry or until removed from service, except following a reportable diving injury, when it is included in the Diving Incident Report Case File and retained indefinitely.	Current entry or until removed from service Compressor logs shall be maintained for the life of the equipment.
Records of hospitalizations	Permanent.	Not applicable.
NOAA-owned Off-duty Equipment User Agreement	Not applicable unless included in a Diving Incident Report Case File and retained indefinitely.	For the term of the diver's participation in the NDP or until the use of NOAA-owned gear is terminated.
NOAA-owned Off-duty Equipment User Release of Liability	Not applicable unless included in a Diving Incident Report Case File and retained indefinitely.	For the term of the diver's participation in the NOAA-owned Off-duty Equipment program.

## 11.2 Reporting

### 11.2.1 Logging of Dives.

- A. The NDP Supervisor's Dive Log (or analogous form) must be used to log all on-duty dives and must be kept on site for no less than 48 hours post operation.
- B. All NOAA divers are required to log all dives using NOAA-owned gear and all on-duty dives using personally-owned gear.
- C. All NOAA divers are encouraged to log off-duty dives using personally-owned gear.
- D. Dives shall be logged as soon as possible after completion, using the web-based recording system available on the NDP website.
- E. A dive is defined as any time spent breathing compressed gas underwater or in a hyperbaric chamber, and is considered completed when an individual returns to surface pressure and remains there for a minimum of 10 minutes.
- F. The following information shall be recorded and maintained for each diving operation:
  - 1) Name(s) of diving buddy(ies), including DM or LD;
  - 2) Date, time, and location;
  - 3) Diving modes used;
  - 4) Breathing gases used;
  - 5) Type of dive (i.e., Working or Scientific);
  - 6) On-duty, or off-duty with NOAA-owned gear;
  - 7) Any specialized equipment used;
  - 8) Diving platform;
  - 9) Tasks performed;
  - 10) Approximate underwater and surface conditions (i.e., visibility, water temperature and current speed);
  - 11) Maximum depth and bottom time for each diver;
  - 12) Decompression mode (tables or dive computer); and
  - 13) Completion of a safety stop (if performed).

## Section 12: DIVING ACCIDENT NOTIFICATION AND INVESTIGATION

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### 12.1 General

- A. The first response to any diving accident is the prompt and appropriate attention to any medical emergencies and is covered in Section 10 of this Manual.
- B. Diving accidents require two (2) administrative responses: notification and investigation.
- C. The severity of the injury or property damage determines the timeline that must be followed for notification and the scope and scale of the investigation, see section 12.3.2 for a table on reporting timelines.
- D. The NDP follows the accident classification system designed by NOAA's Safety and Environmental Compliance Office (SECO). The notification and investigation procedures followed by NDP meet or exceed the SECO requirements, but may not interfere with the primary investigation headed by SECO.
- E. All diving related accidents, incidents and near-misses occurring while performing official NOAA duties shall be reported to SECO via its website, <https://nsdesk.servicenowservices.com/noaasafe>.

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### 12.2 Accident Classification

#### 12.2.1 Class A Accident.

- A. An accident in which:
  - 1) The resulting total cost of property damage or environmental clean-up is \$1,000,000 or more.
  - 2) A NOAA aircraft or NOAA ship is destroyed, missing, or abandoned.
- B. An injury and/or occupational illness that results in:
  - 1) A fatality; or
  - 2) A permanent total disability.

#### 12.2.2 Class B Accident.

- A. An accident in which:
  - 1) The resulting total cost of property damage is \$200,000 or more, but less than \$1,000,000.

- 2) A NOAA marine vessel of any size that is destroyed, missing, or abandoned that does not result in a Class A Accident.
- B. An injury and/or occupational illness that results in:
- 1) Permanent partial disability;
  - 2) Any work-related amputation;
  - 3) Any work-related loss of an eye; or
  - 4) When one (1) or more personnel are hospitalized as inpatients (for other than the sole purpose of observation) as a result of a single accident occurrence
- C. Examples of diving-related injuries in a Class B accident include:
- 1) Arterial Gas Embolism (AGE); or
  - 2) Near drowning.

#### 12.2.3 Class C Accident.

- A. An accident in which the resulting total cost of property damage is \$20,000 or more, but less than \$200,000
- B. An injury and/or occupational illness that results in:
- 1) One or more days away from work beyond the day or shift on which it occurred; or
  - 2) A disability at any time (that does not meet the definition of Class A or B and is a lost time case).
- C. Examples of diving-related injuries in a Class C accident include:
- 1) Type I or Type II Decompression Sickness (DCS) requiring decompression chamber treatment; or
  - 2) Pulmonary barotrauma.

#### 12.2.4 Class D Accident.

- A. An accident in which the resulting total cost of property damage is less than \$20,000.
- B. An injury and/or occupational illness that results in:
- 1) Restricted work activity;
  - 2) Work related loss of consciousness;



- 3) Medical treatment greater than first aid (administration of normobaric oxygen is considered first aid in diving incidents);
  - 4) Medical removal under medical surveillance requirements of an OSHA standard;  
or
  - 5) Occupational hearing loss.
- C. Examples of diving-related injuries in a Class D accident include:
- 1) Envenomation (stingray, lionfish, etc.);
  - 2) Sprained ankle after slipping on dive ladder; or
  - 3) Fish bite requiring stitches.

#### 12.2.5 Near Miss.

- A. Any event which did not result in injury to personnel or property damage but had significant potential for injury or property damage to occur.
- B. Malfunction or failure of significant or life supporting diving equipment.
- C. Any action that jeopardized a diver's safety or that of a dive buddy.
- D. Evidence of poor judgment by a NOAA diver, supervisor or reciprocity diver.
- E. Any near miss shall be treated and investigated as if it were a serious incident.
- F. Examples of diving-related near misses include:
  - 1) Air sharing or buddy breathing;
  - 2) Uncontrolled ascent; or
  - 3) Lost contact between diver(s) and support vessel.

#### 12.2.6 SECO Definition.

Marine Diving Mishap: A mishap that occurs in the water during the course of a NOAA diving operation or a NOAA diver diving for another agency under official duties.

#### 12.2.7 Elevation of Accident Classification.

There may be cases where an injury meeting one class of accident may be elevated in severity due to non-medical factors involved in the accident.

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### 12.3 SECO Notification and Investigation

#### 12.3.1 General.

Follow reporting procedures described in “Accident Investigation and Reporting Resources” which can be located at <https://nsdesk.servicenowservices.com/oaasafe>, by clicking on the tab “Safety Management” located on the left side of the page under “Safety & Health”.

### 12.3.2 SECO Notification Timelines.

Accident Classification	SECO Notification Timeline
Class A	Within eight (8) hours
Class B	Within 24 hours
Class C	Within seven (7) days
Class D	Within seven (7) days
Other	Within 14 days

### 12.3.3 SECO Investigation Procedures.

- A. Class A Accidents: The NOAA CAO and Director, OMAO shall empanel an investigative team to include the NOAA SECO representative assigned to the NDCSB and the DSO. This team shall have full authority to discern the facts related to the accident and promulgate corrective actions. A final report shall be produced with copies delivered to the Directors, OMAO and OCAO.
- B. Class B, C and D Accidents: The Chair, NDCSB shall empanel an investigative team that shall include the DSO and may include the NOAA SECO representative assigned to the NDCSB. This team shall have full authority to discern the facts related to the accident and promulgate corrective actions. A final report shall be produced with copies delivered to the Director, OMAO and SECO.
- C. Near Misses: The Chair, NDCSB shall empanel an investigative team that may include the DSO and NOAA SECO representative assigned to the NDCSB. This team shall have full authority to discern the facts related to the accident and promulgate corrective actions. At the discretion of the NDCSB, and with the concurrence of the NDCSB SECO representative, a ‘Lessons Learned’ may be produced and disseminated to NDP divers or a final report may be produced with copies delivered to the Director, OMAO and SECO.

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## 12.4 NDP Notification and Investigation

### 12.4.1 General.

- A. The NDP shall record the occurrence of any OSHA-recordable diving related injury or illness requiring medical treatment beyond basic first aid, specifying the circumstances of the accident and the extent of any injuries or illnesses.
- B. If pressure related injuries are suspected, or if symptoms are evident, the following additional information shall be recorded and retained permanently with the record of the dive by the NDP:
  - 
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- 1) [NOAA Diving Incident Report \(NF 57-03-01\)](#) form, and
- 2) Written descriptive report to include:
  - a. Name, address, phone numbers of principal parties involved;
  - b. Experience levels of divers and topside support personnel involved;
  - c. Location, description of diving site;
  - d. Description of conditions that led to incident;
  - e. Description of symptoms, including depth and time of onset;
  - f. Description and results of treatment;
  - g. Narrative of events from each individual directly involved;
  - h. Disposition of case; and
  - i. Recommendations to avoid reoccurrence of similar incident.
- C. Consistent with 29 CFR 1904.39(a)(1) dive fatalities must be reported to the Occupational Safety and Health Administration (OSHA), U.S. Department of Labor within eight (8) hours after the death.
- D. Consistent with 29 CFR 1904.39(a)(2), the in-patient hospitalization of one or more employees or an employee's amputation or an employee's loss of an eye must be reported to OSHA within twenty-four (24) hours.
- E. At the conclusion of an incident a final PII redacted report may be made available to appropriate diving industry professionals in the field of diving medicine (e.g. DAN) and scientific diving and safety (e.g. AAUS)

#### 12.4.2 Timelines, Reporting Chains and Investigative Responsibilities for Accidents Involving Injury.

- A. Divers shall:
  - 1) Notify the DM or LD immediately at the first sign or symptom of any injuries sustained during diving operations;
  - 2) Notify work supervisor immediately; and
  - 3) Complete the employee section of the Employees' Operations and Management Portal (ECOMP) Form CA-1 (federal employees only) and forward to immediate work supervisor within 24 hours of being released from medical care. Note: NOAA Corps Officers who suffer an injury are not required to submit a Form CA-1.
- B. Immediate work supervisors shall:

- 1) Report incident via the on-line NOAA Accident/Incident Reporting Form (<https://nsdesk.servicenowservices.com/noaasafe>), or the Form MOC-137 within 24 hours of the incident; and
- 2) Complete the supervisor's section of the Form CA-1 (For NOAA federal employees, with the exception of NOAA Corps Officers, and where medical costs were incurred) and forward all original documents to Managed Care Advisors for processing. MCA's address is:

DOC Workers' Compensation Claims Center  
C/O Managed Care Advisors  
P.O. Box 30640  
Bethesda, MD 20814

C. DMs and LDs shall:

- 1) Immediately notify their respective UDS of the reportable injury; and
- 2) Submit a written incident report to their UDS within seven (7) calendar days of the reportable injury.

D. UDSs shall:

- 1) Immediately notify their respective LODO of the reportable injury;
- 2) In cases where the injured diver is a reciprocity diver, immediately notify the DSO of the reciprocity partner;
- 3) In cases where the injured diver is from a different NOAA Diving Unit than the UDS in control of the dive, immediately notify the diver's UDS;
- 4) Submit a detailed analysis and report of the reportable injury to the respective LODO within ten (10) calendar days of the reportable injury. The report shall include, but not be limited to, the following: nature of the operations (including [NOAA Form 57-03-20 Pre-Dive Planning](#) and [NOAA Form 57-03-30 Dive Mission Execution Plan](#)), existing environmental conditions, diving profiles, dive plans, personnel involved, type of equipment used, nature of any equipment failures, causal analyses that indicates both immediate and basic (root) causes, recommendations for prevention of future injuries, a copy of the DM's or LD's incident narrative and a copy of the [NOAA Diving Incident Report \(NF 57-03-01\)](#); and
- 5) Instruct the diver to submit copies to the NDMO of any relevant medical records from treatment received.

E. LODOs (or DLODOs) shall:

- 1) Immediately notify the NDPM and NDSO of the reportable injury;

- 2) Conduct a fact-finding investigation into the incident and forward final report to the NDPM within thirty (30) calendar days of the reportable injury; and
- 3) Include a copy and an analysis of the report submitted by the UDS, a determination of the cause of the incident, and a corrective action plan (if deemed appropriate).

F. NDPM shall:

- 1) Immediately notify Director, OMAO of the reportable injury;
- 2) Review the report for completeness and any immediate mitigation actions required to prevent a similar event from occurring;
- 3) Forward copy of report to the Chair of the NDCSB, the NDMO and NDSO for review within seven (7) calendar days of receipt of report from LODO; and
- 4) Track corrective actions as determined by the NDCSB.

G. NDMO may at their discretion:

- 1) Forward copies of the report to the members of the NDMRB within seven (7) calendar days of receipt of report from NDPM;
- 2) Consolidate comments received from NDMRB members; and
- 3) Forward comments to the NDPM and Chair of the NDCSB.

H. Chair of the NDCSB shall:

- 1) Forward copies of the report to the members of the NDCSB within seven (7) calendar days of receipt of report from NDPM; and
- 2) Consolidate comments received from the NDCSB members.

I. The NDCSB shall:

- 1) Develop corrective actions as required;
- 2) Discuss the incident and corrective actions and direct the NDPM to implement the corrective actions.
- 3) Ensure appropriate individuals or offices are assigned responsibility for completion of the corrective actions.

#### 12.4.3 Timelines, Reporting Chains and Investigative Responsibilities for Accidents Involving Property Damage.

A. General.

- 1) Reporting of accidents involving property damage varies according to the value of loss and fall into one (1) of two (2) categories:
    - a. Damage less than \$20,000; or
    - b. Damage greater than \$20,000.
  - 2) Any diving accident involving only property damage is handled at the Diving Unit level and does not initiate action by the broader NDP.
- B. Accidents with Damage <\$20,000.
- 1) Divers shall:
    - a. Notify the DM or LD immediately after a diving accident involving property damage; and
    - b. Notify work supervisor immediately;
  - 2) Immediate work supervisors shall work with the UDS to investigate the accident.
  - 3) DMs and LDs shall immediately notify their respective UDS of the property damage.
  - 4) UDSs shall work with the work supervisor to investigate the accident.
  - 5) In cases where the accident involves a reciprocity diver, the UDS shall immediately notify the DSO of the reciprocity partner.
  - 6) Supervisor shall report accidents via the on-line NOAA Accident/Incident Reporting Form (<https://nsdesk.servicenowservices.com/noaasafe>) or Form MOC-137 when occurring on an OMAO vessel within seven (7) days of the incident.
- C. Accidents with Damage >\$20,000.
- 1) Divers shall:
    - a. Notify the DM or LD immediately after a diving accident involving property damage; and
    - b. Notify work supervisor immediately;
  - 2) Immediate work supervisors shall:
    - a. Report accident via the on-line NOAA Accident/Incident Reporting Form (<https://nsdesk.servicenowservices.com/noaasafe>), or the Form MOC-137 when occurring on an OMAO vessel, within 24 hours of the accident; and
    - b. Work with the UDS to investigate the accident.

- 3) DMs and LDs shall immediately notify their respective UDS of the property damage.
  - 4) UDSs shall work with the work supervisor to investigate the accident.
  - 5) In cases where the accident involves a reciprocity diver, the UDS shall immediately notify the DSO of the reciprocity partner.
- D. Additional NDP Investigation.

Some accidents with property damage will require additional investigation beyond the Dive Unit level. In these cases, the LODO will coordinate information gathering from the Dive Unit on behalf of the NDCSB.

**APPENDIX 1: ACRONYMS and INITIALISMS**

ABS	American Bureau of Shipping
acfm	Actual cubic feet per minute
AED	Automated External Defibrillator
AGE	Arterial Gas Embolism
AMU	Authorized for Military Use
ASME	American Society of Mechanical Engineers
ATA	Atmospheres Absolute
BCD	Buoyancy Compensator Device
BIBS	Built-In-Breathing System
CAO	Chief Administrative Officer
CCR	Closed-Circuit Rebreather
CFR	Code of Federal Regulations
CNS	Central Nervous System
CPR	Cardiopulmonary Resuscitation
DAN	Divers Alert Network
DCS	Decompression Sickness
DEAP	Diving Emergency Assistance Plan
DLODO	Deputy Line Office Diving Officer
DM/LD	Divemaster/Lead Diver
DMO	Diving Medical Officer
DO	Diving Officer
DOC	Department of Commerce
DM	Divemaster
DMT	Diving Medical Technician
DPIC	Designated Person-In-Charge
DSC	Digital Selective Calling
DSO	Diving Safety Officer
DUI	Diving Unlimited International
DUSI	Diving Unit Self Inspection
DUSA	Diving Unit Safety Assessment
EAD	Equivalent Air Depth
EAN	Enriched Air Nitrox
END	Equivalent Narcotic Depth
EMS	Emergency Medical Services
END	Equivalent Narcotic Depth
FECA	Federal Employee Compensation Act
fsw	Feet of seawater (or equivalent static pressure head)
FTE	NOAA Full-Time Employee
HIPAA	Health Insurance Portability and Accountability Act
HP	High Pressure
IANTD	International Association of Nitrox and Technical Diving



LD	Lead Diver
LODO	Line Office Diving Officer
LOR	Letter of Reciprocity
LPM	Liters per Minute
MD	Medical Doctor
MOD	Maximum Operating Depth
NAO	NOAA Administrative Order
NAUI	National Association of Underwater Instructors
NBDHMT	National Board of Diving and Hyperbaric Medical Technology
NDC	NOAA Diving Center
NDCSB	NOAA Diving Control and Safety Board
NDMO	NOAA Diving Medical Officer
NDMRB	NOAA Diving Medical Review Board
NDMSPM	NOAA Diving Medical Standards and Procedures Manual
NDP	NOAA Diving Program
NDCM	NOAA Diving Center Manager
NDPM	NOAA Diving Program Manager
NDSO	NOAA Diving Safety Officer
NDSTC	Navy Diving and Salvage Training Center
NDTAC	NOAA Diving Technical Advisory Committee
NEDU	Navy Experimental Diving Unit
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NOS	National Ocean Service
NP	Nurse Practitioner
OER	Office of Exploration and Research
OMAO	Office of Marine and Aviation Operations
OPM	Office of Personnel Management
OSHA	Occupational Safety and Health Administration
OTU	Oxygen Toxicity Unit
PA	Physician's Assistant
PADI	Professional Association of Diving Instructors
PEPIRB	Personal Emergency Position-Indicating Radio Beacon
PLB	Personal Locator Beacon
psi	Unit of pressure, "pounds per square inch"
psig	Unit of pressure, "pounds per square inch gauge"
PVHO	Pressure Vessel for Human Occupancy
RASS	Reserve Air Supply System
REPEX	Repetitive Excursion
RMV	Respiratory Minute Volume
SAC	Surface Air Consumption
SCR	Semi-closed Circuit Rebreather
SCUBA	Self-Contained Underwater Breathing Apparatus
SECO	NOAA Safety and Environmental Compliance Office
SEP	Standardized Equipment Program

SMB	Surface Marker Buoy
STE	Special Task Endorsement
TDI/SDI	Technical Diving International / Scuba Diving International
TDS	Technical Diving Supervisor
TT	U.S. Navy Treatment Table
UDS	Unit Diving Supervisor
UILD	Unit Inspection Lead Diver
USC	United States Code
USN	United States Navy

**APPENDIX 2: DEFINITIONS**

Air sharing: Joint use of a single air supply between divers who are using independent second stage regulators.

Alternate Air Source Inflator: An additional second stage regulator attached to the diver's BCD inflator assembly. During air sharing, this regulator is used by the diver while the primary second stage is passed to the dive buddy. It also serves as a redundant second stage regulator for the diver.

ASME Code or equivalent: American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Section VIII, or an equivalent code which NOAA can demonstrate to be equally effective.

ATA: Total pressure exerted on an object, by a gas or mixture of gases, at a specific depth or elevation, including normal atmospheric pressure.

Barotrauma: An injury caused by the increase or decrease of the ambient pressure in relation to pressure in any gas filled space.

Bell: An enclosed compartment, pressurized (closed bell) or unpressurized (open bell), which allows the diver to be transported to and from the underwater work area and which may be used as a temporary refuge during diving operations.

BIBS: A breathing mask, typically found in hyperbaric chambers, which allows the wearer to breathe a gas (typically oxygen) other than that present in the adjacent environment. Exhaled gases are removed from the adjacent environment via a separate hose from that which supplies the inhalation gases.

Bottom Time: The total elapsed time, measured in minutes, from the time the diver leaves the surface in descent until the time the diver begins a direct ascent to the surface. Time spent at safety stops is not included in bottom time

Breath-Hold Diving: A diving mode in which the diver uses no self-contained or surface-supplied air or gas supply.

Buddy Breathing: Two divers sharing a single air source from a single second stage regulator.

Buddy Diver / Buddy System: A second comparably equipped scuba diver in the water in constant visual or physical contact and ready to render immediate assistance in an emergency.

Bursting Pressure: The pressure at which a pressure containment device would structurally fail.

Certified Diver: A diver who holds a valid certification from an organizational member or internationally recognized certifying agency.

Controlled Ascent: Any one of several kinds of ascents including normal, swimming, and air sharing ascents where the diver(s) maintain buoyancy control so a pause or stop can be made during the ascent.

Cylinder: A pressure vessel for the storage of gases.

Decompression Chamber: See hyperbaric chamber.

Decompression Sickness: A condition with a variety of symptoms, which may result from gas bubbles in the tissues of divers after pressure reduction.

Decompression Table: A profile or set of profiles of depth-time relationships for ascent schedules and breathing mixtures to be followed after a specific depth-time exposure or exposures.

Dive: A dive is defined as the time spent breathing compressed gas underwater or in a hyperbaric chamber and is considered completed when an individual returns to surface pressure and remains at the surface for a minimum of 10 minutes.

Dive Computer: A microprocessor-based device which computes a diver's theoretical decompression status in real time by using pressure (depth), breathing gas composition, and time as inputs to a decompression model, or set of decompression tables, programmed into the device.

Divemaster/Lead Diver (DM/LD): An individual designated to direct and oversee diving activities.

Diver: Anyone breathing compressed gas underwater or in a hyperbaric chamber.

Diving Location: A surface or vessel from which a diving operation is conducted.

Diving Location Reserve Breathing Gas: A supply system of breathing gas at the diving location that is independent of the primary supply system and sufficient to support divers during the planned operation.

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

Diving Site: Physical location of a diver during a dive.

Diving Team: Divers directly involved in a diving operation including the designated person in charge (DPIC).

DLODO: Individual who assists Line Office Diving Officers in overseeing and directing diving activities within specific NOAA Line Offices and serve as voting members of the NDCSB.

DMO: A health care provider with specialized training in diving and hyperbaric medicine capable of recognizing and providing medical services and/or advice for diving related injuries.

DPIC: A person designated by the Divemaster or Lead Diver who is at the diving location, and in charge of all aspects of the diving operation affecting the safety and health of the diving team members.

DSC: A service that allows mariners to instantly send an automatically formatted distress alert to the Coast Guard or other rescue authority anywhere in the world. This feature is often found on modern marine VHF radios.

DSO: Individual responsible for monitoring the safe conduct of a diving program.

EAD: The depth at which air will have the same nitrogen partial pressure as the Nitrox or mixed gas mixture being used. This number, expressed in units of feet of seawater, will always be less than the actual depth for any enriched air mixture. EAD calculations allow the use of air decompression tables when the diver is breathing Nitrox or mixed gas.

EAN: A name for a breathing mixture of air and oxygen when the percentage of oxygen exceeds 21 percent. This term is considered synonymous with the term "Nitrox." Frequently referred to as EANx where 'x' denotes the percentage of oxygen in the breathing gas.

END: The depth at which the inspired nitrogen partial pressure of a breathing gas mixture other than air equates to that of air at a shallower depth.

FO<sub>2</sub>: Fraction of oxygen in a gas mixture by volume, expressed as either a decimal or percentage. For example, the FO<sub>2</sub> of air is usually written as 0.21 or 21%.

FSW: Feet of seawater, or equivalent static head.

Habitat: An underwater facility used to provide life support during the dry phase of saturation diving operations

Heavy gear: Diver-worn deep-sea dress including helmet, breastplate, drysuit, and weighted shoes.

Hookah: Diving mode similar to surface supplied diving 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 of his/her depth, time, and diving profile.

HP: Usually refers to pressures greater than 150 psig, "High Pressure."

Hyperbaric Chamber: A pressure vessel for human occupancy also called a decompression chamber or recompression chamber, commonly used for the treatment of pressure-related diving injuries.

Hyperbaric Conditions: Pressure conditions in excess of normal atmospheric pressure at the diving location.

LD: Certified NOAA diver with experience and training required to oversee the diving operation at hand.

Line-Tended Diving: A specialized diving technique whereby divers are connected to the surface via a strength member (line) managed by a trained individual topside.

Liveboating: The practice of supporting dive operations from a vessel that is underway.

LODO: Individual appointed to oversee and direct diving activities within specific NOAA Line Offices and to serve on the NOAA Diving Control and Safety Board (NDCSB).

Low Visibility: When visual contact with the dive buddy can no longer be maintained.

LP: Usually refers to pressures less than 150 psig.

Mixed Gas: A gas mixture containing proportions greater than 1 percent by volume of an inert gas other than nitrogen.

Mixed-Gas Diving: A diving mode in which the diver is breathing a gas mixture containing proportions greater than 1 percent by volume of an inert gas other than nitrogen.

MOD: Determined as the depth at which the PO<sub>2</sub> for a given gas mixture reaches a predetermined level. The NOAA standard is a maximum PO<sub>2</sub> of 1.40 ATA for open circuit diving, 1.30 ATA for closed circuit diving and 1.60 ATA for the decompression phase of decompression diving

NDCSB: An appointed board of representatives from NOAA's Line Offices who report to the Director of OMAO and have autonomous and absolute authority over the NOAA Diving Program and promote its safe and effective operations.

NDMO: The senior health care provider in the NOAA Diving Program with specialized training in diving and hyperbaric medicine capable of recognizing and providing medical services and/or advice for diving related injuries.

NDMRB: A standing committee of a minimum of five (5) qualified hyperbaric physicians who advise the diving program on various dive-related medical issues.

NDP: Group consisting of the Diving Program Manager, NOAA Diving Control and Safety Board, Diving Center Manager, Diving Safety Officer, Diving Medical Officer, Line Office Diving Officers, Unit Diving Supervisors, Divemasters and Divers who ensure that all NOAA diving operations are conducted safely, efficiently and economically.

NDPM: Individual responsible for managing the day-to-day affairs of the NOAA Diving Program and serving as the ranking NOAA diving official for matters relating to the application of the NOAA diving regulations, policies, and procedures.

NDSO: Individual assigned by the Director of OMAO to monitor the safe conduct of the NDP, provide advice to the NDCSB and senior NOAA Management on diving safety and health related issues, and manage and direct the DUSA Program.

Nitrox: Any gas comprised predominantly of nitrogen and oxygen, most frequently containing between 22 percent and 40 percent oxygen by volume.

NOAA Appointing Officials: Individuals with authority to approve the hiring of NOAA employees.

NOAA Dive Plan: Written details concerning the dive to be performed including personnel, equipment, and operational information.

NOAA DM: NOAA divers certified by the NOAA Diving Program, authorized by the NOAA Diving Program Manager and assigned by the Unit Diving Supervisor to oversee and direct all aspects of a diving operation affecting the safety and health of the diving team members at the diving site.

NOAA Diver: Individual certified by the NOAA Diving Program and authorized by the NOAA Diving Program Manager to dive and perform work in a hyperbaric environment in support of NOAA's mission. NOAA Divers include NOAA employees (federal full-time and contract employees), reciprocity and volunteer divers.

NOAA Diving Manual: Refers to the NOAA Diving Manual, Diving for Science and Technology, current edition, National Oceanic and Atmospheric Administration, US Department of Commerce.

NOAA Diving Standards and Safety Manual: Refers to this document and is separate from the NOAA Diving Manual.

NOAA Funding Manager: Individual with authority to approve the expenditure of Government funds.

NOAA Observer Diver: A person who is certified to dive by a non-NOAA entity and allowed to participate in NOAA diving operations, under the supervision of NOAA divers, for the purposes of familiarization, evaluation, or reporting on NOAA programs.

NOAA Volunteer Divers: Individuals who perform diving services for NOAA on their own initiative without a formal request or compensation other than reimbursement for travel and minor expenses.

No-decompression Limits: A series of relationships between time, depth and breathing gas mixture which allow a diver to safely make a direct ascent to the surface.

Normal Ascent: An ascent made with an adequate gas supply at a rate of 30 feet per minute or less.

Oxygen Clean: A physical condition of diving equipment in which all combustible contaminants have been removed.

Oxygen Compatible: A gas delivery system, including its components (O-rings, valve seats, diaphragms, etc.), that is compatible with oxygen at a stated pressure and temperature.

Oxygen Service: A gas delivery system that is both oxygen clean and oxygen compatible.

OTU Oxygen Toxicity Unit: One OTU is the degree of pulmonary oxygen toxicity produced by breathing 100 percent oxygen continuously at a pressure of 1.00 ATA for 1 minute.

Oxygen Toxicity: Any adverse reaction of the central nervous system (CNS) (called “acute” or “CNS” oxygen toxicity) or lungs (called “chronic,” “whole-body,” or “pulmonary” oxygen toxicity) brought on by exposure to an increased (above atmospheric level) partial pressure of oxygen.

PO<sub>2</sub>: Inspired partial pressure of oxygen, usually expressed in units of atmospheres absolute (ATA). For example, the PO<sub>2</sub> at sea level is 0.21 ATA.

Pressure: The force exerted over a surface divided by its area. In diving, this is most often expressed in pounds per square inch (psi).

Pressure Related Injury: An injury resulting from pressure disequilibrium within the body.

Pressure Vessel: See cylinder.

Proficiency Dives: Dives performed solely for the purpose of maintaining previously acquired diving skills.

PSI: A measurement of pressure which does not include the pressure of the atmosphere. PSI at the earth’s surface is 14.7.

PSIG: A measurement of pressure which includes ambient pressure. PSIG at the earth’s surface is zero.

Qualified Small Boat Operator: A person who is authorized to operate vessels based upon demonstrated skills and documented training. For NOAA owned or contracted vessels, these requirements are documented in the NOAA Small Boat Standards and Procedures Manual.

RASS: A diver-carried auxiliary supply of air sufficient under standard operating conditions to allow the diver to reach the surface from a depth of 130 fsw.

Reciprocity Divers: Divers employed by organizations, agencies, and institutions with which NOAA has established official agreements for the purpose of conducting collaborative diving operations.

Recompression Chamber: See hyperbaric chamber.



Redundant Second Stage Regulator: An additional second stage regulator that is attached to the diver's BCD inflator assembly and is used by the diver in the event a dive buddy needs to share air or the diver's primary second stage malfunctions.

Restricted Visibility: Underwater conditions such as turbidity or darkness that prevent divers from easily seeing their dive buddy, gauges or diving site.

RMV: A measure of diver's gas usage, expressed in cubic feet per minute (cfm), that incorporates the rated volume and pressure of a scuba cylinder and a diver's SAC rate. Most often used for dive planning on decompression dives.

SAC: A measure of a diver's gas usage, expressed in pounds per square inch (psi), that is used in dive planning, particularly on decompression dives.

Safety Diver: An additional in-water diver appropriately equipped and able to render immediate assistance to other divers in the bottom team. The safety diver has no tasks other than monitoring the other divers and rendering assistance in an emergency.

Scientific Diver: Individual who utilizes scientific expertise to perform dives without direct or indirect supervision or guidance from a more qualified individual as determined by the on-site Divemaster/Lead Diver and Chief Scientist.

Scientific Dives: Dives performed solely as a necessary part of a scientific, research, or educational activity to perform tasks for the advancement of science.

Scientific Diver-In-Training: Individual who utilizes scientific expertise to perform dives under the direct or indirect supervision or guidance of a scientist and approval of the on-site Divemaster/Lead Diver and Chief Scientist.

Scuba Diving: A diving mode independent of surface supply in which the diver uses a self-contained underwater breathing apparatus (SCUBA).

SEP: The formalized system used by the NOAA Diving Program for the maintenance and distribution of diver-worn equipment issued to NOAA divers.

Standby Diver: A diver at the diving location appropriately equipped and able to enter the water to assist a diver within one (1) minute during no-decompression diving operations and two (2) minutes for decompression diving operations.

STE: A 12 month authorization granted to NOAA divers by the LODO/ to perform tasks beyond the scope of normal training.

Support Diver: A diver at the diving location appropriately equipped and able to enter the water to assist members of the bottom team during the ascent phase. Support divers typically meet bottom team divers at the initial decompression stop to return unneeded gear to the surface, monitor the bottom team for any signs of distress and/or bring additional breathing gases to the bottom team.

Surface Supplied Diving: A diving mode 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.

Tether: A safety line between the diver and the surface used for communications (voice or line-pulls) and retrieval of the diver in an emergency.

Treatment Table: A depth-time and breathing gas profile designed to treat decompression sickness.

Training Dives: Dives performed solely for the purpose of acquiring new, or relearning previously acquired, diving skills.

UDS: NOAA diver appointed by a NOAA LODO and approved by the NDCSB to oversee, direct, and approve diving activities conducted within their respective unit and to administer to the needs of assigned divers.

Umbilical: Composite hose bundle between a diving location and a diver or bell, or between a diver and a bell, which supplies a diver or bell with breathing gas, communications, power, and/or heat, as appropriate to the diving mode or conditions, and includes a safety line between the diver and the diving location or bell.

Working Dives: Underwater tasks that fall outside the Occupational Safety and Health Administration scientific exemption that do not require scientific expertise, may not lead to the advancement of science or involve tools and techniques beyond those required to perform scientific dives.

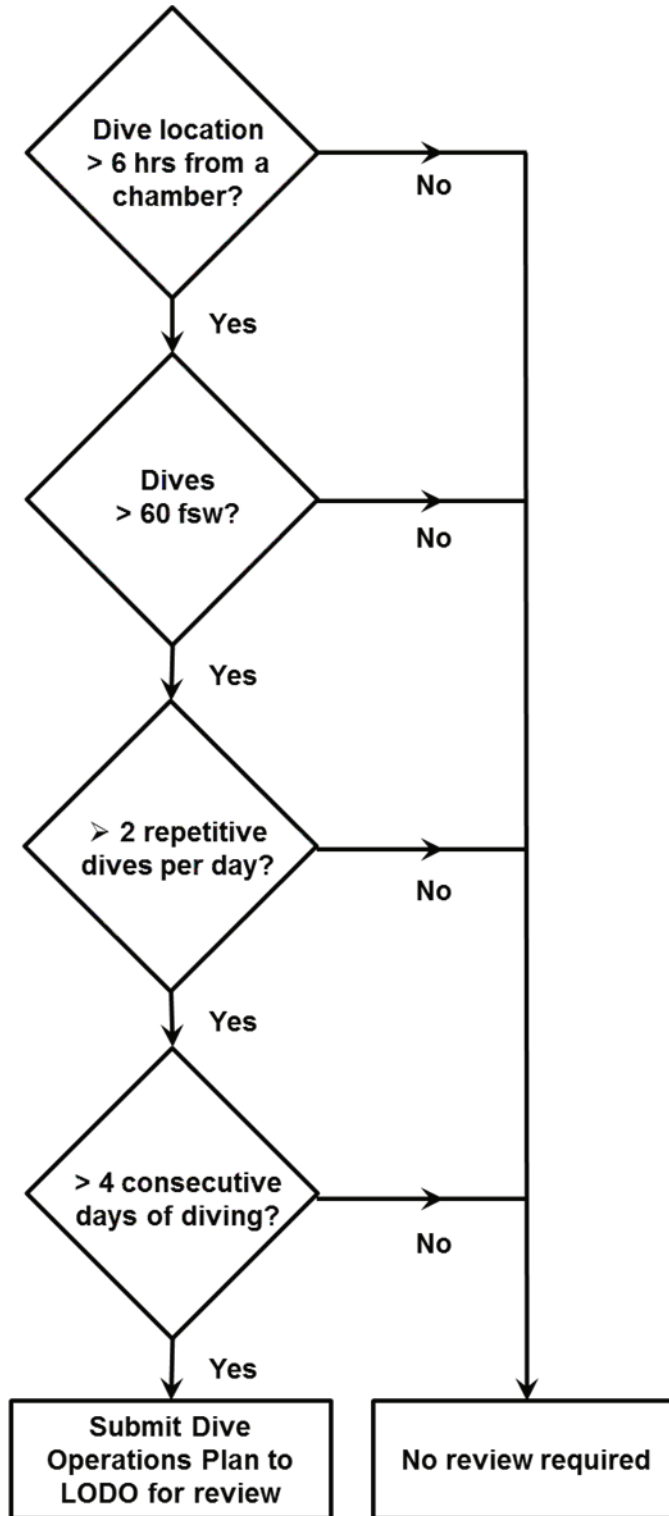
Working Pressure: The maximum pressure to which a pressure containment device may be exposed under standard operating conditions.

**APPENDIX 3: NOAA DIVING OPERATIONS PLAN REVIEW ALGORITHM**

**Instructions:** The algorithm to the right is intended to address the potential dangers of moderately deep, multi-day, multi-dive operations from a safety perspective. It is intended to help ensure that appropriate safeguards are in place to protect NOAA personnel engaged in remote diving operations.

An answer of 'yes' to all of the four decision boxes will necessitate submission of NOAA Form 57-03-20 Dive Operations Plan to the appropriate LODO for review. The LODO will review the information and forward it to the NDCSB for a determination of any special safety precautions which are needed, including an on-site hyperbaric chamber.

Any 'no' answers will negate the need for review of the dive plan.



## APPENDIX 4: NOAA DIVERS FIRST AID KIT INVENTORY

General Items
First Aid pocket book
Diver injury report slate / form
Neuro exam slate
Pencil
Personal Protective Equipment
Non latex gloves (10 pair)
Face shield with mask
Pocket mask
Dressing pack
Band aids – Assorted (20)
Bacitracin or equivalent ointment (6)
Adaptic type non-adhering dressing (3)
Opsite transparent dressing (3)
Gauze 2" x 2" dressings (5)
Gauze 4" x 4" dressings (5)
Non-stick (Telfa) dressings (3)
Kerlix 4" roll (1)
Gauze 2" roller bandage (2)
Gauze 4" roller bandage (2)
5" x 9" abdominal dressing (1)
1" tape (2 rolls)
Waterproof tape (1)
Steri strips (0.25" x 1.5")
Benzoin ampules (2)
Cotton tip applicators – sterile (2)
Alcohol prep pads (10)
Chlorhexidine packets (3)
E-Z Scrub brush with chloroxylenol (1)
20cc syringe for irrigation
Orthopedic Pack
SAM splint (1)
Cold compress (1)
Triangular bandages (2)
2" cloth tape (1 roll)
3" elastic bandage (2)
2" Coban (2)

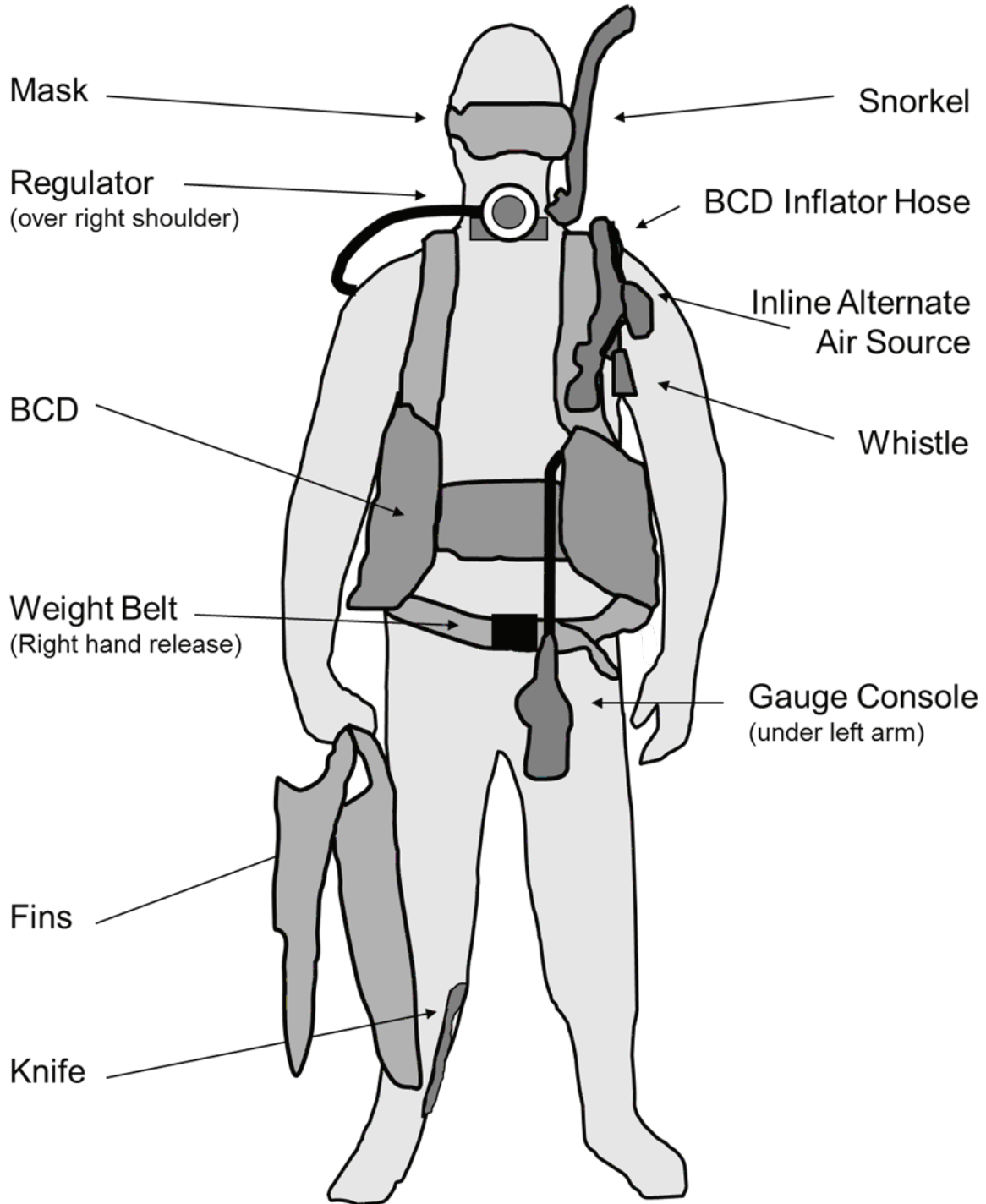
Drug Pack	Min*	Rec*
Ibuprofen tablets, 200 mg	5	10
Acetaminophen 500 mg	5	10
Aspirin (81 mg or 325 mg)	2	4
Diphenhydramine 25 mg	5	10
Meclizine 25 mg	0	10
Sudafed 30 mg	5	10
Antacids	5	5
Loperamide	0	5
Hydrocortisone cream, 1%	5	5
Burn gel packets	5	5
Diagnostic / tools		
Small flashlight		
Thermometer		
Scissors (EMT shears)		
Ring cutter		
Tweezers		
Disposable razor		
Tongue depressors (3)		
CAT Tourniquet		
Oral airways (1 each adult size)		
Nasal airways		
Surgical lubricant		
Advanced/Optional		
Blood pressure cuff		
Stethoscope		
Otoscope		
Reflex hammer		
Bottle of vinegar		

\* Minimum medication quantities are recommended for single day missions in which access to additional medical resources is readily available. Recommended quantities apply to multi day missions or those in which a more robust supply is warranted.

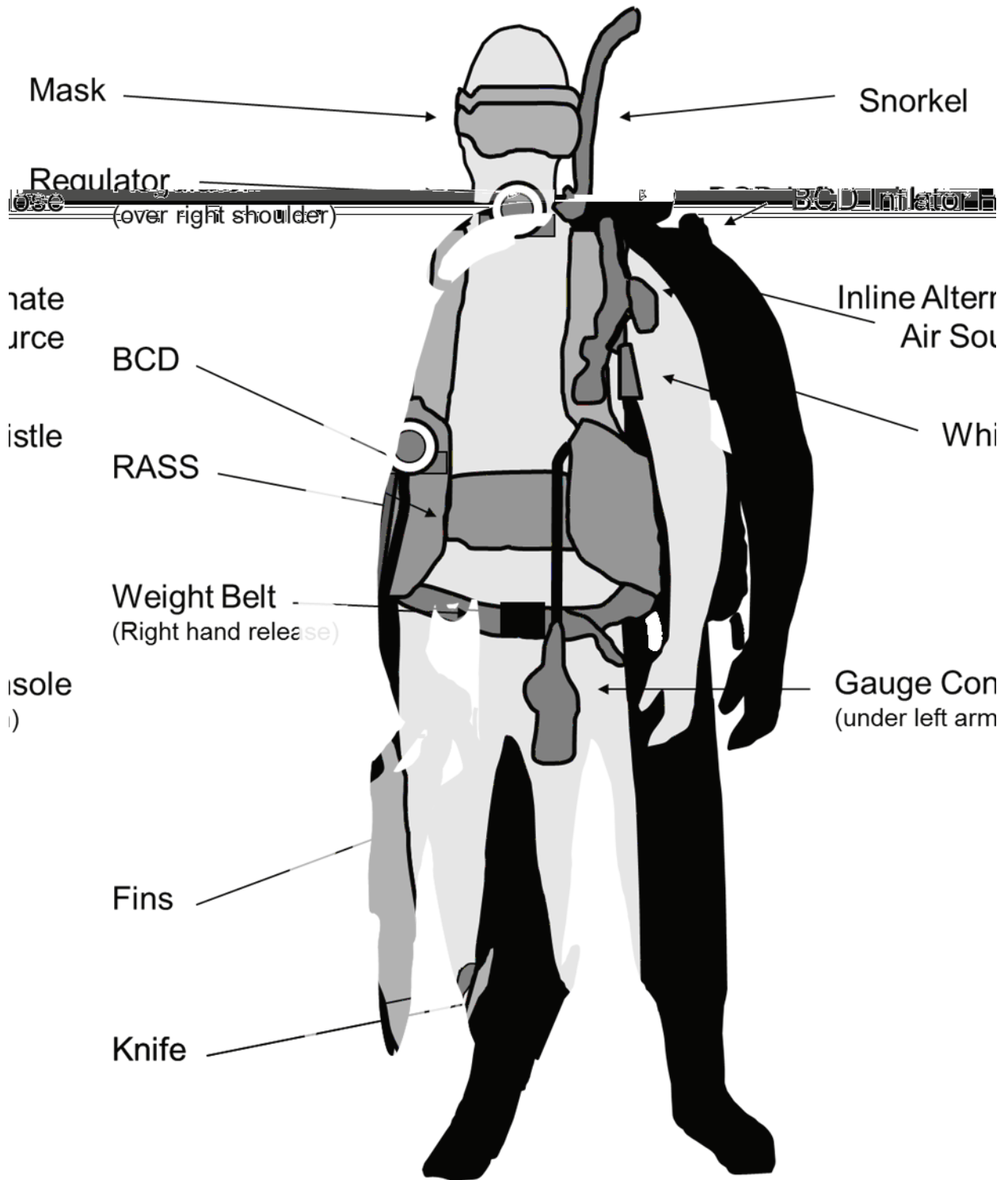
All medications included in the Drug Pack shall be within the noted expiration date. Items for external use are allowed to exceed the noted expiration date by three years, provided the packaging is intact and the item appears to be in good condition. This includes items listed in the Personal Protective Equipment and the Dressing Pack.

APPENDIX 5: NOAA DIVING EQUIPMENT CONFIGURATIONS

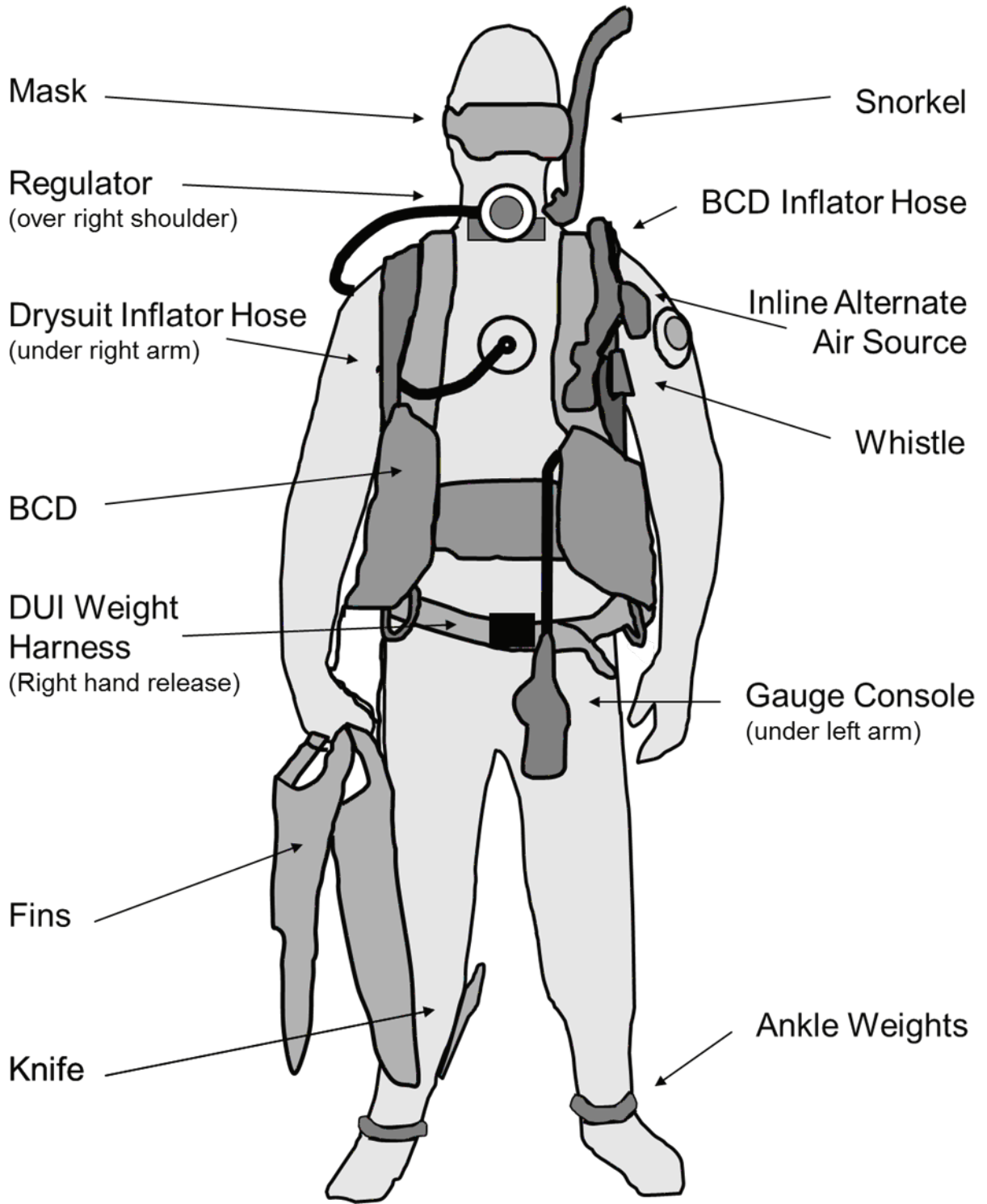
# WETSUIT CONFIGURATION



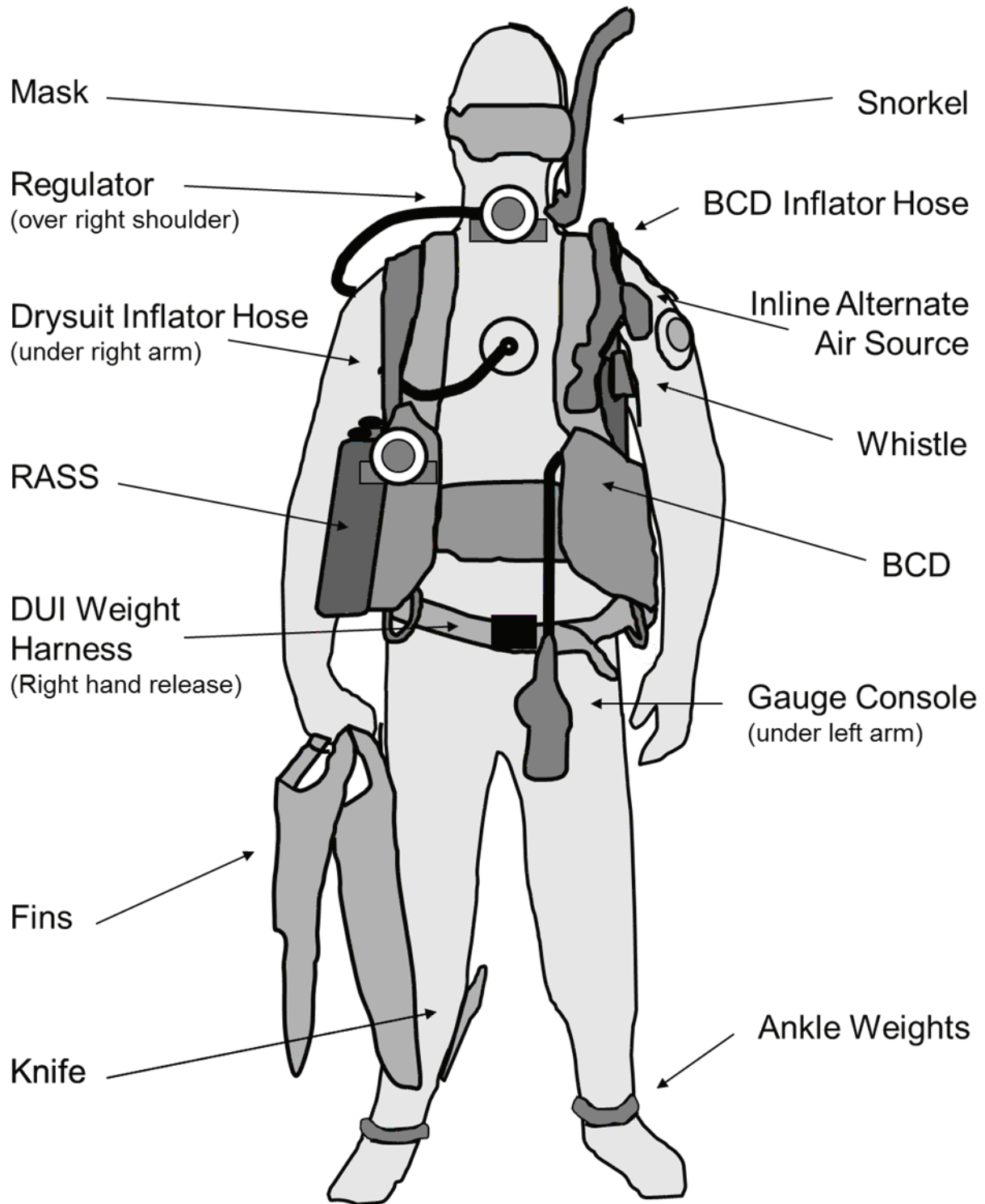
### WETSUIT CONFIGURATION w/OPTIONAL RASS



# DRYSUIT CONFIGURATION

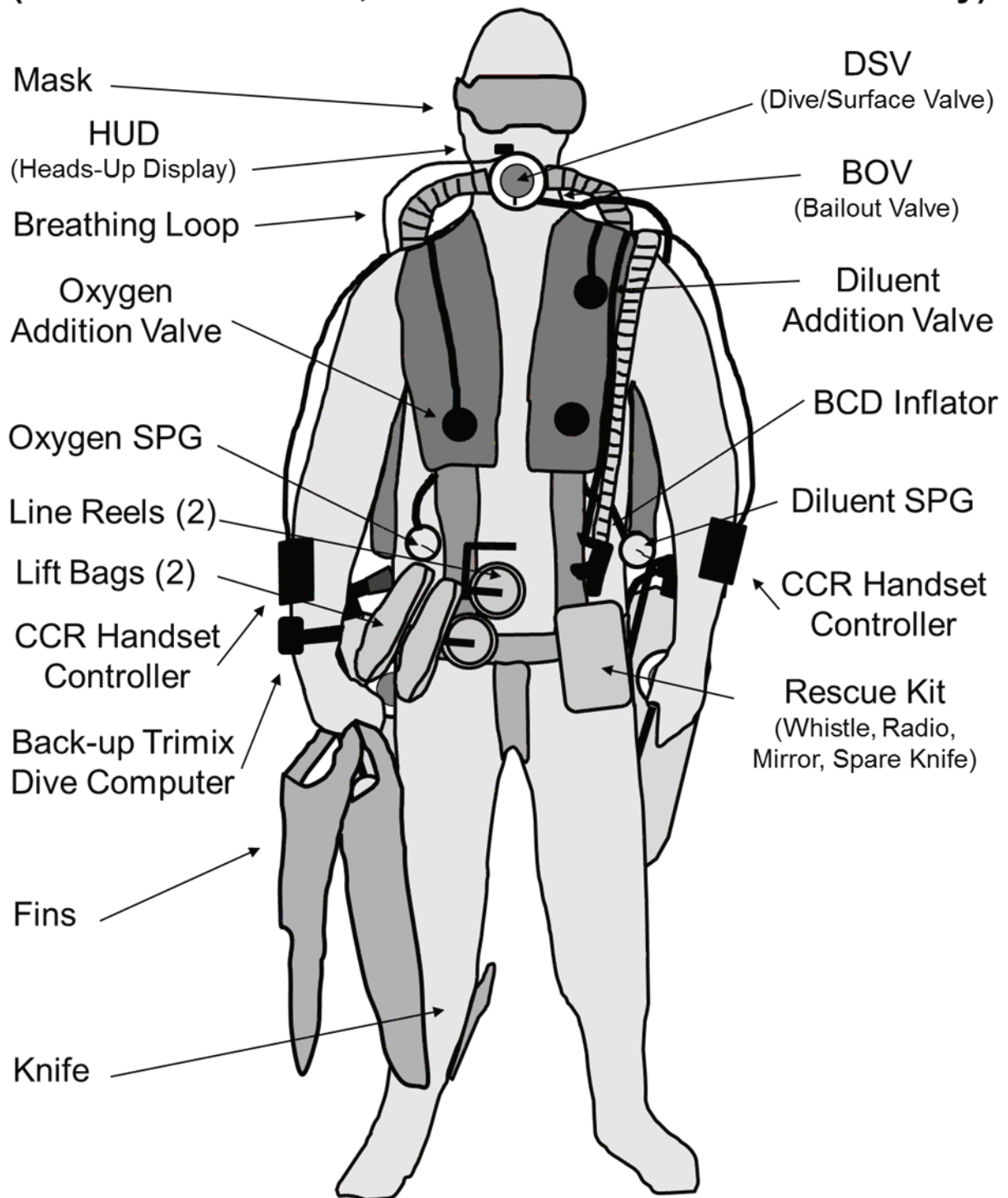


### DRYSUIT CONFIGURATION w/OPTIONAL RASS

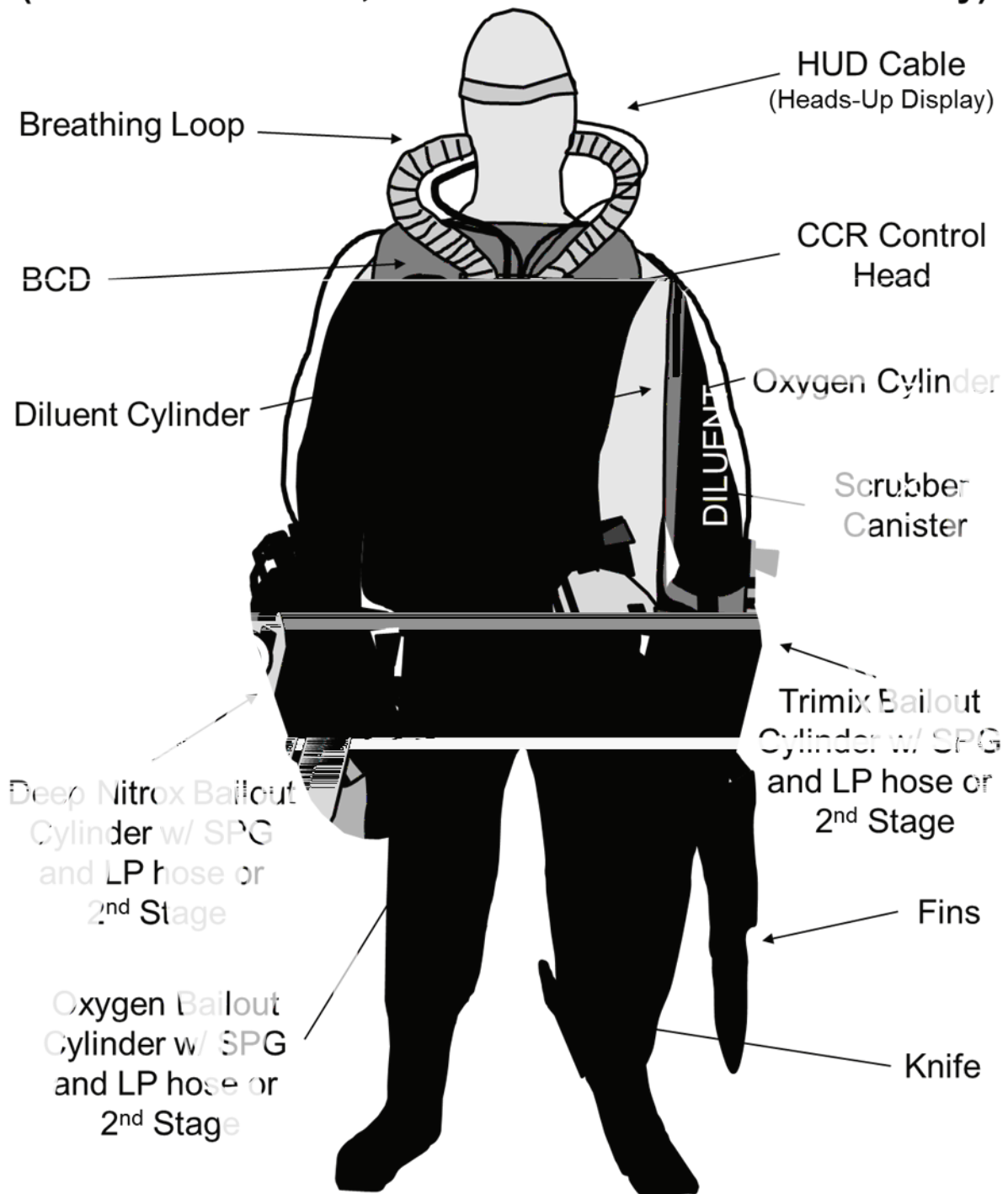




## CLOSED CIRCUIT REBREATHER CONFIGURATION (General Front View, Controls and Gear Locations Vary)



## CLOSED CIRCUIT REBREATHER CONFIGURATION (General Back View, Controls and Gear Locations Vary)



## APPENDIX 6: REQUIRED SURFACE INTERVAL BEFORE ASCENT TO ALTITUDE AFTER DIVING

Repetitive Group Designator	Required Surface Interval Before Ascent to Altitude After Diving										
	1000	2000	3000	4000	5000	6000	7000	8000	9000	10,000	
A	0:00	0:00	0:00	0:00	0:00	0:00	0:00	0:00	0:00	0:00	0:00
B	0:00	0:00	0:00	0:00	0:00	0:00	0:00	0:00	0:00	0:00	1:42
C	0:00	0:00	0:00	0:00	0:00	0:00	0:00	0:00	0:00	1:48	6:23
D	0:00	0:00	0:00	0:00	0:00	0:00	0:00	1:45	5:24	9:59	
E	0:00	0:00	0:00	0:00	0:00	0:00	1:37	4:39	8:18	12:54	
F	0:00	0:00	0:00	0:00	0:00	1:32	4:04	7:06	10:45	15:20	
G	0:00	0:00	0:00	0:00	1:19	3:38	6:10	9:13	12:52	17:27	
H	0:00	0:00	0:00	1:06	3:10	5:29	8:02	11:04	14:43	19:18	
I	0:00	0:00	0:56	2:45	4:50	7:09	9:41	12:44	16:22	20:58	
J	0:00	0:41	2:25	4:15	6:19	8:39	11:11	14:13	17:52	22:27	
K	0:30	2:03	3:47	5:37	7:41	10:00	12:33	15:35	19:14	23:49	
L	1:45	3:18	5:02	6:52	8:56	11:15	13:48	16:50	20:29	25:04	
M	2:54	4:28	6:12	8:01	10:06	12:25	14:57	18:00	21:38	26:14	
N	3:59	5:32	7:16	9:06	11:10	13:29	16:02	19:04	22:43	27:18	
O	4:59	6:33	8:17	10:06	12:11	14:30	17:02	20:05	23:43	28:19	
Z	5:56	7:29	9:13	11:03	13:07	15:26	17:59	21:01	24:40	29:15	

Exceptional Exposure                      Wait 48 hours before ascent

**NOTE 1** When using Appendix 6, use the highest repetitive group designator obtained in the previous 24-hour period.

**NOTE 2** Appendix 6 may only be used when the maximum altitude achieved is 10,000 feet or less. For ascents above 10,000 feet, consult the NOAA DMO for guidance.

**NOTE 3** The cabin pressure in commercial aircraft is maintained at a constant value regardless of the actual altitude in flight. Though cabin pressure varies somewhat with aircraft type, the nominal value is 8000 feet. For commercial flights, use a final altitude of 8000 feet to compute the required surface interval before flying.

**NOTE 4** No surface interval is required before taking a commercial flight if the dive site is at 8000 feet or higher. In this case, flying results in an increase in atmospheric pressure rather than a decrease.

**NOTE 5** For ascent to altitude following a non-saturation helium-oxygen dive, wait 12 hours if the dive was a no-decompression dive. Wait 24 hours if the dive was a decompression dive.