

# NOAA DIVING Standards & Safety MANUAL

N D S S M

**Effective Date: 05 April 2017**

APPROVALS

| | | |
|---|---|---|
| Director, OMAO | RADM David A. Score, NOAA | 05 APRIL 2017 |

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**(Current version)**

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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.

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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 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 gases and equipment that are to be used and the manning 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 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).

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."

C. Tasks exempt from the OSHA commercial diving regulations found in 29 CFR 1910, Subpart T and completed by a scientific diver are limited to observation and data gathering and are performed for collection of data used for the advancement of science.

1) Examples of scientific diving tasks include but are not limited to: data collection (e.g., water or bottom samples flora and fauna); observing and documenting (including the use of cameras); and measuring and counting.

2) If tools are used they include, but are not limited to: "light" hand tools (e.g., small hammers, pliers, screwdrivers, chisels). Other ancillary equipment such as small lift bags (<100 pounds lifting capacity) and small air lifts can also be used if the tasks are associated with data collection.

D. Tasks, such as 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 cannot be conducted under the scientific exemption.

1.1.4 Scope and Application.

A. The policies and procedures in this Manual apply to:

1) All NOAA diving operations – including scientific dives (except where noted) – regardless of where or when they are conducted;

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; 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 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? |
| Can the tasks be accomplished with minimal physical exertion? |
| Can the tasks be accomplished in short duration (e.g., <1-hour)? |
| 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 certification by action of the NDCSB.

D. No person shall engage in diving operations under the auspices of the NDP unless they hold a current certification 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. The NDCSB may accept substitutes for equipment, materials, apparatuses, arrangements, procedures, or tests required in this Manual if it can be demonstrated the substitutes provide an equivalent or increased level of safety and remain in compliance with 29 CFR 1910 Subpart T.

B. 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.

C. 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, total loss of property, 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.

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) website at http://www.omao.noaa.gov/learn/diving-program/diving/regulations.

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 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 and certify 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. Investigate and implement new diving technologies and techniques for NOAA divers.

I. Provide equipment, personnel and expertise to NOAA field operations, as needed.

J. Promote NOAA and the NDP through education and outreach.

K. Investigate diving mishaps, incidents and accidents 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 the NDP.

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. As required by 29 CFR 1910, Subpart T, the NDCSB has absolute and autonomous authority over 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 NDPM.

2.1.2 Responsibilities.

A. Overall responsibility for the NDP.

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.

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### 2.2 NOAA Diving Program Manager

2.2.1 General.

A. Selected by the Director, OMAO from a certified list of candidates from the Workforce Management Office (WFMO) or Office of Personnel Management (OPM) with input 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. (The NDPM may not delegate responsibility for the overall safe operation of the NDP.)

2.2.2 Responsibilities.

A. Implements all policies and decisions prescribed by the NDCSB.

B. Responsible to the Director, OMAO for the management of the NDP.

C. Reviews recommendations from the NOAA Diving Safety Officer (NDSO) and takes appropriate action.

D. Suspends diving operations considered to be unsafe or unwise.

E. Investigates and reviews new diving technologies and techniques.

F. Suspends diving privileges for violations of the standards and procedures in accordance with this Manual.

G. Revokes diving privileges for violating the standards and procedures in accordance with this Manual as directed by the NDCSB.

H. Advises the Director, OMAO of circumstances adversely impacting safety and/or efficiency of the NDP.

2.2.3 Management and Administration.

A. Conducts an annual review of all NOAA diving operations and submits a report to 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.

2.2.4 Training and Certification.

A. Determines completion of certification requirements and issues NOAA diver certifications and authorizations to dive.

B. Signs all “Letters of Authorization to Dive,” “Dive Certifications” and “Diver ID Cards”.

2.2.5 Qualifications.

A. NOAA certified 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. Currently certified in cardiopulmonary resuscitation (CPR), including adult Automated External Defibrillator (AED), first aid and oxygen administration and be knowledgeable in dive accident management.

## 2.3 NOAA Diving Center Manager (NDCM)

2.3.1 General.

A. Selected by the NDPM from a certified list of candidates from the Workforce Management Office (WFMO) or Office of Personnel Management (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.)

2.3.2 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.

2.3.3 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.

2.3.4 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.

2.3.5 Qualifications.

A. NOAA certified diver, or 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 and oxygen administration and be knowledgeable in dive accident management.

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## 2.4 NOAA Diving Control and Safety Board

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

2.4.2 Composition and Qualifications.

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

1) NDPM;

2) LODOs with active diving programs; and

3) NOAA Deputy Line Office Diving Officers (DLODOs) with active diving programs;

B. The NOAA Diving Safety Officer (NDSO), the NOAA Diving Center Manager (NDCM) and the NOAA Diving Medical Officer (NDMO) are non-voting members of the NDCSB.

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.

2.4.3 Selection of NDCSB Members.

A. NDPM is selected by the Director, OMAO from a list of candidates provided by the WFMO or 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.

2.4.4 Chairperson.

A. The Chairperson shall be selected from the current LODOs and DLODOs by majority vote of all voting members.

B. The Chair of the Board communicates directly with the Director OMAO and shall report on a regular basis to the Director, OMAO significant issues and decisions before the NDCSB.

2.4.5 Decision Making Process.

A. The Chairperson 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. Decisions will be made by majority vote with the Chairperson casting the deciding vote in case of a tie.

D. 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 Chairperson.

E. Though not a voting member, the opinion of the NDSO shall be recorded for all decisions relating to safety of the NDP.

2.4.6 Term Limits.

A. The Chairperson shall serve a one (1) year term, and may be re-elected.

B. 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.

C. Appointments should be scheduled so only one (1) member rotates off the NDCSB per year.

2.4.7 Responsibilities.

A. General.

1) Exercises autonomous and absolute authority over and promotes the safe and effective operations of the NDP.

2) Establishes processes and program structure necessary to effectively approve and monitor diving projects across NOAA's geographically dispersed diving program.

3) 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.

4) 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 certification 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.

E. Training and Certification.

1) Establishes and/or approves training and certification programs for both NOAA divers and non-NOAA divers participating in NOAA-sponsored dive projects.

2) Reviews, adopts, and enforces medical standards required to promote diver safety.

3) Recommends to the NDPM the revocation of diving certifications.

4) Determines equivalency of potential diving partner organizations with that of the NDP for diving reciprocity.

5) Considers appeals from divers whose dive certifications are suspended.

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.

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## 2.5 NOAA Diving Safety Officer

2.5.1 General.

A. The NDSO is selected by the Director, Safety and Environmental Compliance Division (SECD), OMAO from a certified list of candidates from WFMO or OPM. The selection committee is chaired by the Director, Safety and Environmental Compliance Division, OMAO and must include members from the NDCSB.

B. Reports to the Director of the OMAO Safety and Environmental Compliance Division.

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 the Director of OMAO SECD.

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 delegate, 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, SECD.

F. Conducts, facilitates and oversees the Diving Unit Safety Assessment (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 and oxygen administration and be knowledgeable in dive accident management.

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## 2.6 Line Office Diving Officers

2.6.1 General.

A. Senior representatives for diving for each of the NOAA Line Offices with active diving missions (NMFS, NOS, OAR, 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 Diving Unit Safety Assessment (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 ensure compliance with this Manual.

2) Maintains familiarity with diving activities within assigned units and submits annual report to the NDPM by November 30 of each year for the preceding fiscal year.

C. Training.

Determines recertification requirements for divers whose diving authorizations have lapsed by more than six (6) months, per Section 3.5.2.

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.

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 and oxygen administration and be knowledgeable in dive accident management.

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## 2.7 Deputy Line Office Diving Officers

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.

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 and oxygen administration and be knowledgeable in dive accident management.

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## 2.8 Unit Diving Supervisors

2.8.1 General.

A. Assigned throughout the agency to provide administrative oversight of divers at the facility level within their respective Line Office.

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.

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 certified 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 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 (e.g., Letters of Certification, training, and equipment) for assigned divers.

3) Ensures all divers are certified, properly trained, and fit to perform the required diving.

4) Conducts or delegates Annual DUSA Self-Assessment Inspection and submits 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.

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.

C. Training. Conducts operational training and skills evaluation check-out dives as needed.

D. Standardized Equipment Program.

1) Keeps NDC apprised of changes to unit roster.

2) Tracks SEP equipment and ensures gear is returned to NDC upon departure of divers from unit.

3) Verifies accuracy of annual SEP assessment charges for assigned divers.

4) Helps facilitate collection of SEP fees by ensuring a local budget office has the accounting codes from divers' supervisors.

2.8.3 Qualifications.

A. Current or former NOAA certified diver.

B. Completes the NOAA DM training program.

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 and oxygen administration, and be knowledgeable in dive accident management.

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## 2.9 Technical Diving Supervisor (TDS)

2.9.1 General.

A. Technical Diving Supervisors 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. Technical Diving Supervisors may dive as long as there is another qualified Technical Diving Supervisor 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 Dive Operations Plan, 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. Approved by the NDCSB.

B. Certified technical diver.

C. Completed NOAA Divemaster training.

D. Completed a minimum of 25 technical dives following technical diving training.

E. Shadowed a qualified Technical Diving Supervisor or equivalent during a minimum of three (3) NOAA technical dives and received the approval for continuance by the qualified Technical Diving Supervisor.

F. Conducted a minimum of four (4) dives as a supervisor in training and received the written approval of the qualified Technical Diving Supervisor. During these dives, the candidate is required to supervise the technical dives as their sole task / responsibility.

G. The application for Technical Supervisor for someone with prior experience will be reviewed and approved by the NDCSB and will be considered on a case by case basis.

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## 2.10 Divemaster and Lead Diver

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 DM’s performance plan.

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) 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.

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 captain 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.

12) Conducts pre- and post-dive safety briefings.

13) Assists in administration of 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 unit.

2.10.3 Qualifications.

A. Divemaster.

1) Current or former NOAA certified 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 and oxygen administration and be knowledgeable in dive accident management.

B. Lead Diver.

1) Current NOAA certified 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.

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## 2.11 Ship Diving Officer

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 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 report to the UDS responsible for the unit by January 15 of each year.

G. Assists in administration of DUSA program.

H. Maintains a thorough passdown log within the Unit Log.

I. Reminds arriving/departing divers of their requirement to submit a NOAA Form 57-03-04 Diving Unit Change Form to NDC.

J. Prepares diver training applications and submits them to UDS.

2.11.3 Qualifications.

A. May be any crewmember duly appointed by the Commanding Officer.

B. Thorough understanding of diving operations and procedures.

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## 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 Divemaster or Lead Diver is physically on the dive station to ensure all NOAA Diving Program (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 Divemaster or Lead Diver is physically on the dive station to ensure all NDP standards, policies, and procedures are followed.

2.12.2 Responsibilities

A. NOAA Divers, Divemaster and Lead Divers

1) Initiates requests to utilize non-NOAA personnel to oversee NOAA diving operations through their Unit Diving Supervisors (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 Divemasters and Lead Divers assigned to assist non-NOAA Diving Personnel on the dive station shall:

a. Ensure that all dive operations are conducted in accordance with the NOAA Diving Standards and Safety 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 the NOAA Diving Standards and Safety 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 Divemaster or Lead Diver in all phases of the dive operation including pre-dive planning;

b. Obtain concurrence from the NOAA Divemasters and Lead Divers to commence dive operations;

c. Keep assigned NOAA Divemaster or Lead Diver informed on progress of dive operations, and;

d. Relinquish oversight of the dive operation when so directed by the assigned NOAA Divemaster or Lead Divers.

C. Unit Diving Supervisors

1) Reviews requests from Divers, Lead Divers, and Divemasters to oversee operations and, if deemed appropriate, forward to their respective Line Office (LO Diving Officer.

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 NOAA Diving Control and Safety Board.

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 shall be certified 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. 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.

I. 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 the NOAA Diving Standards and Safety 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 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.

## 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. B. Observer Divers may participate in up to six (6) dives per year unless otherwise authorized by the LODO.

2.15.5 Manning 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 unless waived by the LODO.

C. A Designated Person In-Charge 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[1] | 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 [1]: 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.

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## 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. 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 of the year in which they were established; they must be re-established annually.

D. 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 for the current calendar year.

D. Reciprocity agreements are reviewed by the NDPM at the end of the calendar year and may be renewed at the request of the sponsoring UDS.

E. A list of current reciprocity agreements is maintained on the website at http://www.omao.noaa.gov/learn/diving-program/about/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 NDC provide the LOR. All LOR requests must be issued within seven (7) days and should be issued within three (3) days.

B. LOR requests submitted to NDC must use the Letter of Reciprocity Request Form, available on the NDC website and be sent to 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

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 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 LO 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.

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 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 his/her recommendation, to their LODO. The LODO shall forward documentation, along with his/her 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 authorization to dive as a Volunteer under NOAA auspices. The NDPM will notify the LODO and UDS of his/her 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 Openwater, Advanced Openwater 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 Trainer.

G. Successful completion of Checkout Dive(s) with a NOAA Trainer, 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 Special Task Endorsement

2.19.1 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.

2.19.2 Responsibilities.

A. Unit Diving Supervisor. 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. 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 send a copy to support.ndc@noaa.gov so the STE can be included in the NOAA Diver Database.

2.19.3 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 his 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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## 2.20 Recognition of Non-NOAA Diving Certifications

2.20.1 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. NDCSB will ultimately determine equivalency of non-NOAA dive certifications (e.g., commercial or military dive training and experience) towards meeting NOAA requirements.

2.20.2 Responsibilities.

A. NOAA Diver candidates must meet the requirements for safety training, medical clearance, and swim test outlined in Section 3.1 of this Manual.

B. Must pass a written examination covering the topics outlined in Section 3.2.1 of this Manual.

C. Must pass a practical examination (checkout dive) administered by a NOAA Dive Trainer covering the topics outlined in Section 3.2.2 and 3.2.3 of this Manual.

D. Must complete other NOAA-specific training as determined by the NDCSB.

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## 2.21 NOAA Diving Medical Officer

2.21.1 General.

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

2.21.2 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-recognized hyperbaric training courses, including both NOAA/Undersea and Hyperbaric Medical Society (UHMS) Physicians Training in Diving Medicine course and the U.S. Navy's Recognition and Treatment of Diving Injuries course.

D. Holds and maintains a NOAA diving certification.

2.21.3 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 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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## 2.22 Other Diving Medical Officers within NOAA

2.22.1 General.

A Diving Medical Officer (DMO) is a health care provider with specialized training in diving and hyperbaric medicine as stated in 2.19.1. These individuals may be assigned anywhere within NOAA.

2.22.2 Qualifications.

A. Is a licensed health care provider assigned to NOAA; and

B. Completes a NOAA-recognized hyperbaric training course. Completion of either the NOAA/Undersea and Hyperbaric Medical Society (UHMS) Physicians Training in Diving Medicine course or the U.S. Navy's Recognition and Treatment of Diving Injuries course will satisfy this requirement.

2.22.3 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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## 2.23 NOAA Diving Medical Review Board

2.23.1 General.

A. The NOAA Diving Medical Review Board (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.

2.23.2 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 NDMO to assess application of the NDP'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.

2.23.3 Qualifications.

A. Chair.

1) Federal employee or a member of a uniformed service.

2) NOAA certified scuba 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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## 2.24 NOAA Diving Technical Advisory Committee

2.24.1 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.

2.24.2 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.

2.23.3 Qualifications.

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

## Section 3: DIVER CERTIFICATION AND TRAINING

### 3.1 Diver Candidate Requirements

3.1.1 Safety Training.

Candidates for NOAA Diver certification 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).

3.1.2 Medical Clearance.

A. All NOAA diver candidates must successfully pass a NOAA diving physical examination prior to beginning the NOAA Diver certification process.

B. Specific physical examination requirements are briefly described in Section 6.2 and covered in detail in the NOAA Diving Medical Standards and Procedures Manual which can be viewed and downloaded from the NDP website at http://www.omao.noaa.gov/learn/diving-program/diving/noaa-diving-medicine.

C. NOAA Forms 57-03-50 Medical Evaluation Checklist and Authorization to Dive, 57-03-51 Report of Physical Examination - Diver, and 57-03-52 Report of Medical History 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.

3.1.3 Swim Test.

A. General.

1) All NOAA diver candidates must successfully pass the NOAA Swim Test prior to undergoing initial NOAA Diver certification.

2) All swim test skills are to be completed in one (1) pool session.

3) Completion of swim test shall be documented on NOAA Form 57-03-36 NOAA Diver Skills Checkout Checklist or NOAA Form 57-03-39 Swim Test Evaluation, signed and dated by the NOAA diver candidate's UDS or designee.

B. NOAA Swim Test requirements include:

1) Swim 550 yards (500 meters) on the surface without stopping in under 15 minutes without swimming aids (goggles are allowed);

2) Swim 25 yards (22 meters) underwater without swimming aids, without surfacing, and without pushing off from the wall of the pool; and

3) Tread water for 30 minutes without any flotation aids.

3.1.4 Training Authorization.

Candidates for NOAA Diver certification 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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## 3.2 NOAA Dive Training Topics

3.2.1 Academic Topics.

Topics should include, but may not be limited to the following:

A. Diving Physics

B. Diving Physiology

C. Diving Equipment

D. NOAA Diving Standards, Policies and Procedures

E. NOAA No-Decompression Tables

F. Dive Rescue and Accident Management

G. Diving Skills and Techniques

H. Dive Planning

I. Equipment Set-up and Pre-dive Checks

J. Post-dive Information Recording

K. Air Consumption Calculations

L. Hazardous Aquatic Animals

3.2.2 Pool or Confined Water Skills.

Topics should include, but may not be limited to the following:

A. Entering and exiting water with full SCUBA equipment;

B. Clearing of mask and regulator while submerged;

C. Recovery of a regulator using two different methods;

D. Proficiency in air sharing, including buddy breathing and use of an alternate air delivery source, as donor and recipient, with and without mask;

E. Use of a Redundant Air Supply System (RASS);

F. Ability to alternate between snorkel and SCUBA while kicking;

G. Understanding of underwater hand and light signals;

H. Simulated in-water mouth-to-mouth resuscitation;

I. Rescue and transport, as a diver, a passive simulated victim of a diving accident;

J. Ability to remove and replace equipment SCUBA unit and weight belt while submerged; and

K. Watermanship ability, which is acceptable to the Course Director or Diver Trainer.

3.2.3 Open Water Skills.

Topics should include, but may not be limited to the following:

A. Proficiency in air sharing, including buddy breathing and use of an alternate air delivery source, as donor and recipient, with and without mask recipient;

B. Entering and exiting procedures to include shore, pier, and small boat while wearing SCUBA equipment;

C. Ability to maneuver efficiently at and below the surface of the water;

D. Clearing of mask and regulator while submerged;

E. Recovery of a regulator using two different methods;

F. Ability to switch to a reserve alternate air source while submerged;

G. Ability to remove and replace equipment SCUBA unit and weight belt while submerged;

H. Ability to achieve and maintain neutral buoyancy while submerged;

I. Techniques of self and buddy rescue;

J. Underwater navigation;

K. Adequate judgment for safe diving;

L. Planning and execution of a dive; and

M. Proper use of underwater tools and techniques

3.2.4 Additional Considerations.

Students should be exposed to open-water conditions while diving at night, and under conditions of reduced visibility.

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## 3.3 NOAA Dive Training Modalities

3.3.1 NOAA Dive Center Training

A. General

1) Diver candidates. Students in diving classes must meet the initial certification requirements outlined in Section 3.1.

2) Instructors

a. NOAA dive instructors shall be experienced in the subject being taught and approved by the NDPM.

b. NOAA instructors shall carry out their duties as directed by the NDPM or by the NOAA Diving Center Manager (NDCM) where appropriate.

c. The NDCM shall serve as the Course Director.

3) 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 the OSHA Commercial Diving Standards outlined in 29 CFR § 1910, Subpart T.

B. 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.

C. 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 his designee:

1) Pool or similar environments: One (1) instructor per eight (8) students; and

2) Open-water: One (1) instructor per four (4) students.

D. 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.

E. 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 NAO 209-125 (NOAA Small Boat Regulations).

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 (1) 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.

3.3.2 Local NOAA Dive Unit Training

A. General

1) Diver candidates. Students in diving classes must meet the initial certification requirements outlined in Section 3.1 as well as the following:

a. Scuba diving certification, above the basic entry level, from a nationally, or internationally recognized, diver training agency;

b. Rescue Diver certification, or equivalent as determined by the NDCSB, from a nationally or internationally recognized diver training agency; and

c. A minimum of 25 logged dives.

OR

d. NDCSB approved military or commercial training.

2) Trainers. Trainers shall have completed the NOAA Dive Trainer instructional program and be approved by the NDPM.

3) Standards.

a. Training dives conducted by employees 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 contract, 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.

c. Completion of academic instruction shall be documented on NOAA Form 57-03-37, Diver Training Course Student Evaluation Record, signed and dated by the NOAA Dive Trainer.

B. Practical Instruction.

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

2) In additional 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, NOAA Diver Skills Checkout Checklist, signed and dated by the NOAA Dive Trainer.

4) NOAA Dive Trainers may allow students who initially fail to complete a skill or exercise to repeat them until they demonstrate adequate performance.

C. 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 Dive Trainer 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.

## 3.4 Depth Limitations

3.4.1 Initial Depth Limitations.

Although the nominal depth to which NOAA Divers are certified is 130 feet sea water (fsw), all newly certified NOAA Divers and NOAA Divers transferring to a new unit shall be initially authorized to a maximum depth of 60 fsw. A diver's UDS shall assess the diver's skill, experience, and mission requirements before authorizing dives deeper than 60 fsw.

3.4.2 Certification to Dive Deeper than 130 fsw.

A. A diver holding a 130 fsw certificate may be certified to a depth greater than 130 fsw after successfully completing a NDCSB-approved deep-diving training program.

B. Dives requiring in-water decompression or deeper than 130 fsw must be pre-approved by the NDCSB.

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## 3.5 Maintaining Certification

3.5.1 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.

3.5.2 Dive Proficiency Requirements.

A. In order to maintain dive certification, NOAA Divers must log a minimum of three (3) dives during the preceding three (3) months.

B. If 24 dives are completed in a calendar year, proficiency is earned for the remainder of that calendar year.

C. 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.

D. 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.

3.5.3 Medical Standards (See Section 6).

3.5.4 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.

3.5.5 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 on NOAA Form 57-03-34 Annual Diver Training Record, by the UDS or designee, and filed on site.

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 12 minutes or less;

3) Swim 550 yards (500 meters) in drysuit with mask, snorkel and fins in 15 minutes or less;

4) Swim 550 yards (500 meters) underwater in scuba gear and wetsuit in 16 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.

3.5.6 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 a conditioning level sufficient to pass the annual watermanship assessment. [See 5 USC 7901(a)].

3.5.7 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 on NOAA Form 57-03-34 Annual Diver Training Record by the UDS or designee.

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 Assessment 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).

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## 3.6 Recertification

3.6.1 General.

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

3.6.2 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 recertification 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

1) If a diver does not maintain proficiency for a period of 6-12 months, the LODO is responsible for reauthorization.

2) Divers must complete a minimum of a training-only, basic checkout dive with the UDS or designee.

3) NOAA Form 57-03-35 Checkout Dive Skills Evaluation must be completed.

4) The UDS will forward a copy of the Skills Checkout Form and a recommendation to the LODO for consideration.

5) The LODO will determine if the diver has met the recertification requirements and either authorize the diver to return to diving status or specify any additional requirements needed to reauthorize.

6) 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.

C. More than 12 month lapse. If a diver does not maintain proficiency for a period of more than 12 months they must complete Module 2 of the NOAA Diver Training course or a refresher training program specified by the LODO.

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## 3.7 Suspension and Revocation of Dive Certifications

3.7.1 General.

A. NOAA dive certifications may be temporarily suspended or permanently revoked for cause.

B. Temporary suspension of NOAA dive certification is typically issued for medical reasons or minor infractions of NOAA diving regulations, policies, or procedures.

C. Permanent revocation of dive certification is typically reserved for more serious conditions or violations of NOAA diving regulations, policies, or procedures.

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

3.7.3 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-dive 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 certifications shall only be issued by the NDPM upon direction of the NDCSB.

3.7.4 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.

## Section 4: DIVING STANDARDS AND PROCEDURES

### 4.1 General

4.1.1 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.

4.1.2 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 the Manual are specific requirements that must be met in order to conduct scientific training or proficiency dives under the OSHA scientific exemption.

4.1.3 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 3.2 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.

4.1.4 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.

B. The diver should report to the DM/LD:

1) The conditions that led her/him 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.

4.1.5 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.

4.1.6 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 his/her 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.

4.1.7 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.

4.1.8 Unit Inspections.

A. All NOAA diving units will conduct an annual self-inspection using NOAA Form 57-03-03 Diving Unit Inspection Checklist.

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. 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.

4.1.9 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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## 4.2 Pre-Dive Procedures

4.2.1 General.

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

4.2.2 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 Dive Operations Plan. 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.

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.

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. Decompression Tables and Procedures. NOAA-approved decompression computers shall be at the dive location.

4.2.3 Diving Emergency Assistance Plan (DEAP).

A. All DEAPs shall be prepared using NOAA Form 57-03-21 Diving Emergency Assistance Plan (DEAP).

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.

4.2.4 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) Safety procedures for the diving mode;

5) Any unusual hazards or environmental conditions likely to affect the safety of the diving operation;

6) Any modifications to operating procedures necessitated by the specific diving operation;

7) Entry and exit location and procedures;

8) Descent, on-bottom, and ascent procedures; and

9) Emergency and accident management procedures, including diver recall procedures.

4.2.5 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; and

2) Inform the dive team members that physical problems or adverse physiological effects should be verbally reported to the DM or LD.

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.

4.2.6 Pre-Dive Checklist.

A. NOAA Form 57-03-23, DOP Pre and Post-Dive 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.

4.2.7 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. First aid kit. The following items shall be available at the dive location:

1) An NDMO-approved first aid kit, appropriate for the diving or chamber operation, and with current medications (Appendix 4); and

2) A first aid handbook from the American Red Cross, American Heart Association or equivalent.

D. Oxygen resuscitator.

1) Positive pressure ventilator and a bag-type manual resuscitator with transparent mask capable of ventilating an unconscious victim.

2) Sufficient quantity of oxygen to supply one (1) diver for:

a. The time required to transport them to a higher-level medical care facility; or

b. 12 hours, whichever occurs first.

3) Oxygen cylinders shall be maintained within current hydrostatic test date.

4) Oxygen kits shall be stowed in a clean, protected and clearly labeled space.

5) Oxygen kits shall be checked prior to each day of diving.

E. Automated External Defibrillator (AED). An AED, in good working condition, shall be available at the dive site.

F. Backboard. A backboard and cervical collar, in good working condition, shall be available at the dive site when practical.

4.2.8 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. The DM or LD shall conduct a final safety check of each diver's gear before allowing divers to enter the water.

D. Any equipment in questionable condition shall be removed from service immediately and clearly labeled in order to preclude its use.

E. Unless approved by the LODO, all dive equipment shall be worn in the configuration depicted in Appendix 5.

4.2.9 Warning Signals.

A. For all OSHA-exempt 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 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.

4.2.10 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.

4.2.11 Diver Recall Capability.

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.

## 4.3 Diving Procedures and Requirements

4.3.1 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. 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.

D. The propulsion system (e.g., propeller, jet drive) of the vessel shall be disengaged before divers enter or exit the water.

4.3.2 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.

4.3.3 Supervisor Dive Log.

A dive log will be kept at the dive location in accordance with Section 12.1.5.

4.3.4 Decompression Tables.

A set of NOAA-approved decompression tables (as appropriate for the breathing gases used) shall be at the dive location during air and nitrox (EAN28 – EAN40) no-decompression dives. A NOAA-approved decompression computer shall be at the dive location during decompression and mixed gas dives.

4.3.5 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 include the use of solo line-tended standby divers, solo tethered dives with hardwired communications and emergency situations.

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 4.9).

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.

4.3.6 Safety Stops.

A. For all no-decompression dives conducted deeper than 60 fsw and all repetitive dives deeper than 45 fsw, a precautionary safety stop is recommended at a depth between 15 feet and 20 feet for 3-5 minutes.

B. If sea conditions or breathing gas supply are such that safety stops cannot be performed safely, they may be omitted.

C. The time spent at a safety stop need not be added to the diver's total bottom time.

4.3.7 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 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) SpareAir® (3 $Ft^3$ minimum) for depths ≤30 feet; or

3) 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 per diagram 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.

4.3.8 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.

4.3.9 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 all dives conducted beyond a comfortable swimming distance from shore, in areas of strong current, arduous egress or outside the no-decompression limits, 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.

C. The small boat operator can serve as the DPIC as long as they are able to devote their full attention to the diving operation.

D. The DM/LD may require additional topside support personnel based on the conditions anticipated.

E. The UDS may waive the topside support requirement for OSHA-exempt dives where the ingress and egress is from shore.

4.3.10 Standby Diver(s).

A. Standby diver(s) shall be configured per 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 deeper than 100 fsw or 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 deemed appropriate by the DM or LD of the dive operation.

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.

4.3.11 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 captain 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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## 4.4 Post-Dive Procedures

4.4.1 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).

4.4.2 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 24 hours after completion of a dive.

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.

4.4.3 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.

4.4.4 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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## 4.5 Open Circuit Scuba Diving

4.5.1 General.

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

B. 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).

C. 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.

4.5.2 Manning Requirements.

The minimum personnel required to conduct a scuba dive:

| 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 |
|---|---|---|---|---|---|
| **OSHA-subject dives** | Divers | 2 | 2 | n/a | 1 |
| | Standby Divers | 2[A] | 2[A] | n/a | 1 |
| | Topside Support | 1 | 1 | n/a | 1 |
| | **TOTAL** | **5** | **5** | **n/a** | **3** |

| | | | | | |
|---|---|---|---|---|---|
| **OSHA-exempt dives** | Divers | 2 | 2 | 2 | 1 |
| | Standby Divers | 0[B] | 2 | 2[D] | 1 |
| | Topside Support | 1[C] | 1 | 1 | 1 |
| | **TOTAL** | **3** | **5** | **5** | **3** |

[A] A line-tended standby diver may be substituted for two (2) free swimming standby divers.
[B] The UDS/DM or LD may require standby divers on any dive.
[C] The UDS may waive the topside support for shore based dives.
[D] An on-bottom safety diver may be substituted for free swimming standby divers.

4.5.3 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 meteorological conditions prevent safe deployment, retrieval or tracking of divers.

4.5.4 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.

4.5.5 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 approved by the NDCSB.

C. Dive computers shall:

1) Have the batteries replaced annually;

2) Have O-rings inspected annually and replaced as needed; and

3) Be compared against a master reference gauge annually and any time there is a discrepancy greater than two (2) percent between any two (2) equivalent gauges. Computers may have no deviation from the master gauge greater than +3.0/-0.0 fsw at a pressure equivalent to 300 fsw.

4.5.6 Line Tenders.

A. Non-tethered, Free Swimming Buddy Team Mode.

1) In this mode, a line tended standby diver used only in an emergency; and

2) 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.

B. Tethered with Voice Communications Mode.

1) In this mode, line tending is required; and

2) Training consists of completing an NDP tethered SCUBA diver course.

---

## 4.6 Drysuit Diving

4.6.1 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.

4.6.2 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.

4.6.3 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 except during initial drysuit training.

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. Inflator and exhaust valves shall be serviced according to the manufacturer's recommendations. If manufacturer has no service recommendation, valves shall be serviced annually. SEP equipment will be serviced by NDC, non-SEP equipment will be serviced by the Dive Unit.

4.6.4 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 instructions for excess positive buoyancy above.

---

## 4.7 Line-Tended Scuba Diving

4.7.1 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. As defined by NOAA, line-tended diving does not utilize voice communications, and therefore, can only be used by standby divers.

C. Each line-tended SCUBA diver must be tended by a separate tender.

4.7.2 Manning Requirements (Refer to Section 4.5.2).

4.7.3 Limits.

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

4.7.4 Equipment Requirements.

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

4.7.5 Training Requirements.

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:

1) Dressing procedures;

2) Tending procedures; and

3) Emergency procedures.

C. Non-divers may be trained as tenders and shall participate in the entire training session, minus the actual diving portion, outlined in this section.

4.7.6 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.

---

## 4.8 Tethered Scuba with Voice Communications

4.8.1 General.

A. When conducting tethered scuba diving operations the diver shall be equipped with a life-line and two-way voice communications.

B. Standby diver(s) shall be outfitted with the same gear configuration as the primary diver(s) including two-way communications.

4.8.2 Manning Requirements. (Refer to Section 4.5.2)

4.8.3 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.

4.8.4 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.

4.8.5 Training.

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 minimum cumulative bottom time of 150 minutes for certification.

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

4.8.6 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.

4.8.7 Emergency Procedures.

A. Loss of primary gas supply. The diver will switch to the reserve breathing supply, notify topside personnel, 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 personnel via voice communications 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.

4.8.8 Proficiency Requirements.

In order to maintain tethered scuba diving certification, all trained divers and tenders must perform/tend at least one (1) tethered scuba dive every 12 months. Dives will be documented using the standard online dive log.

---

## 4.9 Diving in Low Visibility

4.9.1 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 (holding hands) 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.

4.9.2 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. NOAA divers shall be trained in methods of maintaining contact.

D. 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.

4.9.3 Equipment.

A. Equipment used for line-tending diver(s) in zero visibility shall comply with standards described in the Procedures for Tending Standby Scuba Divers presentation.

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.

4.9.4 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 4.9.2 A) to use to conduct low-visibility dives.

B. NOAA Unit Diving Supervisor. Appoints DMs/LDs to oversee and direct diving operations.

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## 4.10 Blue-Water and Over-Bottom Diving

4.10.1 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 approved by the LODO.

4.10.2 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.

4.10.3 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.

4.10.4 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.

---

## 4.11 Overhead Obstruction Diving

4.11.1 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.)

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.

4.11.2 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.

4.11.3 Training and Proficiency.

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.

---

## 4.12 Cold-Water Diving

4.12.1 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.

4.12.2 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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## 4.13 Snorkeling/Breath-Hold Diving

4.13.1 Scope.

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

4.13.2 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.

4.13.3 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.

## 4.14 Diving Near Unexploded Ordinance

4.14.1 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.

4.14.2 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).

4.14.3 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.

## 4.15 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.

## 4.16 Surface Supplied Diving Mode

4.16.1 General.

A. Surface-supplied dives are those dives where the primary breathing gas is supplied from the surface by means of a pressurized umbilical.

B. NOAA divers engaged in surface-supplied diving activities shall obtain approval from the NDCSB prior to commencing operations and shall comply with the requirements outlined in this section.

C. Equipment standards for surface supplied diving can be found in Sec 7.5.1.

4.16.2 Limits.

A. Surface-supplied diving shall not be conducted at depths deeper than 185 fsw.

B. Dives outside the no-decompression limits or deeper than 100 fsw require a dual lock, multi-place hyperbaric chamber located within 5 minutes of the dive location.

C. A bell shall be used for dives with an in-water decompression time greater than 120 minutes, except when diving is conducted in physically confining spaces.

4.16.3 Minimum Personnel.

A. The minimum number of personnel to conduct surface-supplied dives is as follows:

| | |
|---|---|
| Diver | 1 |
| DPIC | 1 |
| Tender | 1 |
| Standby Diver | 1 |
| **TOTAL** | **4** |

Additional personnel may be required based on the specific operation.

4.16.4 Procedures.

A. Each diver shall be continuously tended by a separate dive team member while in the water.

B. A diver shall be stationed at the underwater point of entry when diving is conducted in enclosed or physically confining spaces.

C. Each diving operation shall have a primary breathing gas supply sufficient to support divers for the duration of the planned dive including the ascent phase of the dive.

D. A standby diver shall be available while a diver is in the water.

E. A diver-carried reserve breathing gas supply shall be provided for each diver.

F. A dive-location reserve breathing gas supply shall be provided.

G. Non-return valves on mask or helmets shall be functionally tested prior to commencement of dive.

---

**4.17** 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. OSHA-exempt dives conducted beyond the US Navy No-Decompression Limits shall be conducted in accordance with standards outlined in Sections 8, 9 and 10 of this manual.

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**4.18** Other Techniques

4.18.1 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.

4.18.2 Spear Guns and Powerheads

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

4.18.3 Welding and Burning.

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.

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## 4.19 Hyperbaric Chamber Operations

4.19.1 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.

4.19.2 Manning 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 |
| **TOTAL** | **4** |

4.19.3 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 according with established standards; and

d. Coordinates treatment procedures with medical personnel and vessel captain.

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. Prescribes and administers as necessary, hyperbaric chamber treatment procedures; and

b. 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.

4.19.4 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 5: DIVING AND SUPPORT EQUIPMENT

### 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 examined by the person using it prior to diving.

C. All equipment in need of 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, 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.

D. Any diving conducted using specialized equipment or procedures (e.g., drysuits, full face masks, tethered or line-tended scuba) shall be practiced on an annual basis to maintain proficiency. Failure to meet these minimum standards requires work-up dives to be conducted prior to making duty dives.

E. All diving equipment shall be stored in a secure, properly ventilated space free of noxious fumes and 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 recorded on NOAA Form 57-03-72 Standardized Equipment Program Review of Property and submitted to the UDS.

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.

A. Participation in the Standardized Equipment Program (SEP) is required for all full time employees (FTEs) in the NOAA Diving Program.

B. Participation in the Standardized Equipment Program (SEP) is voluntary for all NOAA-contract employees in the NOAA Diving Program who are authorized to do so by their contracting offices within NOAA.

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, 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) with attached alternate air source regulator. Additional equipment includes a wetsuit, boots, gloves, hood, fins, weight belt/harness, knife, ankle weights (for drysuit) and a gear storage bag.

B. Participants in the SEP who have been certified by NOAA to dive using a drysuit 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.

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. Annual Service.

Regulator sets, BCD inflators, and alternate air source second stage regulators shall be returned to the SEP Coordinator annually for service.

B. 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.

C. 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 will 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 will 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, the regulator sets, BCD, and drysuit (if supplied) shall be returned to the SEP. It is the responsibility of the UDS to ensure this gear is collected from the diver and promptly returned to the SEP.

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## 5.3 Support Equipment

5.3.1 Emergency Oxygen Kits.

A. A 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/positive pressure regulator 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)shall be serviced according to the manufacturer's recommendations to ensure delivery pressure is within the manufacturer's specifications. If manufacturer has no service recommendation, valves shall be serviced every two (2) years. SEP-issued equipment will be serviced by NDC, non-SEP equipment will be serviced by the Dive Unit.

E. 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.

F. Oxygen kits shall be checked before every day of diving.

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 shall be within expiration date.

5.3.4 Air Compressor Systems.

A. Air 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. Air 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. Air compressor final stage relief valves shall be tested for proper operation every three (3) years.

E. The output of NOAA compressor systems shall be tested for gas purity every six (6) months and test results maintained at both the unit and NDC.

F. Non-oil lubricated compressors (e.g. Rix) need not be tested for oil mist contaminants.

G. 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.

H. When possible, the test results should be posted near the compressor.

I. A log shall be maintained showing operation, repair, overhaul, filter maintenance, and temperature adjustment for each compressor.

J. A copy of the manufacturer's operator's manual shall be readily available for reference and written operating procedures posted near the compressor.

K. All air system components (e.g., plumbing, valves, and gauges) shall be:

1) Properly rated for the working pressure of the system and labeled with their functions; and

2) Properly secured to prevent injury.

L. 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.

M. 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.

N. 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.

O. 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 and protected from excessive heat;

3) Be secured from falling;

4) Have shut-off valves recessed into the cylinder or protected by a cap, except when in use or interconnected; and

5) Be hydrostatically tested every 5 years if part of a bank of cylinders, including those stamped with a star (★) in the codes.

5.3.5 Air Quality Standards.

Breathing air for NOAA diving shall meet the following specifications as set forth in OSHA regulations at 29 CFR 1910.430(b)(3) and as appear in current NAVSEA regulations.

| NAVSEA 0910-LP-106-0957 USN Diving Manual, VOL 1, REV 6, Change A, 15 October 2011, TBL 4-1 (current as of 25 Aug 2016) | |
|---|---|
| Constituent | Specification |
| Oxygen (percent by volume) | 20 - 22% |
| Carbon dioxide (by volume) | 1000 ppm (max) |
| Carbon monoxide (by volume) | 20 ppm (max) |
| Condensed Hydrocarbons (as $CH_4$ by volume) | 25 ppm (max) |
| Odor and taste | Not objectionable |
| Oil, mist, particulates | 5 $mg/m^3$ (max) |

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.

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## 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 the same configuration as the figures shown in Appendix 5.

B. At a minimum, all NOAA certified 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;

6) A weight system capable of quick release;

7) A knife or other cutting device;

8) A pair of swim fins;

9) A timekeeping device;

10) A depth gauge;

11) Thermal protection appropriate for the conditions; and

12) 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

1) The NDC will not issue a RASS 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, serviced and tested by a qualified technician every 12 months.

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. 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 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. The inflation assembly shall be serviced every 12 months from the date of issue.

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. 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.

D. A timekeeping device shall be:

1) Worn by each diver; and

2) Present at the diving location for topside support.

E. 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.

F. 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 applicable provisions of the Unfired Pressure Vessel Safety Orders;

2) Hydrostatically tested every five (5) years in accordance with U.S. Department of Transportation standards; and

3) Visually inspected internally and externally by a qualified technician annually or when suspect.

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

5.4.6 Other Maintenance Requirements.

A. Dive computers shall:

1) Have the batteries replaced annually;

2) Have the O-rings inspected annually and replaced as needed; and

3) Be compared against a master reference gauge annually and any time there is a discrepancy greater than two (2) percent between any two (2) equivalent gauges. Computers may have no deviation from the master gauge greater than +3.0/-0.0 fsw at a pressure equivalent to 300 fsw.

B. Buoyancy compensator device inflator assemblies shall be serviced annually in accordance with the manufacturer’s recommended guidelines.

C. Weight-harness systems with quick-release mechanisms shall be tested for proper function prior to each diving day.

D. Standby diver tending line (without communication wires) shall be pull-tested annually to a minimum of 300 pounds.

5.4.7 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 helps maintain familiarity with the controls and function of the equipment, develop muscle memory needed to react automatically during emergencies, and promote physical fitness.

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 57-03-69 NOAA-Owned Gear Off-Duty User Agreement and NOAA Form 57-03-70 NOAA-Owned Diving Equipment Off-Duty Equipment User Release of Liability. 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 NOAA 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 NDPM. 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 Surface Supplied Diving Equipment

5.6.1 Hookah Diving.

OSHA regulations prohibit hookah diving; no NOAA diver shall use hookah.

5.6.2 Masks and Helmets.

A. Surface-supplied and mixed gas masks and helmets shall have:

1) A non-return valve at the attachment point between the mask/helmet and hose which shall close readily and positively; and

2) An exhaust valve.

B. Surface-supplied masks and helmets shall have a minimum ventilation rate capability of 4.5 actual cubic feet per minute (acfm) at any depth at which they are operated or the capability of maintaining the diver's inspired carbon dioxide partial pressure

below 0.02 atmospheres absolute (ATA) when the diver is producing carbon dioxide at the rate of 1.6 standard liters per minute.

C. Helmets or masks connected directly to the dry suit or other buoyancy-changing equipment shall be equipped with an exhaust valve.

5.6.3 Breathing Gas Supply Hoses.

A. Breathing gas supply hoses shall:

1) Have a working pressure at least equal to the working pressure of the total breathing gas system (if HP bank is used, a relief valve must be downstream from the pressure reducing regulator);

2) Have a rated bursting pressure at least equal to four (4) times the working pressure;

3) Be tested at least annually to 1.5 times their working pressure; and

4) Have their open ends taped, capped, or plugged when not in use.

B. Breathing gas supply hose connectors shall:

1) Be made of corrosion-resistant materials;

2) Have a working pressure at least equal to the working pressure of the hose to which they are attached; and

3) Be resistant to accidental disengagement.

C. Umbilicals shall:

1) Be marked in ten (10) foot increments to 100 feet, beginning at the diver's end, and in 50 foot increments thereafter;

2) Be made of kink-resistant materials; and

3) Have a working pressure greater than the pressure equivalent to the maximum depth of the dive (relative to the supply source) plus 100 psi.

5.6.4 Weights and Harnesses.

A. Divers shall be equipped with a weight belt or assembly capable of quick release.

B. Diver shall wear a safety harness capable of lifting the diver from the water to the platform (i.e., man-rated) and be configured with:

1) A positive buckling device;

2) An attachment point for the umbilical to prevent strain on the mask or helmet; and

3) A lifting point to distribute the pull force of the line over the diver's body.

5.6.5 Buoyancy Control.

A drysuit or other buoyancy-changing equipment not directly connected to the helmet or mask shall be equipped with an exhaust valve.

5.6.6 Gauges and Timekeeping Devices.

A. A timekeeping device and gauges indicating diver depth that can be read at the surface shall be available at each diving location.

B. All depth gauges shall be deadweight tested or calibrated against a master reference gauge every six (6) months, and when there is a discrepancy greater than two (2) percentage points between any two (2) equivalent gauges.

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## 5.7 Hyperbaric Chamber Equipment and Systems

5.7.1 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 a level of 25 percent oxygen by volume;

b. Mufflers on intake and exhaust lines, which shall be regularly inspected and 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.

5.7.2 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 cu ft. 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 cu ft), plus the tender, during the last 30 minutes and the ascent (75 cu ft).

## Section 6: MEDICAL STANDARDS

### 6.1 Medical Standards and Procedures for NOAA Diving

6.1.1 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.

6.1.2 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.

6.1.3 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.

## 6.2 Medical Examinations

6.2.1 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.

B. At the time the physical examination is performed, the examiner must complete, sign and date NOAA Form 57-03-52 Report of Medical History – Diver and NOAA Form 57-03-51 Report of Physical Examination – Diver.

6.2.2 Examination Types, Timing and Frequency of Medical Examinations.

A. Examination types.

1) An initial medical examination of all new applicants is required for diving certification, as well as 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).

6.2.3 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. 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, they may be asked to provide additional medical information and justification before they are allowed to dive with NOAA.

6.2.4 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.

6.2.5 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 12.1.4 of this Manual.

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## 6.3 Reporting Changes in Medical Condition

6.3.1 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.

6.3.2 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, his/her diving certification may be summarily terminated.

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## 6.4 Lapsed Diving Physicals

6.4.1 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 6.2.2 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.

6.4.2 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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## 6.5 Funding for NOAA Diving Physical Examinations

6.5.1 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.

6.5.2 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.

6.5.3 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.

6.5.4 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 7: NITROX DIVING

### 7.1 General

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 $PO_2$ for any NOAA dive is 1.40 ATA.

### 7.2 Prerequisites

Divers must be certified to use Nitrox by NOAA or another nationally or internationally recognized diver training organization.

### 7.3 Requirements for Authorization to Use Nitrox

7.3.1 Approval.

A. Successful completion of a NOAA Nitrox training course.

OR

Presentation of a Nitrox certification from a nationally or internationally recognized diver training organization.

B. Endorsement from the UDS.

C. Receipt of a Letter of Authorization with a Nitrox endorsement from the NDPM.

7.3.2 Minimum Activity to Maintain Authorization.

A. The diver should log at least one (1) Nitrox dive per year.

B. Failure to meet the minimum activity level may be cause for restriction or revocation of Nitrox authorization.

### 7.4 Nitrox Training Requirements

7.4.1 General.

The minimum academic and practical instruction listed in this section must be mastered in order to receive a Nitrox Certification from NOAA.

7.4.2 Classroom Instruction.

A. Topics should include, but are not limited to:

1) Physical gas laws pertaining to Nitrox, partial pressure calculations and limits, and equivalent air depth (EAD) concept and calculations;

2) Oxygen physiology and oxygen toxicity and calculation of oxygen exposure and Maximum Operating Depth (MOD);

3) Determination of decompression schedules (both by EAD method using approved air dive tables, and using approved Nitrox dive tables);

4) Dive planning and emergency procedures;

5) Gas analysis;

6) Personnel requirements; and

7) Equipment marking and maintenance requirements.

B. 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.

7.4.3 Practical Training.

A. The practical training portion will consist of the following:

1) Oxygen analysis and logging of Nitrox gases;

2) Determination of MOD, oxygen partial pressure exposure, and oxygen toxicity time limits for various Nitrox gases at various depths; and

3) 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.

B. Nitrox dive computer use may be included (Section 4.5.5).

7.4.4 Written Examination.

Before authorization, the trainee shall successfully pass a written examination 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:

1) Equivalent air depth (EAD) for a given $FO_2$ and actual depth;

2) $PO_2$ exposure for a given $FO_2$ and depth;

3) Appropriate Nitrox gas for a given $PO_2$ exposure limit, and planned depth and time; and

4) MOD for a given gas blend and $PO_2$ exposure limits.

E. Dive table selection and usage;

F. Nitrox production methods and considerations;

G. Oxygen analysis; and

H. Nitrox operational guidelines and dive planning.

7.4.5 Open-Water Dives.

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.

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## 7.5 Diving Personnel Requirements

7.5.1 Diver.

A. NOAA Divers who have completed the requirements of Section 7.4 may be authorized by the NDPM to use Nitrox.

B. Depth authorization to use Nitrox should be the same as that specified in the diver's authorization, as described in Section 3.4, or equivalent to the depth rating of advanced certifications (i.e. advanced nitrox diver).

7.5.2 Divemaster / Lead Diver.

A. 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.

B. DM/LD authorization for Nitrox dives by the UDS (or designee) should occur as part of the approval process for the diving project.

C. In addition to responsibilities listed in Section 2.10.2, the DM/LD shall:

1) As part of the planning process for the dive, verify that all divers using Nitrox are properly qualified and authorized.

2) 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.

3) Reduce the maximum allowable $PO_2$ exposure limit for the diving team if indicated by on-site conditions.

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## 7.6 Nitrox Diving Parameters

7.6.1 Oxygen Exposure Limits.

A. The inspired oxygen partial pressure experienced at depth should not exceed 1.4 ATA. All dives performed using Nitrox breathing gases should comply with the current NOAA Diving Manual "Oxygen Partial Pressure Limits for 'Normal' Exposures."

B. 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.

7.6.2 Bottom Time Limits.

A. Maximum bottom time should be based on the depth of the dive and the Nitrox gas being used.

B. 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.

7.6.3 Dive Tables and Gases.

A. A set of NDCSB-approved Nitrox dive tables shall be available at the dive site.

B. When using the EAD method, dives should be conducted using air dive tables approved by the NDCSB.

C. If Nitrox is used to increase the safety margin of air-based dive tables, the MOD and oxygen exposure for Nitrox gases used on a dive shall not be exceeded.

D. 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 7.6.1 of this Manual.

7.6.4 Nitrox Dive Computers.

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

B. 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.

C. Dive computers capable of $PO_2$ limit (1.4 ATA) and $FO_2$ adjustment should be checked by the diver prior to the start of each dive to assure conformity with the gas being used.

7.6.5 Repetitive Diving.

A. 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.

B. 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.

C. The total cumulative exposure for $PO_2$ shall remain within Repetitive Excursion (REPEX) limits as provided in the NOAA Diving Manual.

7.6.6 Oxygen Parameters.

A. Authorized Nitrox Gases. Gases meeting the criteria outlined in this section may be used for Nitrox diving operations.

B. 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.

C. In addition to 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.

| ANALYTE | Membrane Systems | Partial Pressure Systems |
|---|---|---|
| Oxygen | 20 - 22 | 20 - 22 |
| Carbon Dioxide (ppmv) | 1000 | 1000 |
| Carbon Monoxide (ppmv) | 20 | 10 |
| Total Gaseous Hydrocarbons including Methane (ppmv) | 25 | 25 |
| Oil Mist and Particulate ($mg/m^3$) | 5 | 5 |
| Oil Mist ($mg/m_3$) | N/A | 0.1 |
| Particulate ($mg/m_3$) | N/A | 0.1 |
| Odor (Objectionable) | None | None |
| Methane (ppmv) | N/A | N/A |

7.6.7 Diver Responsibility for Gas Analysis.

A. Individuals responsible for producing and/or analyzing Nitrox gases shall be trained and have experience in all aspects of the technique.

B. In situations where NOAA owns or operates the compressors, only those trained individuals approved by the UDS shall be responsible for blending Nitrox gases.

C. It is the responsibility of the UDS to approve the specific Nitrox production method used.

D. 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:

1) $FO_2$;

2) MOD;

3) Cylinder pressure;

4) Date of analysis; and

5) User's name.

E. Individual dive log reporting forms should report $FO_2$ of Nitrox used, if different than 21 percent.

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## 7.7 Nitrox Diving Equipment

7.7.1 General.

A. All designated equipment and scuba equipment requirements in this Manual apply to Nitrox scuba operations.

B. Additional minimal equipment necessary for Nitrox diving operations includes properly labeled scuba cylinders and oxygen analyzers.

7.7.2 Oxygen Cleaning and Maintenance Requirements.

A. 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.

B. Oxygen systems over 125 psig shall have slow-opening shut-off valves.

7.7.3 Scuba Cylinder Identification.

A. Cylinders shall be marked “NITROX,” “EANx,” or “Enriched Air.”

B. 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.

C. 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.

D. Other markings, which identify the cylinder as containing gases other than air, may be used with the approval of the NDCSB.

E. A label should be affixed with the contents of each cylinder, to include the current $FO_2$, MOD, date of analysis, cylinder pressure and name or initials of the person who analyzed the gas.

F. 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.

G. 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.

7.7.4 Other Support Equipment.

A. 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.

B. 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.

C. Oxygen sensors in oxygen analyzers shall be replaced every 12 months or sooner if the analyzer cannot be calibrated with air.

D. All diver and support equipment should be suitable for the fraction of oxygen ($FO_2$) being used.

7.7.5 Nitrox Mixing Equipment and Procedures.

All equipment and procedures used for the mixing of Nitrox breathing gases shall comply with standards outlined in the latest version of the NOAA Diving Manual.

# Section 8: AIR OR NITROX DECOMPRESSION DIVING

## 8.1 Introduction and Scope

Decompression diving is not allowed on OSHA-subject dives conducted by NOAA. This standard specifies minimum requirements for conducting 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.

## 8.2 Qualifications

8.2.1 Certification and Authorization.

A. Divers must be trained and certified by the NDP or another NOAA-approved certification agency (i.e., International Association of Nitrox and Technical Diving, NAUI) for the proposed equipment, depth, and gas mixture.

B. Divers must be currently authorized NOAA divers or have a valid LOR from a current reciprocity partner.

8.2.2 Proficiency Requirements.

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

B. Divers must also have completed one (1) dive within the previous 30-day period wearing the minimum equipment configuration to be used on the project.

C. Task-free work-up dive(s) may be completed at the beginning of a project to meet the requirement listed in 8.2.2 B

## 8.3 'Tech Lite' - Decompression Operations

8.3.1 General Requirements.

A. 'Tech Lite' - Decompression allows divers authorized by the NDP to conduct decompression dives using open circuit scuba gear without mission-specific pre-approval from the NDCSB.

B. Dives are limited to a maximum depth of 130 fsw.

C. Decompression obligations are limited to a maximum of ten (10) minutes.

D. Units participating in the 'Tech Lite' – Decompression program must complete a probationary period of up to one (1) year before 'Tech Lite' decompression dives can be undertaken without pre-approval of dive plans by the NDCSB.

E. All other standards, policies and regulations pertaining to decompression diving operations apply to the 'Tech Lite' program.

8.3.2 Approval Process.

A. Divers wishing to enroll in the 'Tech Lite' decompression diving program shall request initial approval of the NDCSB.

B. The NDCSB will review each application for 'Tech Lite' decompression diving, and may include any further requirements deemed necessary beyond those listed here on a case-by-case basis.

C. 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 trail period until the NDCSB is satisfied with the unit's performance.

8.3.3 Prerequisites.

Advanced Nitrox and Decompression Procedures with certification to 150 fsw.

8.3.4 Equipment – Dive Computers.

A. All dive computers and/or computer based decompression schedule generating software programs will be set to a conservative gradient factor of 30/70.

B. All dive computers and/or computer based decompression schedule generating software programs must be approved by the NDCSB.

8.3.5 Breathing Gases and Gas Management.

A. A maximum $PO_2$ of 1.4 ATA will be utilized during the bottom phase of the dive and maximum $PO_2$ of 1.6 ATA may be used during the decompression phase of the dive evolution.

B. Divers shall carry, at a minimum, a 40 cubic foot or larger cylinder of decompression gas based on the divers' surface air consumption (SAC) and respiratory minute volume (RMV) rates.

C. Divers shall carry appropriately sized back gas cylinders based on the divers' SAC and RMV rates.

D. Divers will follow the 'rule of thirds' for gas management.

8.3.6 Manning Requirements.

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 / Support Divers.

1) A minimum of two (2) standby / support divers, capable of reaching 130 feet and functioning as a buddy team, will be on site for all decompression diving operations.

2) All standby / support divers will carry at least one (1) cylinder of all bottom gases bottles being carried by the bottom divers.

3) The standby / support divers will carry at least one (1) cylinder of all decompression gases being carried by the bottom divers.

4) 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.

5) 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.

C. Technical Diving Supervisor.

1) Must meet all the requirements in Section 2.9 of this Manual.

2) Must remain at the surface during diving operations.

3) Must be approved by the NDCSB to supervise open-circuit decompression dives.

D. Vessel Operator.

1) Must remain on the vessel during diving operations.

2) 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.

8.3.7 Operational Considerations.

A. Maximum depth shall not exceed 130 fsw.

B. Maximum decompression obligation shall not exceed ten (10) minutes.

C. All operations shall be conducted within four (4) hours of a multi-place, multi-lock recompression chamber, unless there is a recompression chamber (including a Hyperlite) on site.

D. Repetitive dives may be approved by the TDS, if appropriate and all other 'Tech Lite' standards are followed.

8.3.8 Proficiency.

A. An authorized diver shall make at least six (6) dives over the course of twelve (12) months to a depth near 130 feet, practicing open-circuit decompression protocols.

B. 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.

## 8.4 Equipment

8.4.1 General.

A. Valve and regulator systems for primary (bottom) gas supplies shall be configured with a minimum of two (2) cylinders with separate regulators (consisting of a first and second stage) each with its own on/off valve that allows continuous gas delivery in the event of failure of any one (1) component of the regulator/valve system.

B. Minimum diver-worn equipment required:

1) Buoyancy control device (dual bladder with a wetsuit, single bladder with a drysuit);

2) Two (2) NOAA-authorized dive computers;

3) Decompression tables;

4) Two (2) lift bags (>50 lbs buoyancy) and line reels;

5) Two (2) cutting devices;

6) Two (2) signaling devices; and

7) Slate and pencil.

8.4.2 Scuba Cylinders.

A. Scuba cylinders used on dives >130 fsw should be equipped with DIN valves.

B. If using a single cylinder as the primary gas supply, an auxiliary gas supply with adequate volume to reach the depth of the next gas switch is required.

C. Dual cylinders shall be connected with an isolation manifold that 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. All valves must be accessible by the diver without removing the scuba unit.

D. 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 | 4-inch green band with "NITROX" or "Enriched Air" stenciled in 2-inch high letters |
| | Other | Non-yellow cylinders have an additional 1-inch yellow band above and below the green label |

8.4.3 Scuba Regulators.

A. Dual cylinders shall be outfitted with redundant scuba regulators.

B. The primary supply regulator 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.

8.4.4 Buoyancy Control.

A. Divers shall have the capability to achieve positive buoyancy at all depths.

B. Acceptable means of buoyancy control include:

1) Dual-bladder buoyancy compensator with separate inflator hoses for each bladder; or

2) Single-bladder buoyancy compensator with a variable-volume drysuit, each attached to separate first stage regulators;
AND
3) Two (2) lift bags with sufficient buoyancy for the diver to achieve positive buoyancy at all depths of the dive.

C. When wearing dual cylinders, top and bottom dump valves shall be provided for the primary BCD bladder, with a top dump valve standard for the redundant backup bladder. Each bladder must be capable of achieving positive buoyancy at all depths of the dive and be outfitted with an over pressurization relief valve.

8.4.5 Depth and Cylinder Pressure Gauges.

A. Each diver shall have redundant means of monitoring depth. At least one (1) of the devices shall be capable of recording the maximum depth obtained during dives for display once on the surface.

B. Each gas supply will have its own dedicated submersible pressure gauge.

C. Button gauges are not allowed.

8.4.6 Dive Timing Devices.

A. Each diver shall have redundant means of tracking dive time.

B. Examples of acceptable devices include dive computers, bottom timers, and watches.

8.4.7 Signaling Devices.

A. Unless approved by the Technical Dive Supervisor (TDS), each diver shall carry the following surface signaling devices:

1) Two surface marker buoys (SMBs) or lift bags;

2) Signal mirror; and

3) Whistles or other audible signaling devices.

B. If dives are conducted within two (2) hours of sunset, each diver must 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 diver should also carry, at a minimum, one (1) of the following; DSC-enabled handheld VHF marine radio, Personal Locator Beacon (PLB) or Personal Emergency Position-Indicating Radio Beacon (PEPIRB).

8.4.8 Lift Bags and Line Reels.

A. Each diver shall carry two (2) SMBs or lift bags, one (1) of which will have a minimum of 50 pounds (22.7 Kg) buoyancy.

B. Each diver shall carry two (2) line reels equal in length to 1.5 times the maximum depth anticipated during a dive.

8.4.9 Support Boat(s).

A. Provide a means of extracting an unconscious victim from the water during all phases of decompression diving operations.

B. Carry onboard a minimum of one (1) spare cylinder of each type of decompression gas mixture used on the dive.

8.4.10 Hyperbaric Chamber.

A. A fully staffed and operational hyperbaric chamber shall be accessible within four (4) hours of the dive site.

B. A plan shall be prepared and verified to transport an injured diver to a hyperbaric chamber within the required time frame.

C. Only ASME, ABS, or equivalent certifying authority – including current Pressure Vessel for Human Occupancy – hyperbaric chambers may be used.

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## 8.5 Breathing Gases and Gas Management

8.5.1 General.

A. All gases used for diving must be of breathing quality (e.g., Medical, Technical or Aviator Grade).

B. All air or Nitrox breathing mixtures to be used for diving shall be analyzed for oxygen content using an oxygen analyzer. Gases must test within acceptable parameters as specified in the dive tables or computers used.

C. 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) to not exceed a $PO_2$ of 1.40 ATA;

3) Cylinder Pressure;

4) Date; and

5) Diver's initials or signature.

D. When physiologically appropriate, and approved by the NDCSB, Nitrox and/or 100 percent oxygen may be substituted for compressed air during ascent and/or decompression stops.

E. Each diver is responsible for calculating and carrying the required volume of breathing gases needed for each phase of the dive including the contingency of next deeper depth and next longer bottom time, plus reserves. Each diver shall maintain a reserve volume capable of allowing both divers in a dive team to ascend safely and comfortably to a depth at which they may switch to a supplemental decompression

gas. If no supplemental cylinders are utilized, then each diver should reserve sufficient gas volume to allow both divers to ascend to the surface, including any required decompression stops.

8.5.2 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 (air breaks) 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.

8.5.3 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 standards outlined in Section 7.6.6 of this manual.

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## 8.6 Manning Requirements

8.6.1 Minimum Diving Positions and Capabilities.

A. Bottom divers.

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

B. Standby, Safety and Support Divers.

1) A minimum of two (2) surface-based standby divers, functioning as a buddy team, is 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.

2) 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 operation. 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.

3). Support Divers. Two (2) support divers shall be required to support the bottom divers during the decompression phase of a dive occurring at a depth shallower than 130 fsw.

8.6.2 Minimum Topside Support.

A. Technical Dive Supervisor:

1) Must meet the qualifications described in Section 2.9 of this Manual;

2) Must remain at the surface during diving operations; and

3) Must be approved by the NDCSB.

B. Vessel Operator:

1) Must remain on the vessel during diving operations; and

2) 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.

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## 8.7 Operational Requirements

8.7.1 Dive Planning.

A. Diving condition limits: The TDS and the Vessel Operator shall assess environmental conditions including current speed and direction, sea state and weather predictions to decide whether or not diving can be safely initiated.

B. Diver communications.

1) Bottom divers must be able to signal topside personnel at all times during the dive.

2) Signaling protocols must be established that allow the differentiation between routine and emergency situations.

8.7.2 Decompression Calculation.

A. All decompression dive computers and algorithms must be approved by the NDCSB.

B. The use of computer programs that generate decompression tables must be approved by the NDCSB.

C. Each diver must carry a hard copy set of decompression dive tables for the planned dive including next deeper depth and next longer time contingencies.

8.7.3 Maximum Depth and Bottom Time.

A. The maximum depth for decompression diving using open circuit scuba equipment shall be such that the $PN_2$ does not exceed 4.0 ATA.

B. The $PO_2$ of any gas mixture breathed during a dive shall not exceed 1.4 ATA, except during the decompression phase when a $PO_2$ of 1.6 is allowed.

C. 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.

D. Repetitive dives may be approved by the TDS if appropriate and approved diving tables and procedures are available.

8.7.4 Diving Procedures.

A. 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, both 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.

B. 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.

8.7.5 Contingency Protocols.

A. The following contingency protocols shall be established, practiced, and reviewed by all participants prior to commencement of diving:

1) Out of gas – Bottom mix. Begin gas sharing with dive buddy(ies) and abort the dive, observing decompression schedule during ascent.

2) Out of gas - Decompression nitrox cylinder. At the beginning of decompression, the support divers shall bring one spare staging mix cylinder for each group of

bottom divers, in accordance with normal operational protocols. Any further stage gas failure will warrant gas sharing of stage mix. Divers shall communicate any problem to the in-water support diver who shall retrieve and deliver additional spare stage mix cylinder(s) to divers as needed.

3) Out of gas – Decompression oxygen cylinder. The support divers will carry extra deco gas and will be with bottom divers during the first gas switch during decompression. Any deco oxygen failure from bottom diver's supply will require a support diver to transport a deco oxygen cylinder for attachment to the bottoms diver's harness for use as the gas source during the completion of decompression. Any further stage gas failure would warrant gas sharing of stage mix if necessary. Bottom divers shall communicate the problem to in-water support divers whom shall then retrieve and deliver spare stage mix cylinder to the bottom divers.

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. The bottom divers may abort any planned decompression dive and return directly to the surface if a depth of 150 FSW and an elapsed time of five (5) minutes has not been exceeded (U.S. Navy Standard Air Compression Tables – current edition). If a depth of 150 FSW or an elapsed time of five (5) minutes has been exceeded during a planned decompression dive, bottom time divers must complete all decompression stops as scheduled. Bottom divers may elect to deploy a lift bag to signal to the surface support team and dive vessels. At such time the bottom divers shall be recovered by the primary support vessel. Upon review of the bottom divers dive profile, the dive team may elect to make a second drop. On a repetitive dive, the abort procedure will require an additional in-water decompression stop and the bottom divers must follow the dive computer or contingency table.

6) Omitted decompression. If a bottom diver is asymptomatic, the diver must repeat all stops deeper than and including the 40 FSW stop. The diver shall multiply the 30 FSW, 20 FSW, and 10 FSW stop times by 1.5. The bottom diver shall maximize $PO_2$ by using the most hyperoxic gas appropriate for the depth without exceeding a $PO_2$ of 1.6 ATA. If a bottom diver is symptomatic, the diver must be placed on oxygen, hydrated, and evacuated to the nearest recompression facility.

7) Central Nervous System (CNS) Oxygen Toxicity. Hyperoxia can occur at a $PO_2$ of > 1.4 ATA. Hyperoxic oxygen convulsions will present themselves in two (2) phases. Phase 1 will place the diver in a state of convulsions, with no respiration, and the diver is likely to clinch their teeth, which may serve to keep the regulator mouthpiece in the diver’s mouth. In Phase 2 the diver will be relaxed and will start to hyperventilate (breathe fast). The second phase poses a

significant risk of drowning if the regulator mouthpiece is allowed to fall out of their mouth. Dive planning should ensure PO2 during all phases of the dive, except decompression, remains significantly below 1.6 ATA. In the unlikely event of any Con-VENTID symptoms, an asymptomatic diver shall immediately gain control of the symptomatic diver and begin ascent.

8) Dive team unable to reach down-line. If a 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.

9) Dive team separated during deployment. If a dive team finds themselves separated from their buddy(ies) during deployment, the divers should abort the dive after searching for team members for five (5) minutes and return to the surface. Divers will deploy a lift bag to signal to the surface support team and dive vessel(s). The divers shall be recovered to the primary support vessel and may elect to make a second drop.

10) 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 (1) minute before returning to the base of the down-line. Once at the down-line separated divers will allow no more than four (4) 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.

11) Dive team separated and swept off dive site. Upon separation and if unable to locate each other, the divers should independently shoot a bag to the surface and commence their own decompression. Divers shall exercise normal decompression procedures, and expect to see Support Diver in the water above them.

12) Dive team swept off dive site. Divers stay together; attempt to regain position on dive site. If unable to return to the dive site, launch lift bag on a reel, abort the dive and safely ascend as a team. Exercise appropriate decompression procedures.

13) Diver entanglement on bottom. Divers shall carry at least two knives and an additional cutting tool, either EMT scissors or a seatbelt cutter. If entangled, notify other diver(s) of problem. Evaluate the nature of entanglement and attempt to free self or signal buddy(ies) for assistance. If using the standby diver mode, separated from buddy(ies) and entangled without remedy, inflate bag to surface with penciled distress message on slate attached by snap hook to the bag. The standby diver from primary support vessel shall then enter the water and search

for the entangled diver. The other diver, if separated and successfully decompressing on a lift bag, shall be accompanied by the Small Boat. Both vessels will maintain radio contact with each other, but the primary support vessel will remain with the entangled diver and the designated Diving Supervisor will monitor the situation topside. If using the on-bottom safety diver mode, given this contingency or similar difficulties in which a pair of divers will need to assist the expedition team at the bottom, the second dive team of the day (if available) will deploy to assist the entangled diver.

14) Dive team unable to locate ascent-line. Remain mindful of bottom time (BT). Divers can either shoot a lift bag on a reel to the surface and begin decompression ascent on the bag line, or, if adequate gas supply is available, take an additional five (5) minutes to search and extend to the next bottom time group. Divers must be on a line beginning ascent by five (5) minutes past original plan. Divers shall carry hard copies of planned decompression schedules and contingencies. Decompress according to the appropriate schedule or according to the dive computer. If divers come up on the bag line, surface support will shift to the divers' location, be they drifting or stationary. In the event of loss of ascent line, divers will shoot a lift bag and commence a drifting ascent under the bag.

15) Buoy/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.

16) Dive team ascends to surface, but support vessel is gone. Divers stay together upon reaching surface. Use appropriate signaling device to signal surface craft.

17) Change in environmental conditions during the dive. In the time interval between the beginning of a dive and the completion of decompression, it is possible for environmental conditions to change sufficiently to require adjustment to the dive plan.

    a. Current Strength - A significant increase in current strength during a dive will make it more difficult for the divers to decompress if they are using a fixed down-line, subjecting the decompressing divers to the full strength of the current. Divers should consider “drift decompression” to be the preferred method in strong currents.

    b. Surface Waves or Swell Height - A significant deterioration of sea conditions will make it more difficult for the divers to decompress because the ascent line (either a hard line anchored to the bottom or a drifting line suspended from a buoy) will rise and fall, sometimes violently, as the dive vessel strains on the line, if at anchor. Therefore, decompressing divers must take care not to hold to the ascent line too tightly, especially on the shallower stops where the effect is most pronounced. 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. One end of the Jon line is looped around the down-line and the other is clipped to the diver's "scooter ring." Otherwise the dive team should choose to use drift decompression.

c. Visibility - A significant decrease in visibility on the bottom will make it more difficult for the divers to work, but also might decrease the safety of the divers. Therefore, if the visibility decreases to less than ten (10) feet, the divers should consider terminating the dive.

d. Water Temperature - A decrease in water temperature, due to a deep-layer thermocline or to an alteration of current patterns, will affect diver comfort and, if significant, could affect safety. Divers should wear adequate thermal protection-a well-fitting wet suit and hood, or a dry suit. If water temperature decreases significantly, the dive should be terminated.

18) Initiation of subsequent dives. If any emergency arises while one team is in the water, a second team will not commence operations until the problem has been resolved and it has been deemed appropriate to make the second dive.

B. Post-dive incident review:

1) Following the actual occurrence of any of the above scenarios, a post-dive “stand down” will be initiated to thoroughly review the incident. After review of the incident, mitigation protocols will be established to prevent a reoccurrence and the “stand down” may be lifted by the TDS.

2) If deemed a “near-miss”, an incident report will be written and submitted in accordance with NOAA Diving Program and SECO requirements.

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## 8.8 Dive Plan

8.8.1 General.

A. Diving projects involving the use of equipment other than open circuit design, use of gas mixtures other than air or Nitrox, or bottom times outside the no-decompression limits must be approved by the NDCSB before diving activities begin.

B. In order to evaluate the proposed diving activities, a detailed dive plan must be submitted to the NDCSB using NOAA Form 57-03-28 Decompression Diving Request for review a minimum of 30 days prior to the commencement of diving operations.

8.8.2 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 stop times for maximum planned depths and times;

G. Logistical arrangements and considerations;

H. Normal and emergency diving procedures;

I. Diving Emergency Assistance Plan; and

J. Supporting documents, permits, and forms.

# Section 9: MIXED GAS DECOMPRESSION DIVING

## 9.1 General

Mixed gas diving is not allowed on OSHA-subject dives conducted by NOAA. 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.

## 9.2 Qualifications

9.2.1 Certification and Authorization.

A. Divers must be trained and certified by the NDP or another NOAA-approved certification agency (i.e., International Association of Nitrox and Technical Diving, NAUI) for the proposed equipment, depths, and gas mixtures.

B. Divers must be currently authorized NOAA divers or have a valid LOR from a current reciprocity partner.

C. The NDCSB shall review the qualifications of candidates seeking mixed gas training while on duty and make a determination concerning the diver's eligibility.

D. Qualifications of candidates with prior mixed gas training who desire to become NOAA mixed gas divers will be reviewed by the NDCSB on a case by case basis.

9.2.2 Proficiency Requirements.

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

B. Divers must also have completed one (1) dive within the previous 30-day period wearing the minimum equipment configuration to be used on the project.

C. If a period of more than six (6) months has elapsed since the last mixed gas dive, a series of progressive workup dives prior to the start of project diving operations is required to return the diver(s) to proficiency status.

D. Task-free work-up dive(s) may be completed at the beginning of a project to meet the requirement listed in 9.2.2 B and C.

## 9.3 Training Requirements

9.3.1 Classroom Training.

Shall include, but not be limited to:

A. Review of topics and issues previously outlined in Nitrox and staged decompression diving training as pertinent to the planned operations;

B. The use of helium or other inert gases, and the use of multiple decompression gases;

C. Equipment configurations and modifications;

D. Mixed gas decompression planning;

E. Gas management planning;

F. Thermal considerations;

G. Equivalent Narcotic Depth (END) determination;

H. Mission planning and logistics;

I. Emergency procedures;

J. Mixed gas mixing methods;

K. Methods of gas handling and cylinder filling;

L. Oxygen exposure management;

M. Gas analysis; and

N. Mixed gas physics and physiology.

9.3.2 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.

B. A minimum of six (6) open water training dives.

C. At least one (1) initial dive shall be in 130 fsw or less to practice equipment handling and emergency procedures.

D. Subsequent dives will gradually increase in depth, with a majority of the training dives conducted between 130 fsw and the planned operational depth.

E. Planned operational depth for initial training dives shall not exceed 250 fsw.

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## 9.4 Equipment

9.4.1 General.

A. Valve and regulator systems for primary (bottom) gas supplies shall be configured with a minimum of two (2) regulators (consisting of a first and second stage) each with its own on/off valve that allows continuous gas delivery in the event of failure of any one component of the regulator/valve system.

B. Minimum diver-worn equipment required:

1) Buoyancy control device (dual bladder with a wetsuit, single bladder with a drysuit);

2) Two (2) NOAA-authorized dive computers;

3) Hardcopies of the decompression schedule for the planned dive with contingencies for next longer and next deeper dives;

4) Two (2) lift bags (≥50 lbs buoyancy) and line reels;

5) Two (2) cutting devices;

6) Two (2) signaling devices; and

7) Slate and pencil.

9.4.2 Scuba Cylinders.

A. Scuba cylinders used on dives >130 fsw should be equipped with DIN valves.

B. If using a single cylinder as the primary gas supply, an auxiliary gas supply with adequate volume to reach the depth of the next gas switch is required.

C. Dual cylinders shall be connected with an isolation manifold, 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. All valves must be accessible by the diver without removing the scuba unit.

D. 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 |
| Trimix | Any color | Prominent label listing oxygen and helium percentage, minimum and maximum operating depths (MID, MOD), cylinder pressure, analysis date, initials of analyzer. |

9.4.3 Scuba Regulators.

A. Dual cylinders shall be outfitted with redundant scuba regulators.

B. The primary supply regulator 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.

9.4.4 Buoyancy Control.

A. Divers shall have the capability to achieve positive buoyancy at all depths.

B. Acceptable means of buoyancy control include:

1) Dual-bladder buoyancy compensator with separate inflator hoses for each bladder;

OR

Single-bladder buoyancy compensator with a variable-volume drysuit, each attached to separate first stage regulators; and

2) Two (2) lift bags with sufficient buoyancy for the diver to achieve positive buoyancy at all depths of the dive.

C. When wearing dual cylinders, top and bottom dump valves shall be provided for the primary BCD bladder, with a top dump valve standard for the redundant backup bladder. Each bladder must be capable of achieving positive buoyancy at all depths of the dive and be outfitted with an over pressurization relief valve.

9.4.5 Depth and Cylinder Pressure Gauges.

A. Each diver shall have redundant means of monitoring depth. At least one (1) of the devices shall be capable of recording the maximum depth obtained during dives for display once on the surface.

B. Each gas supply will have its own dedicated submersible pressure gauge.

C. Button gauges are not allowed.

9.4.6 Dive Timing Devices.

A. Each diver shall have redundant means of tracking dive time.

B. Examples of acceptable devices include dive computers, bottom timers, and watches.

9.4.7 Signaling Devices.

A. Unless approved by the Technical Diving Supervisor (TDS), each diver shall carry the following surface signaling devices:

1) Two (2) surface marker buoys (SMBs) or lift bags;

2) Signal mirror; and

3) Whistles or other audible signaling devices.

B. If dives are conducted within two (2) hours of sunset, each diver must 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 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).

9.4.8 Lift Bags and Line Reels.

A. Each diver shall carry two (2) SMBs or lift bags, one (1) of which will have a minimum of 50 pounds (22.7 Kg) buoyancy.

B. Each diver shall carry two (2) line reels equal in length to 1.5 times the maximum depth anticipated during a dive.

9.4.9 Support Boat(s).

A. Provide a means of extracting an unconscious victim from the water during all phases of decompression diving operations.

B. Carry onboard a minimum of one (1) spare cylinder of each type of decompression gas mixture used on the dive.

9.4.10 Hyperbaric Chamber.

A. A fully staffed and operational hyperbaric chamber shall be accessible within 2 hours of the dive site.

B. A plan shall be prepared and verified to transport an injured diver to a hyperbaric chamber within the required time frame.

C. Only ASME, ABS, or equivalent certifying authority – including current Pressure Vessel for Human Occupancy – hyperbaric chambers may be used.

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## 9.5 Breathing Gases and Gas Management

9.5.1 General.

A. All gases used for diving must be of breathing quality (e.g., Medical, Technical or Aviator Grade).

B. All breathing mixtures to be used for diving shall be analyzed for oxygen and inert gas content using an appropriate analyzer. Gases must test within acceptable parameters as specified in the dive tables or computers used.

C. All mixed gases must be analyzed by the diver using the mixture.

D. Gas analysis must be accomplished by analyzing the fractions of each individual gas component in the mixture, less one. Thus, if Heliox 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.

E. 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) Percentages of all gases;

2) Maximum Operating Depth (MOD);

3) Minimum Operating Depth (MinOD) – if applicable;

4) Cylinder pressure;

5) Date; and

6) Initials of diver.

F. Each diver is responsible for calculating and carrying the required volume of breathing gases needed for each phase of the dive including the contingency of next deeper depth and next longer bottom time, plus reserves. Each diver shall maintain a

reserve volume capable of allowing two (2) divers in a dive team to ascend safely and comfortably to a depth at which they may switch to a supplemental decompression gas. If no supplemental cylinders are utilized, then each diver should reserve sufficient gas volume to allow two divers to ascend to the surface, including any required decompression stops.

9.5.2 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.

9.5.3 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 standards outlined in Section 7.6.6 of this manual.

9.5.4 Inert Gas.

A. 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.

B. 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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## 9.6 Manning Requirements

9.6.1 Minimum Diving Positions and Capabilities.

A. 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.

B. Standby, Safety and Support Divers

1) A minimum of two (2) surface-based 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.

2) 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.

3) 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.

9.6.2 Minimum Topside Support.

A. Technical Diving Supervisor (TDS):

1) Must meet the qualifications described in Section 2.9 of this Manual;

2) Must remain at the surface during diving operations; and

3) Must be approved by the NDCSB.

B. Vessel Operator:

1) Must remain on the vessel during diving operations; and

2) 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.

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## 9.7 Operational Requirements

9.7.1 Dive Planning.

A. Diving condition limits: The Technical Diving Supervisor (TDS) and the Vessel Operator shall assess environmental conditions including current speed and direction, sea state and weather predictions to decide whether or not diving can be safely initiated.

B. Diver communications.

1) Bottom divers must be able to signal topside personnel at all times during the dive.

2) Signaling protocols must be established that allow the differentiation between routine and emergency situations.

9.7.2 Decompression Calculation.

A. All decompression dive computers and algorithms must be approved by the NDCSB.

B. The use of computer programs that generate decompression tables must be approved by the NDCSB.

C. Each diver must carry a hardcopy of decompression schedule for the planned dive including next deeper depth and next longer time contingencies.

9.7.3 Maximum Depth and Bottom Time.

A. The maximum depth for decompression diving using open circuit scuba equipment shall be such that the $PN_2$ does not exceed 4.0 ATA.

B. The $PO_2$ of any gas mixture breathed during a dive shall not exceed 1.4 ATA, except during the decompression phase when a $PO_2$ of 1.6 is allowed.

C. 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.

D. Repetitive dives may be approved by the TDS if appropriate and approved diving tables and procedures are available.

9.7.4 Depth Progressions.

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.

9.7.5 Diving Procedures.

A. 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, both 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.

B. 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.

4) 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.

9.7.6 Contingency Protocols.

A. The following contingency protocols shall be established, practiced, and reviewed by all participants prior to commencement of diving:

1) Out of gas – Bottom mix. Begin gas sharing with dive buddy(ies) and abort the dive, observing decompression schedule during ascent.

2) Out of gas - Decompression nitrox/trimix cylinder. At the beginning of decompression, the support divers shall bring one spare staging mix cylinder for each group of bottom divers, in accordance with normal operational protocols. Any further stage gas failure will warrant gas sharing of stage mix. Divers shall communicate any problem to the in-water support diver who shall retrieve and deliver additional spare stage mix cylinder(s) to divers as needed.

3) Out of gas – Decompression oxygen cylinder. The support divers will carry extra deco gas and will be with bottom divers during the first gas switch during decompression. Any deco oxygen failure from bottom diver's supply will require a support diver to transport a deco oxygen cylinder for attachment to the bottoms diver's harness for use as the gas source during the completion of decompression. Any further stage gas failure would warrant gas sharing of stage mix if necessary. Bottom divers shall communicate the problem to in-water support divers whom shall then retrieve and deliver spare stage mix cylinder to the bottom divers.

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. The bottom divers may abort any planned decompression dive and return directly to the surface if a depth of 150 FSW and

an elapsed time of five (5) minutes has not been exceeded (U.S. Navy Standard Air Compression Tables – current edition). If a depth of 150 FSW or an elapsed time of five (5) minutes has been exceeded during a planned decompression dive, bottom time divers must complete all decompression stops as scheduled. Bottom divers may elect to deploy a lift bag to signal to the surface support team and dive vessels. At such time the bottom divers shall be recovered by the primary support vessel. Upon review of the bottom divers dive profile, the dive team may elect to make a second drop. On a repetitive dive, the abort procedure will require an additional in-water decompression stop and the bottom divers must follow the dive computer or contingency table.

6) Omitted decompression. If a bottom diver is asymptomatic, the diver must repeat all stops deeper than and including the 40 FSW stop. The diver shall multiply the 30 FSW, 20 FSW, and 10 FSW stop times by 1.5. The bottom diver shall maximize $PO_2$ by using the most hyperoxic gas appropriate for the depth without exceeding a $PO_2$ of 1.6 ATA. If a bottom diver is symptomatic, the diver must be placed on oxygen, hydrated, and evacuated to the nearest recompression facility.

7) Central Nervous System (CNS) Oxygen Toxicity. Hyperoxia can occur at a $PO_2$ of > 1.4 ATA. Hyperoxic oxygen convulsions will present themselves in two (2) phases. Phase 1 will place the diver in a state of convulsions, with no respiration, and the diver is likely to clinch their teeth, which may serve to keep the regulator mouthpiece in the diver's mouth. In Phase 2 the diver will be relaxed and will start to hyperventilate (breathe fast). The second phase poses a significant risk of drowning if the regulator mouthpiece is allowed to fall out of their mouth. Dive planning should ensure PO2 during all phases of the dive, except decompression, remains significantly below 1.6 ATA. In the unlikely event of any Con-VENTID symptoms, an asymptomatic diver shall immediately gain control of the symptomatic diver and begin ascent.

8) Dive team unable to reach down-line. If a 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.

9) Dive team separated during deployment. If a dive team finds themselves separated from their buddy(ies) during deployment, the divers should abort the dive after searching for team members for five (5) minutes and return to the surface. Divers will deploy a lift bag to signal to the surface support team and dive vessel(s). The divers shall be recovered to the primary support vessel and may elect to make a second drop.

10) 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 Research Divers be separated by more than fifteen (15) feet. Separated

divers will perform a visual search for each other for one (1) minute before returning to the base of the down-line. Once at the down-line separated divers will allow no more than four (4) 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.

11) Dive team separated and swept off dive site. Upon separation and if unable to locate each other, the divers should independently shoot a bag to the surface and commence their own decompression. Divers shall exercise normal decompression procedures, and expect to see Support Diver in the water above them.

12) Dive team swept off dive site. Divers stay together; attempt to regain position on dive site. If unable to return to the dive site, launch lift bag on a reel, abort the dive and safely ascend as a team. Exercise appropriate decompression procedures.

13) Diver entanglement on bottom. Divers shall carry at least two knives and an additional cutting tool, either EMT scissors or a seatbelt cutter. If entangled, notify other diver(s) of problem. Evaluate the nature of entanglement and attempt to free self or signal buddy(ies) for assistance. If using the standby diver mode, separated from buddy(ies) and entangled without remedy, inflate bag to surface with penciled distress message on slate attached by snap hook to the bag. The standby diver from primary support vessel shall then enter the water and search for the entangled diver. The other diver, if separated and successfully decompressing on a lift bag, shall be accompanied by the Small Boat. Both vessels will maintain radio contact with each other, but the primary support vessel will remain with the entangled diver and the designated Diving Supervisor will monitor the situation topside. If using the on-bottom safety diver mode, given this contingency or similar difficulties in which a pair of divers will need to assist the expedition team at the bottom, the second dive team of the day (if available) will deploy to assist the entangled diver.

14) Dive team unable to locate ascent-line. Remain mindful of bottom time (BT). Divers can either shoot a lift bag on a reel to the surface and begin decompression ascent on the bag line, or, if adequate gas supply is available, take an additional five (5) minutes to search and extend to the next bottom time group. Divers must be on a line beginning ascent by five (5) minutes past original plan. Divers shall carry hard copies of planned decompression schedules and contingencies. Decompress according to the appropriate schedule or according to the dive computer. If divers come up on the bag line, surface support will shift to the divers' location, be they drifting or stationary. In the event of loss of ascent line, divers will shoot a lift bag and commence a drifting ascent under the bag.

15) Buoy/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.

16) Dive team ascends to surface, but support vessel is gone. Divers stay together upon reaching surface. Use appropriate signaling device to signal surface craft.

17) Central Nervous System (CNS) Oxygen Toxicity. Hyperoxia can occur at a $PO_2$ of > 1.4 ATA. Hyperoxic oxygen convulsions will present themselves in two (2) phases. Phase 1 will place the diver in a state of convulsions, with no respiration, and the diver is likely to clinch their teeth, which may serve to keep the regulator mouthpiece in the diver's mouth. In Phase 2 the diver will be relaxed and will start to hyperventilate (breathe fast). The second phase poses a significant risk of drowning if the regulator mouthpiece is allowed to fall out of their mouth. Dive planning should ensure PO2 during all phases of the dive, except decompression, remains significantly below 1.6 ATA. In the unlikely event of any Con-VENTID symptoms, an asymptomatic diver shall immediately gain control of the symptomatic diver and begin ascent.

18) Change in environmental conditions during the dive. In the time interval between the beginning of a dive and the completion of decompression, it is possible for environmental conditions to change sufficiently to require adjustment to the dive plan.

    a. Current Strength - A significant increase in current strength during a dive will make it more difficult for the divers to decompress if they are using a fixed down-line, subjecting the decompressing divers to the full strength of the current. Divers should consider "drift decompression" to be the preferred method in strong currents.

    b. Surface Waves or Swell Height - A significant deterioration of sea conditions will make it more difficult for the divers to decompress because the ascent line (either a hard line anchored to the bottom or a drifting line suspended from a buoy) will rise and fall, sometimes violently, as the dive vessel strains on the line, if at anchor. Therefore, decompressing divers must take care not to hold to the ascent line too tightly, especially on the shallower stops where the effect is most pronounced. 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. One end of the Jon line is looped around the down-line and the other is clipped to the diver's "scooter ring." Otherwise the dive team should choose to use drift decompression.

    c. Visibility - A significant decrease in visibility on the bottom will make it more difficult for the divers to work, but also might decrease the safety of the divers. Therefore, if the visibility decreases to less than ten (10) feet, the divers should consider terminating the dive.

d. Water Temperature - A decrease in water temperature, due to a deep-layer thermocline or to an alteration of current patterns, will affect diver comfort and, if significant, could affect safety. Divers should wear adequate thermal protection-a well-fitting wet suit and hood, or a dry suit. If water temperature decreases significantly, the dive should be terminated.

19) Initiation of subsequent dives. If any emergency arises while one team is in the water, a second team will not commence operations until the problem has been resolved and it has been deemed appropriate to make the second dive.

B. Post-dive incident review:

1) Following the actual occurrence of any of the above scenarios, a post-dive "stand down" will be initiated to thoroughly review the incident. After review of the incident, mitigation protocols will be established to prevent a reoccurrence and the "stand down" may be lifted by the TDS.

2) If deemed a "near-miss", an incident report will be written and submitted in accordance with NOAA Diving Program and SECO requirements.

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## 9.8 Dive Plan

9.8.1 General.

A. Diving projects involving the use of equipment other than open circuit design, use of gas mixtures other than air or Nitrox, or bottom times outside the no-decompression limits must be approved by the NDCSB before diving activities begin.

B. In order to evaluate the proposed diving activities, a detailed dive plan must be submitted to the NDCSB using NF 57-03-28 (Decompression Diving Request) for review a minimum of 30 days prior to the commencement of diving operations.

9.8.2 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 stop times for maximum planned depths and times;

G. Logistical arrangements and considerations;

H. Normal and emergency diving procedures;

I. Diving Emergency Assistance Plan; and

J. Supporting documents, permits, and forms.

## Section 10: REBREATHERS

### 10.1 General

Semi-closed circuit and closed circuit rebreathers cannot be used for OSHA-subject dives.

10.1.1 Scope and Application.

A. This section defines specific requirements for the use of rebreathers, including: training and/or experience verification, equipment, and safety protocols.

B. All pertinent requirements in other sections of this Manual must be applied in addition to this standard.

C. 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.

D. Instructors shall be qualified for the type of training to be provided. Training shall be conducted by agencies or instructors approved by the NDCSB.

10.1.2 Approval Process.

A. No diver shall conduct planned decompression or mixed-gas diving operations using rebreathers without prior review and approval of the NDCSB. 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.

B. The NDCSB will review each application for specialized rebreather diving, and may require divers to follow additional guidelines beyond those listed here.

### 10.2 Minimum Experience and Training Requirements

10.2.1 Prerequisites.

A. General.

1) Rebreather training shall be approved by the NDCSB.

2) Training shall include factory-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).

B. Requirements.

1) Active NOAA Diver status, with depth qualification sufficient for the planned application.

2) Completion of a minimum of 100 open water dives on open circuit scuba.

3) 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.

4) Nitrox training. Basic nitrox training in the use of mixtures containing 25 percent to 40 percent oxygen is required. 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.

10.2.2 Academic Training.

A. NDCSB approved rebreather training shall follow the following progression:

1) Air diluent, no decompression;

2) Air diluent, decompression;

3) Normoxic trimix diluent, decompression; and

4) Hypoxic trimix diluent, decompression.

B. Divers seeking authorization to use rebreathers must demonstrate to the NDCSB the proper attitude, judgment, and discipline to safely conduct such operations prior to final authorization from the NDPM.

C. Classroom training shall include, but is not limited to:

1) A review of diving physics and physiology, decompression management, dive planning, Nitrox, staged decompression and/or mixed gas training as they pertain to the safe operation of the selected NOAA approved rebreather system and planned diving application.

2) In particular, causes, signs and symptoms, first aid, treatment and prevention of the following must be covered:

a. Hyperoxia (Central Nervous System (CNS) and Pulmonary Oxygen Toxicity);

b. Hypoxia;

c. Hypercapnia;

d. Inert gas narcosis;

e. Decompression sickness;

f. Caustic cocktail;

g. Middle Ear Oxygen Absorption Syndrome (oxygen ear);

h. Hyperoxic myopia;

i. Allergic reactions; and

j. Disease transmission.

3) Rebreather-specific information required for the safe and effective operation of the system to be used, including system design and operation, for the following:

a. Counterlung(s);

b. $CO_2$ scrubber;

c. $CO_2$ absorbent material types, activity characteristics, storage, handling and disposal;

d. Oxygen control system types and designs;

e. Diluent control system types and designs (if any).

4) Pre-dive setup and testing.

5) Post-dive break-down and maintenance.

6) Oxygen exposure management.

7) Decompression management and applicable decompression tracking methods.

8) Dive operations planning.

9) Problem recognition and management, including system failures leading to hypoxia, hyperoxia, hypercapnia, flooded loop, and caustic cocktail.

10) Emergency protocols and bailout procedures.

11) Logging of maintenance and usage.

10.2.3 Practical Training.

A. Minimum number of hours of underwater time:

| Type | Pool/Confined Water | O/W Training | O/W Evaluation |
|---|---|---|---|
| Oxygen Rebreather | 1 dive, 90 min[1] | 4 dives, 120 min[1] | 1 dive, 30 min[1] |
| Semi-Closed Circuit | 1 dive, 90-120 min | 4 dives, 120 min[2] | 2 dives, 60 min[2] |
| Closed-Circuit | 1 dive, 90-120 min | 8 dives, 380 min[3] | 2 dives, 120 min[3] |

Notes:
[1] Dives should not exceed 20 fsw.
[2] First two (2) dives should not exceed 60 fsw. Subsequent dives should be to progressively greater depths, with at least one (1) dive between 100-130 fsw.
[3] Total underwater time (pool and open water) of approximately 500 minutes. First two (2) open water dives should not exceed 60 fsw. Subsequent dives should be to progressively greater depths, with at least two (2) dives between 100-130 fsw.

B. Amount of required in-water time should increase proportionally with the complexity of rebreather system used.

C. Training shall be in accordance with the manufacturer's recommendations.

10.2.4 Practical Evaluations.

A. As an integral part of practical training, the diver must demonstrate to the instructor their proficiency in pre-dive, dive, and post-dive operational procedures for the NOAA approved model of rebreather to be used.

B. Skills shall include, at a minimum:

1) Oxygen control system calibration and operational checks;

2) Carbon dioxide absorbent canister packing;

3) Supply gas cylinder analysis and pressure check;

4) Test of one-way valves in the breathing loop;

5) System assembly and positive/negative breathing loop leak testing;

6) Pre-dive breathing to test system operation;

7) In-water leak checks;

8) Buoyancy control during descent, bottom operations, and ascent;

9) System monitoring and control during descent, bottom operations, and ascent;

10) Proper interpretation and operation of system instrumentation (e.g., $PO_2$ displays, dive computers, gas supply pressure gauges, alarms) as applicable;

11) Unit donning and doffing on the surface;

12) Bailout and emergency procedures for self and buddy, including:

    a. System malfunction recognition and solution;

    b. Manual system control;

    c. Flooded breathing loop recovery (if possible);

    d. Absorbent canister failure; and

    e. Alternate bailout options.

13) Symptom recognition and emergency procedures for hyperoxia, hypoxia, and hypercapnia;

14) Proper system maintenance, including:

    a. Full breathing loop disassembly and cleaning (e.g., mouthpiece, check-valves, hoses, counterlung, absorbent canister);

    b. Oxygen sensor replacement for Semi-Closed Circuit Rebreather (SCR) and Closed Circuit Rebreather (CCR); and

    c. Other tasks required for specific rebreather models.

10.2.5 Written Examination.

A written examination approved by the NDCSB is required, with a pre-determined passing score, and covering concepts of both classroom and practical training.

10.2.6 Previously Certified or “Crossover” Rebreather Divers.

A. Crossover Rebreather Divers are divers previously certified on a non-NOAA approved rebreather.

B. To be considered to dive with a rebreather for NOAA, Crossover Rebreather Divers must have completed the requirements in Sections 10.2.2 through 10.2.5, and if not familiar with a NOAA-approved unit, must complete a “Crossover Course” that certifies them on the unit they will be diving.

C. Crossover Rebreather Divers must conduct Evaluation Rebreather Dives described in Section 10.2.3.

D. With approval from the NDCSB, Crossover Rebreather Divers may be certified to the maximum depth they were certified to on a different model of rebreather.

10.2.7 Operational, No-decompression, Air Diluent Rebreather Dives.

A. Upon successful completion of 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 NDPM shall add the relevant endorsement to the diver's Letter of Authorization.

C. Once NDPM has signed the amended Letter of Authorization, the diver is authorized to dive under the following conditions:

1) The dive plan must specify that the diver will be using a rebreather for no-decompression, air diluent diving in water shallower than 130 fsw;

2) If the rebreather diver will be diving with an open-circuit buddy, the buddy must be trained and qualified according to the standards in Section10.5.2 below;

3) 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.

4) The rebreather diver will always conduct an immediate pre-dive check of the gear before entering the water in accordance with Section 10.5.5 D below;

5) The rebreather diver will routinely practice the skills necessary to be able to respond to any of the contingencies listed in Section 10.8.3 below;

6) Any "near miss" contingencies according to Section 10.8.3 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;

7) 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

8) The divers will maintain proficiency for their level of certification.

10.2.8 Extended Range Diving.

A. 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.

B. 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.

C. As prerequisites for training for use of rebreathers with normoxic trimix diluents (He, $O_2$, $N_2$ with $\geq$ 17% $O_2$), 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.

D. As prerequisites for training for use of rebreathers with hypoxic trimix diluents (He, $O_2$, $N_2$ with < 17% $O_2$), the diver shall have logged a minimum of 100 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 180 fsw and 250 fsw.

E. Training shall be in accordance with standards for decompression and mixed gas diving, as applicable to rebreather systems, starting at the 130 fsw level.

F. 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.

10.2.9 Maintenance of Proficiency.

A. To maintain authorization to dive with rebreathers, a diver shall make at least one (1) dive using a rebreather every eight (8) weeks. For divers authorized to conduct extended range, decompression or mixed-gas diving, at least one (1) dive should be made annually to a depth near 130 fsw, practicing decompression protocols.

B. Divers authorized to conduct extended range, 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.

C. For a diver in arrears, 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.

## 10.3 'Tech Lite' – Rebreather Operations

10.3.1 General Requirements.

A. 'Tech Lite' – Rebreather allows divers authorized by the NDP to conduct decompression dives using rebreathers without mission-specific pre-approval from the NDCSB.

B. Dives are limited to a maximum depth of 130 fsw.

C. Decompression obligations are limited to a maximum of 10 minutes.

D. Units participating in the 'Tech Lite' – Rebreather program must complete a probationary period of up to one (1) year before 'Tech Lite' decompression dives can be undertaken without pre-approval of dive plans by the NDCSB.

E. All other standards, policies and regulations pertaining to decompression diving and rebreather operations apply to the 'Tech Lite' – Rebreather program.

10.3.2 Approval Process.

A. Divers wishing to enroll in the 'Tech Lite' – Rebreather decompression diving program shall request initial approval of the NDCSB.

B. The NDCSB will review each application for 'Tech Lite' – Rebreather decompression diving, and may include any further requirements deemed necessary beyond those listed here on a case-by-case basis.

C. All dive units approved for 'Tech Lite' – Rebreather 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' - Rebreather operations without NDCSB pre-approval of dive plans, or the unit will have to continue their trail period until the NDCSB is satisfied with the unit's performance.

10.3.3 10.3.3 Prerequisites.

Air-diluent decompression to 150 fsw on the rebreather model to be used for operations.

10.3.4 10.3.4 Equipment – Dive Computers.

A. All dive computers and/or computer based decompression schedule generating software programs will be set to a conservative gradient factor of 30/70.

B. All dive computers and/or computer based decompression schedule generating software programs must be approved by the NDCSB.

10.3.5 Breathing Gases and Gas Management.

A. A maximum $PO_2$ of 1.3 ATA will be utilized during the bottom phase of the dive and maximum $PO_2$ of 1.6 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.

10.3.6 Manning Requirements.

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 / Support Divers

1) A minimum of two (2) standby/support divers, capable of reaching 130 feet and functioning as a buddy team, will be on site for all decompression diving operations.

2) All standby / 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.

3) 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.

4) 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.

5) 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.

C. Technical Diving Supervisor

1) Must meet all the requirements in Section 2.9 of this Manual.

2) Must remain at the surface during diving operations.

3) Must be approved by the NDCSB to supervise dives utilizing the model(s) of rebreather employed on the dive(s).

D. Vessel Operator.

1) Must remain on the vessel during diving operations.

2) 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.

10.3.7 Operational Considerations.

A. Maximum depth shall not exceed 130 fsw.

B. Maximum decompression obligation shall not exceed 10 minutes.

C. All operations shall be conducted within four (4) hours of a multi-place, multi-lock recompression chamber, unless there is a recompression chamber (including a Hyperlite) on site.

D. Repetitive dives may be approved by the TDS, if appropriate and all other 'Tech Lite' standards are followed.

10.3.8 Proficiency.

A. An authorized diver shall make at least one (1) dive using a CCR every six (6) weeks, or ten (10) 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.

B. 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.

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## 10.4 Equipment Requirements

10.4.1 General Requirements.

A. Only those models of rebreathers specifically approved by NDCSB shall be used.

B. Rebreathers shall be manufactured according to acceptable Quality Control/Quality Assurance protocols, as evidenced by compliance with the essential elements of ISO 9000-9004. Manufacturers should be able to provide to the NDCSB supporting documentation to this effect.

C. Unit performance specifications shall be within acceptable levels as defined by the NDCSB.

D. 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.

E. A complete instruction manual is required, fully describing the operation of all rebreather components and subsystems as well as maintenance procedures.

F. A maintenance log is required. The unit and subsystem component (i.e., regulators, computers, and cylinders) maintenance shall be up-to-date based upon the manufacturer's recommendations.

10.4.2 Minimum Equipment.

A. General.

1) Dive/Surface Valve (DSV) in the mouthpiece assembly, allowing the breathing loop to seal from the external environment when not in use.

2) Automatic diluent addition valve (ADV) or equivalent, so that manual volumetric compensation during descent is unnecessary.

3) Manual gas addition valves, so that manual volumetric compensation during descent and manual oxygen addition are possible at all times during the dive.

4) 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.

B. Oxygen Rebreathers. Oxygen rebreathers shall be equipped with manual and automatic gas addition valves.

C. Semi-Closed Circuit Rebreathers (SCRs). SCRs shall be equipped with at least one (1) manufacturer-approved oxygen sensor sufficient to warn the diver of impending hypoxia.

D. Closed Circuit Rebreathers (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.

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

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## 10.5 Operational Requirements

10.5.1 General Requirements.

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.

10.5.2 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 $PO_2$ on the CCR diver’s handset, computer and Heads Up Display (HUD);

3) How to change the rebreather’s handset controller to an appropriate $PO_2$;

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 the Mixed-gas Bypass Valve (MBV);

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 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.

B. 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.

10.5.3 Oxygen Exposures.

A. Planned oxygen partial pressure in the breathing loop shall not exceed 1.4 ATA for SCRs, oxygen rebreathers and the bottom phase of dives with CCRs.

B. Planned oxygen partial pressure set point for CCRs shall not exceed 1.4 ATA. Set point at depth should be reduced to manage oxygen toxicity according to the NOAA Oxygen Exposure Limits.

C. 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.

10.5.4 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) Mass flow SCR (presumed constant $FO_2$):

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 (constant $PO_2$):

a. Constant $PO_2$ monitor, with an integrated constant $PO_2$ computer being desirable.

b. One (1) non-integrated constant $PO_2$ dive computer or two (2) if there is no integrated constant $PO_2$ dive computer with open circuit bailout capabilities.

c. Constant $PO_2$ 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.

10.5.5 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 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
14) Final operational verification immediately before entering the water to include:
    a. A positive pressure check of the BC;
    b. Check of the BC inflator to ensure proper function;
    c. A negative pressure check of the loop;
    d. Bailout life support is functioning;
    e. Oxygen addition system is functioning;
    f. Volumetric diluent addition (the ADV) is functioning;
    g. Controller and computers are attached and turned on;
    h. All gas cylinder valves are open;
    i. A negative pressure check of the bailout second stage;

j. Bailout bottles are securely attached, turned on and isolated or shut off;

k. Pre-breathe the unit for 3-5 minutes (longer in colder water) with mask on;

l. $PO_2$ in the breathing loop is not hypoxic or hyperoxic; and

m. Bubble check upon entering the water.

10.5.6 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.

10.5.7 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.

10.5.8 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. Other consumables (e.g., batteries) shall be maintained, tested, and replaced in accordance with the manufacturer's specifications.

10.5.9 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.

10.5.10 Safety Equipment Configuration.

A. Bailout Bottles.

1) Bailout bottles shall be carried by every diver (e.g., no “team” bailout) on all CCR 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.

2) Divers will always carry at least one (1) bailout bottle with a gas mixture that can be breathed at any point during the dive ($PO_2$ between 0.20 and 1.60 ATA).

3) 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) in an LP port on the first stage of the regulator to prevent the possibility of first stage high-pressure creep rupturing the LP hose. All divers on a single dive shall use the same method. The bailout first stage may also be outfitted with an additional second stage configured in the same manner as above and worn on a necklace underneath the breathing hose of the CCR.

4) Each bailout first stage shall have a pressure gauge affixed with a hose of sufficient length that allows the diver to see the tank pressure at any point during the dive. “Button” gauges are not allowed for bailout bottles.

5) The first stage of each bailout regulator shall also 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 use the same method.

6) 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.

7) Each bailout bottle shall be marked with tape which clearly indicates the percentages of oxygen and inert gases in the mix, the Maximum Operating Depth (MOD), the cylinder pressure, the date the gases were analyzed and the diver’s initials. 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.

8) 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 $FO_2$ is employed.

B. Lift Bags.

1) Each diver will carry two (2) lift bags of at least 50 lbs. positive lift. One (1) lift bag 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.

2) Lift bags shall be affixed to the backplate or harness in a manner that allows the diver to reach both bags with either hand.

3) Each lift bag shall be equipped with a stainless or brass clip which can be attached to the CCR to provide positive lift in the case of a total rig flood.

C. Line Reels.

1) Each diver will carry two (2) line reels, one (1) of which has sufficient line length to reach the surface from any depth in which the divers operate.

2) Line reels should be attached to the backplate or harness in a manner that allows the diver to reach both reels with either hand.

D. Dive Computers.

1) 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 $PO_2$ monitor unless an integrated computer is hard-wired to the head.

2) Each diver will wear a NOAA-approved fixed $PO_2$ dive computer to calculate no-decompression times/decompression schedules in the event the primary dive computer fails.

E. Other Safety Equipment.

1) Each diver will carry an accessory pouch which includes at a minimum: a light, a signal mirror; a backup knife, a whistle, decompression tables (with contingencies) appropriate for the diluent mixture used and decompression schedules (with contingencies) appropriate for the bailout gases.

2) Safety equipment such as EPIRBS, waterproof GPS-enabled radios, and Dive Alerts™ should be considered essential equipment when operating in remote areas or in areas dominated by high current.

10.6.1 Depth Limits.

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

10.6.2 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.

## 10.7 Semi-Closed Circuit Rebreathers

10.7.1 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 0.2 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 $FO_2$.

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 $FO_2$ in the active supply cylinder.

10.7.2 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.

## 10.8 Mixed Gas Closed-Circuit Rebreathers

10.8.1 Oxygen Parameters and Considerations.

A. The $FO_2$ 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 $PO_2$ greater than 0.20 ATA but no greater than 1.3 ATA, unless approved by the TDS in very limited circumstances during mixed gas diving operations.

B. MOD shall be based on the $FO_2$ of the diluent in use during each phase of the dive, so as not to exceed a $PO_2$ limit of 1.3 ATA.

C. The $PO_2$ setpoint shall not be lower than 0.5 ATA nor higher than 1.4 ATA during the bottom phase of the dive.

10.8.2 Monitoring of Oxygen Parameters.

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).

10.8.3 CCR Contingency Protocols.

A. Out of gas, onboard diluent cylinder: Bail out to depth-appropriate off-board gas or pipe in off-board gas from the depth-appropriate bailout cylinder. Notify buddy(ies), adjust dive computers to account for gas or diving mode changes (CCR vs OC), abort the dive and begin ascent conducting all decompression stops (if a decompression obligation has been incurred) while monitoring the gas supply of the bailout.

B. Out of gas, onboard oxygen cylinder: If conducting no-decompression dives and the onboard supply of oxygen is lost, bail out to off-board gas. If conducting decompression operations, pipe in the off-board oxygen bailout, manually add $O_2$ and monitor the $PO_2$. Notify the buddy(ies), adjust dive computers to account for gas or diving mode changes (CCR vs OC), abort the dive and begin the ascent conducting all necessary decompression stops while monitoring the gas supply of the bailout.

C. Out of gas, lost bailout: The CCR diver should go to an on-bottom safety diver (for decompression operations) or a buddy with bailout gas properly configured for CCR response. Any failure from a diver's onboard oxygen supply would require a safety diver or properly configured CCR diver (decompression operations) to transfer an oxygen cylinder for attachment on the diver's harness and remain as a gas source during completion of decompression or until such time as additional bailout can be delivered. Any further bailout gas failure would warrant gas sharing of bailout mix through the off-board connector of a CCR buddy's bailout. If below the depth where support divers are present, an emergency lift bag or surface marker buoy should be launched with a message describing the problem so a support diver can descend with additional cylinders. If during the phase of the dive where support divers are

present, divers shall communicate problem to an in-water support diver who shall acquire and deliver spare bailout to diver.

D. Gas failure, 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 the ADV, or disconnecting the hose to the manual addition valve or the BC inflator. If the problem is not resolved, the diver will close the valve on the affected side. Either bail out or pipe in appropriate off-board gas (unless the problem is that valve). Immediately perform an open loop diluent flush if the $PO_2$ spikes. Notify buddy(ies) of problem and abort the dive.

E. Gas failure, source of problem not obvious: If the diver cannot see where the leak is occurring, 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 and open the unaffected side, and check the handset for the $PO_2$. If the gas loss occurred on the diluent side, pipe in off-board gas or bail out. If the gas loss occurred on the oxygen side, bail out immediately as hypoxia will ensue. In either case, notify buddy(ies) of problem and abort the dive. If there is concern over the amount of bailout gas available to reach the surface including decompression, pipe in oxygen from the diver's or the CCR buddy's oxygen bottle to the off-board connector or the oxygen manual addition valve.

F. Oxygen solenoid stuck open: If the oxygen solenoid is stuck open, as evidenced by the sound of oxygen being continuously injected into the head, immediately close the oxygen valve, and follow with an open loop diluent flush to bring down the $PO_2$ then check the handset for the $PO_2$ level. Feather (slowly open and close just enough to add oxygen to the breathing loop) the oxygen valve to maintain an appropriate $PO_2$. If an off-board cylinder of oxygen is available, it can be piped in via the off-board connector to the off-board valve, or the oxygen manual addition valve and oxygen can be manually added to the loop. If an appropriate $PO_2$ cannot be maintained, bail out to an appropriate off-board gas. In either case, notify buddy(ies) of the problem and abort the dive. A slow oxygen leak past the solenoid may not be heard, instead, the leak may show up as increased buoyancy and slow $PO_2$ increase.

G. Oxygen solenoid stuck closed: If the oxygen solenoid is stuck closed, as evidenced by no sound of oxygen being injected into the head, first ensure that the oxygen valve on the tank is indeed open. If it is, leave the oxygen valve open and manually add oxygen to maintain an appropriate $PO_2$. If the oxygen valve is not open, turn it at least one (1) full turn and check to see if the solenoid is properly injecting oxygen. If an off-board cylinder of oxygen is available, it can be piped in via the oxygen manual addition valve or the off-board connector to the off-board valve and oxygen can be manually added to the loop. If an appropriate $PO_2$ cannot be maintained, bail out to an appropriate off-board gas. In either case, notify buddy(ies) of the problem and abort the dive. In cold water, the solenoid may not be heard at all due to a thick hood and/or ambient noise. A solenoid stuck in the closed position may show up as a slow decrease in buoyancy and a falling $PO_2$ reading.

H. Partially Flooded Loop: If the Dive Surface Valve (DSV) is removed from the mouth while in the open position, the loop may partially flood. If diving a Megalodon and this happens, either grab the loop overhead with a hand or use both hands to find the loop from the “T” pieces. Once located, put the DSV in the mouth and conduct a loop recovery maneuver. Open the Over-Pressurization Relief Valve (ORV) on the exhalation counterlung, blow into the DSV and simultaneously perform a diluent flush but do not breathe out through the nose. If this does not resolve the problem, bail out to an appropriate off-board gas, notify buddy(ies) and abort the dive.

I. Totally Flooded Loop: A totally flooded loop is non-recoverable and if the diver continues to attempt to breathe off the loop they risk a “caustic cocktail.” Anytime a gurgling sound is heard coming from the inhalation side of the loop, the diver tastes or smells carbon dioxide absorbent, experiences sudden increased breathing resistance, or experiences a sudden loss of buoyancy, suspect a flooded scrubber canister. If any of these scenarios occurs, immediately bail out to an appropriate offboard gas, notify buddy(ies) and abort the dive.

J. Total Electronics Failure: While a total failure of electronics is possible it is not very likely. In the event that a diver experiences total electronics failure of a CCR, immediately bail out, switch the dive computer to open circuit, notify buddy(ies), abort the dive and ascend following the appropriate decompression schedule.

K. 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.

L. Hypoxia: Hypoxia can occur at a $PO_2$ of < 0.21 ATA. If the diver notices the $PO_2$ is low, DO NOT ASCEND until the situation has been corrected or unconsciousness can occur. Immediately perform a Diluent Flush maneuver. Check the handsets and the oxygen cylinder pressure and ensure that the oxygen valve is open. Consider the possibility that the solenoid may be stuck in the closed position and attempt to add oxygen manually. Consider also that the wrong gas may be in the oxygen cylinder, or that the cylinders are mounted reversed. If the problem is correctable continue in CCR mode, otherwise bail out, notify buddy(ies) and abort the dive.

M. Hyperoxia: Hyperoxia can occur at a $PO_2$ of >1.4 ATA. If the diver notices the $PO_2$ is too high, do not descend any further until the situation is corrected or unconsciousness can occur. Immediately perform a Diluent Flush to reduce the $PO_2$. Check the handsets and if the $PO_2$ continues to climb, consider that the solenoid may be stuck in the open position, the oxygen manual addition valve may be stuck or the internal fittings may be loose and bleeding into the rebreather head; if the oxygen manual addition valve is stuck, remove the low pressure hose from the valve. If the source of increased oxygen is a stuck solenoid or internal fitting leak, close the oxygen valve and turn it on and off (feathering) to maintain a $PO_2$ of 1.3. If a constant $PO_2$ cannot be maintained, bail out to the appropriate gas, notify buddy(ies) and abort the dive. Hyperoxic oxygen convulsions will present themselves in two (2)

phases. Phase 1 will place the diver in a state of convulsions, with no respiration, and the diver is likely to clinch their teeth, which may serve to keep the DSV in the diver's mouth. In Phase 2 the diver will be relaxed and will start to hyperventilate (breathe fast). The second phase poses a significant risk of drowning if the DSV is allowed to fall out of their mouth.

N. Hypercapnia: Hypercapnia can occur if the carbon dioxide is not being properly scrubbed (breakthrough or pushing sorbent past its capacity to remove carbon dioxide), or if there is no scrubber canister in the rebreather. If the diver notices that they "do not feel right," carbon dioxide may be too high and, if the situation is not corrected, unconsciousness will occur. Immediately bail out to an appropriate gas and do not go back on the loop. Notify buddy(ies) and abort the dive.

O. Unconscious CCR Diver: A CCR diver should constantly be moving; if not, it could be an indication they are unconscious and may have succumbed to hypercapnia, hyperoxia or hypoxia. If you suspect the diver is unconscious, shake the diver to check. If no response is seen, approach the diver from the back, reach around with the right hand and keep the DSV in the mouth. Check the $PO_2$ to see what partial pressure is currently being displayed. If possible, perform a vigorous Diluent Flush. Get the diver to the surface as soon as safely possible. Once on the surface, close the DSV or the diver will immediately lose buoyancy if water enters the loop. If the diver regains consciousness, and a decompression obligation exists, consider lowering the setpoint and extending decompression time. If the DSV is not in the diver's mouth, close the DSV and get the diver to the surface as fast as is safely possible. If the diver is unconscious, and a decompression obligation exists, get the diver to the surface and return to the last missed stop and continue decompression with a buddy. Follow omitted decompression procedures by extending all stops shallower than 30 fsw by 1.5 times the originally scheduled time.

P. "Caustic cocktail:" While some CCRs can tolerate a small amount of water in the system, depending on the location of the leak, the water-trapping capacity of the system may become overwhelmed. Signs of a flood include: gurgling in the inhalation hose, carbon dioxide absorbent smell or taste, increased breathing resistance, drop in temperature of inhaled gas, and loss of buoyancy. If any of these signs are present, immediately bail out to an appropriate gas, notify buddy(ies) and abort the dive. If the caustic cocktail entered 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. If a caustic cocktail is not present, but the diver suspects some water has entered the loop (gurgling on exhalation) the diver can follow the procedures for a partially flooded loop.

Q. Omitted decompression: If a bottom diver is asymptomatic, the diver must repeat all stops deeper than and including the 40 FSW stop. The diver shall multiply the 30 FSW, 20 FSW, and 10 FSW stop times by 1.5. The bottom diver shall maximize PO2

by using the most hyperoxic gas appropriate for the depth without exceeding a PO2 of 1.6 ATA. If a bottom diver is symptomatic, the diver must be placed on oxygen, hydrated, and evacuated to the nearest recompression facility.

R. 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.

S. Dive team separated during deployment: If a buddy team finds themselves separated from their buddy(ies) during deployment, the divers should abort the dive after searching for team members for five (5) minutes and return to the surface. Divers will deploy a lift bag to signal to the surface support team and dive vessel(s). The divers shall be recovered to the primary support vessel and may elect to make a second drop.

T. 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.

U. Dive team separated, swept off dive site: Upon separation and if unable to locate each other, the divers should independently shoot a bag to the surface and commence their own decompression. Divers shall exercise normal decompression procedures, and expect to see Support Diver in the water above them.

V. Dive team swept off dive site: Divers stay together; attempt to regain position on dive site and abort if necessary. If unable to return to the dive site, launch a lift bag of a reel, abort the dive and safely ascend as a team. Exercise appropriate decompression procedures.

W. Diver entanglement on bottom: Divers shall carry at least two knives and an additional cutting tool, either EMT scissors or a seatbelt cutter. If entangled, notify other diver(s) of problem. Evaluate the nature of entanglement and attempt to free self or signal buddy(ies) for assistance. If using the standby diver mode, separated from buddy(ies) and entangled without remedy, inflate bag to surface with penciled distress message on slate attached by snap hook to the bag. The standby diver from primary support vessel shall then enter the water and search for the entangled diver. The other diver, if separated and successfully decompressing on a lift bag, shall be accompanied by the Small Boat. Both vessels will maintain radio contact with each

other, but the primary support vessel will remain with the entangled diver and the designated Diving Supervisor will monitor the situation topside. If using the on-bottom safety diver mode, given this contingency or similar difficulties in which a pair of divers will need to assist the expedition team at the bottom, the second dive team of the day (if available) will deploy to assist the entangled diver.

X. Dive team unable to locate ascent-line: Remain mindful of bottom time (BT). Divers can either shoot a lift bag on a reel to the surface and begin decompression ascent on the bag line, or, if adequate gas supply is available, take an additional five (5) minutes to search and extend to the next bottom time group. Divers must be on a line beginning ascent by five (5) minutes past original plan. Divers shall carry hard copies of planned decompression schedules and contingencies. Decompress according to the appropriate schedule or according to the dive computer. If divers come up on the bag line, surface support will shift to the divers' location, be they drifting or stationary. In the event of loss of ascent-line, divers will shoot a lift bag and commence a drifting ascent under the bag.

Y. 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.

Z. Dive team ascends on ascent line, but dive support vessel is gone: Research (bottom) divers stay together upon reaching surface. Use appropriate signaling device to signal surface craft.

AA. Change of environmental conditions during dive: In the time interval between the beginning of a dive and the completion of decompression, it is possible for environmental conditions to change sufficiently to require adjustment to the dive plan

1) Current strength – A significant increase in current strength during a dive will make it more difficult for the divers to decompress if they are using a fixed down-line, subjecting the decompressing divers to the full strength of the current. Divers should consider “drift decompression” to be the preferred method in strong currents.

2) Surface waves or swell height – A significant deterioration of sea conditions will make it more difficult for the divers to decompress because the ascent-line (either a hard line anchored to the bottom or a drifting line suspended from a buoy) will rise and fall, sometimes violently, as the dive vessel strains on the line, if at anchor. Therefore, decompressing divers must take care not to hold to the ascent-line too tightly, especially on the shallower stops where the effect is most pronounced. 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. One end of the Jon line is looped around the ascent-line and the other is clipped to the diver's "scooter ring." Otherwise the dive team should choose to use drift decompression.

3) Visibility – A significant decrease in visibility on the bottom will make it more difficult for the divers to work, but also might decrease the safety of the divers. Therefore, if the visibility decreases to less than ten (10) feet, the divers should consider terminating the dive.

4) Water temperature – A decrease in water temperature, due to a deep-layer thermocline or to an alteration of current patterns, will affect diver comfort and, if significant, could affect safety. Divers should wear adequate thermal protection-a well-fitting wet suit and hood, or a dry suit. If water temperature decreases significantly, the dive should be terminated.

BB. Initiation of subsequent dives: If any emergency arises while one team is in the water, a second team will not commence operations until the problem has been resolved and it has been deemed appropriate to make the second dive.

# Section 11: EMERGENCY PROCEDURES

## 11.1 Diving Accident Management

11.1.1 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; and

4) Activating pre-planned methods of evacuation.

C. The primary reference documents for NOAA Diving Accident Management are:

1) NOAA Diving Accident Management Field Reference Guide; and

2) NOAA Diving Medical Standards and Procedures Manual.

11.1.2 Diving Emergency Procedures.

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 57-03-21 Diving Emergency Assistance Plan (DEAP) for this purpose.

2) The DEAP shall be submitted to the UDS 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.

4) The UDS shall submit a copy of each unique DEAP to ndp.diveplans@noaa.gov.

11.1.3 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. 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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## 11.2 Emergency Protocols

11.2.1 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.

11.2.2 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 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 history information from diver, buddy and/or eyewitnesses;

G. Perform field neurological exam;

H. Contact the on-call DMO and Emergency Medical Services (EMS) as soon as possible; and

I. Administer 0.5 liters of water orally per hour for two (2) hours, and then reduce to 100-200 milliliters per hour thereafter.

11.2.3 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;

C. Remove exposure suit, dry patient, and keep warm;

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 history information from diving buddy and/or eyewitnesses;

G. Perform field neurological exam and Glascow Coma Scale evaluation; and

H. Contact the on-call DMO and EMS as soon as possible.

11.2.4 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;

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;

F. If there are changes in signs or symptoms after 30 minutes of oxygen breathing, continue administering 100 percent oxygen, consult a diving physician, and begin evacuation to a hyperbaric chamber; and

G. If there are no changes in signs or symptoms after 30 minutes, contact the on-call DMO for permission to take the diver off oxygen. Observe for one (1) hour and re-examine the diver every 2-6 hours thereafter.

11.2.5 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 (2.8 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 (2.8 ATA) and begin a USN TT6.

2) If unable to contact the on-call DMO, pressurize diver to 60 fsw (2.8 ATA) and begin a USN TT6.

C. Standing medical orders for divers undergoing hyperbaric treatment with a DMT on-site.

1) If the diver is able to take oral fluids but is not voiding at least 60-90 cc per hour (2-3 ounces), increase fluid intake.

2) If the diver is unable to take oral fluids, start IV with Lactated Ringers or Normal Saline and administer 500 cc immediately, and then infuse at 100-125 cc per hour.

3) If diver is unable to void, start a Foley catheter with urine output goal of 60-90 cc/hour; increase fluid intake if necessary.

4) Repeat field neurological exam every 15 minutes during the treatment.

5) If victim is unconscious and does not regain consciousness once at depth, place a nasogastric (NG) tube.

D. 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.

11.2.6 Guidelines for Non-Standard Scenarios.

The following guidelines are provided to aid the chamber supervisor/operator and DMO in responding to non-standard problems not addressed elsewhere.

A. Inability to equalize ears during pressurization of the chamber and victim has been determined to have:

1) Type I DCS.

a. Stop descent, ascend a few feet and try equalizing.

b. If still unable to clear after several tries, return chamber to surface and administer a nasal decongestant spray.

c. Wait until patient is able to auto-inflate their middle ear, then repeat attempt of pressurization in chamber.

2) Type II DCS or Arterial Gas Embolism (AGE).

a. Conscious victim: Depending on the symptoms, the chamber supervisor may elect to try one (1) or more of the steps listed in 11.2.6.A.1.

b. Unconscious victim: Do not delay; begin pressurization to 60 fsw in the chamber immediately. A qualified DMO may perform needle tympanostomy if time allows.

B. Confined Space Anxiety Syndrome (Claustrophobia).

1) Try to calm and reassure patient; and

2) If necessary, the DMO may direct the administration of an anti-anxiety agent to the patient orally.

11.2.7 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.

11.2.8 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.

11.2.9 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 12: RECORDKEEPING AND REPORTING REQUIREMENTS

## 12.1 Recordkeeping

12.1.1 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 permanent 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.

12.1.2 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 for ease of tracking and verification by DUSA inspectors.

12.1.3 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 the attending physician of a diver or former diver when released in writing by the diver.

12.1.4 Retention of Records.

A. The following records shall be retained for the following minimum periods:

| Record | Period at NDC | Period at Diving Units |
|---|---|---|
| Pre- and Post-Dive Checklists | Three (3) years if included in a Diving Incident Report Case File, then forwarded to the Federal Records Center and kept for 72 years before destruction. | 24 hours post operation, except following a reportable diving injury, when it is included in the Diving Incident Report Case File. |
| Dive Plan | One (1) year, except following a reportable diving injury, when it is included in the Diving Incident Report Case File. | 24 hours post operation. |
| Diving Emergency Assistance Plans | One (1) year, except following a reportable diving injury, when it is included in the Diving Incident Report Case File. | Filed at ndp.diveplans@noaa.gov on an annual basis or when the information on the DEAP changes (e.g., geographically or seasonally). |
| Diver medical records | Duration of diver's active service plus three (3) 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 | Permanent. | Current manual available. |

| | | |
|---|---|---|
| Safety Manuals | | |
| On-site Supervisor's Dive Log | Not applicable. | Five (5) days 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. | Current entry or until removed from service, except following a reportable diving injury, when it is included in the Diving Incident Report Case File. |
| Records of hospitalizations | Permanent. | Not applicable. |
| NOAA-owned Off-duty Equipment User Agreement | Three (3) years if included in a Diving Incident Report Case File, then forwarded to the Federal Records Center and kept for 72 years before destruction. | For the term of the diver's participation in the NDP or until the use of NOAA-owned gear is terminated, except following a reportable diving injury, when it is included in the Diving Incident Report Case File. |
| NOAA-owned Off-duty Equipment User Release of Liability | Three (3) years if included in a Diving Incident Report Case File, then forwarded to the Federal Records Center and kept for 72 years before destruction. | For the term of the diver's participation in the NOAA-owned Off-duty Equipment program, except following a reportable diving injury when it is included in the Diving Incident Report Case File. |

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) 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.

12.1.5 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 five (5) days 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) Names of diving team members, 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 13: DIVING ACCIDENT NOTIFICATION AND INVESTIGATION

## 13.1 General

A. The first response to any diving accident is the prompt and appropriate attention to any medical emergencies and is covered in Section 11 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.

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://secure.seco.noaa.gov/.

## 13.2 Accident Classification

13.2.1 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.

13.2.2 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.

13.2.3 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

1) Pulmonary barotrauma.

13.2.4 Class D Accident.

A. An accident in which the resulting in 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;

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.

13.2.5 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 accident.

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.

13.2.6 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.

13.2.7 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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## 13.3 SECO Notification and Investigation

13.3.1 General.

Follow reporting procedures described in “Accident Investigation and Reporting Resources” which can be located at https://secure.seco.noaa.gov, by clicking on the tab “Safety Management” located on the left side of the page under “Safety & Health”.

13.3.2 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 |

13.3.3 SECO Investigation Procedures.

A. Class A Accidents: The Director, OMAO shall empanel an investigative team to 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.

B. Class B, C and D Accidents and Near Misses: The Chair, NDCSB shall empanel an investigative team that 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.

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## 13.4 NDP Notification and Investigation

13.4.1 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:

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.

13.4.2 Internal 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://secure.seco.noaa.gov/), 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 Dive Operations Plan and NOAA Form 57-03-21 Diving Emergency Assistance Plan (DEAP), 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, a copy of the NOAA Diving Incident Report (NF 57-03-01), and a copy of the SECO online incident report; 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 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 shall:

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.

13.4.3 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://secure.seco.noaa.gov) 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://secure.seco.noaa.gov/), 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.

$FO_2$: Fraction of oxygen in a gas mixture by volume, expressed as either a decimal or percentage. For example the $FO_2$ 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 $PO_2$ for a given gas mixture reaches a predetermined level. The NOAA standard is a maximum $PO_2$ 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 21 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 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.

$PO_2$: Inspired partial pressure of oxygen, usually expressed in units of atmospheres absolute (ATA). For example, the $PO_2$ 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.

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.

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.

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.

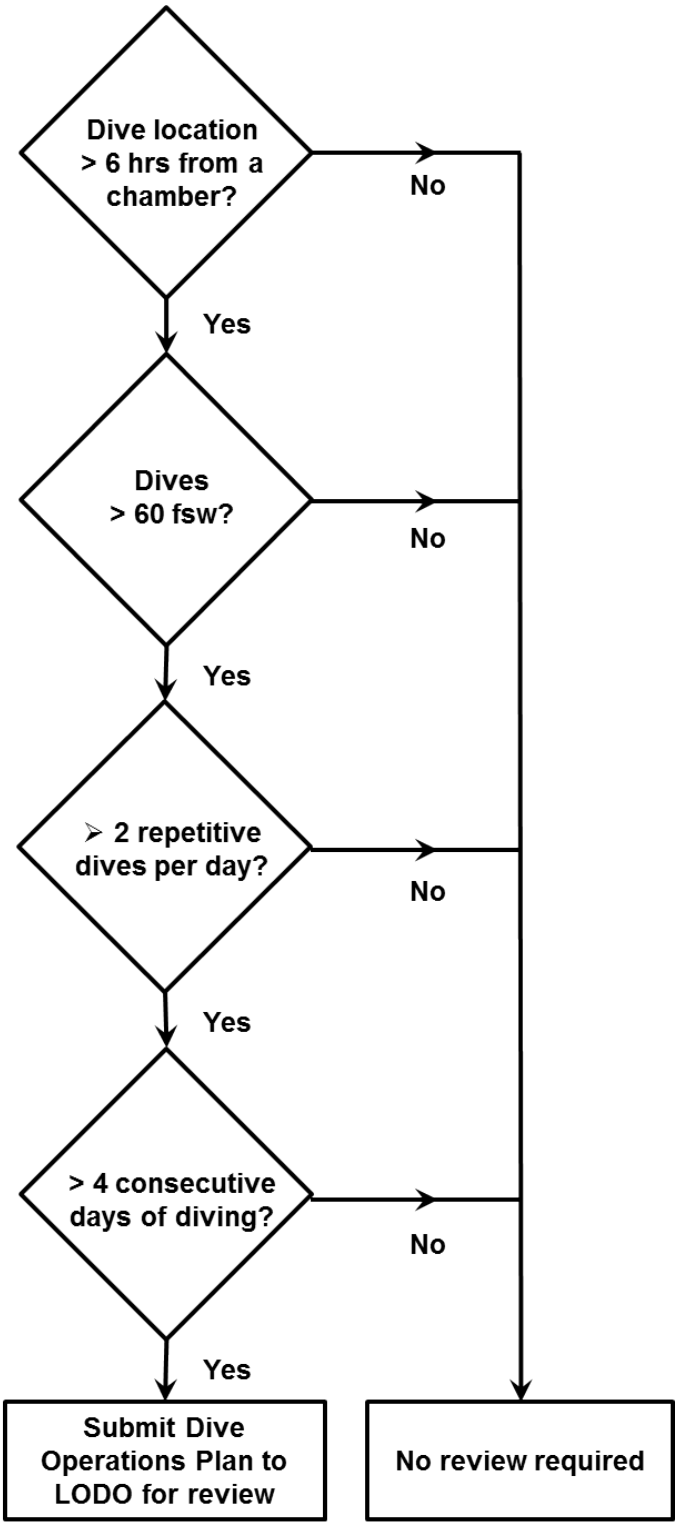
Working Pressure: The maximum pressure to which a pressure containment device may be exposed under standard operating conditions.

## **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.

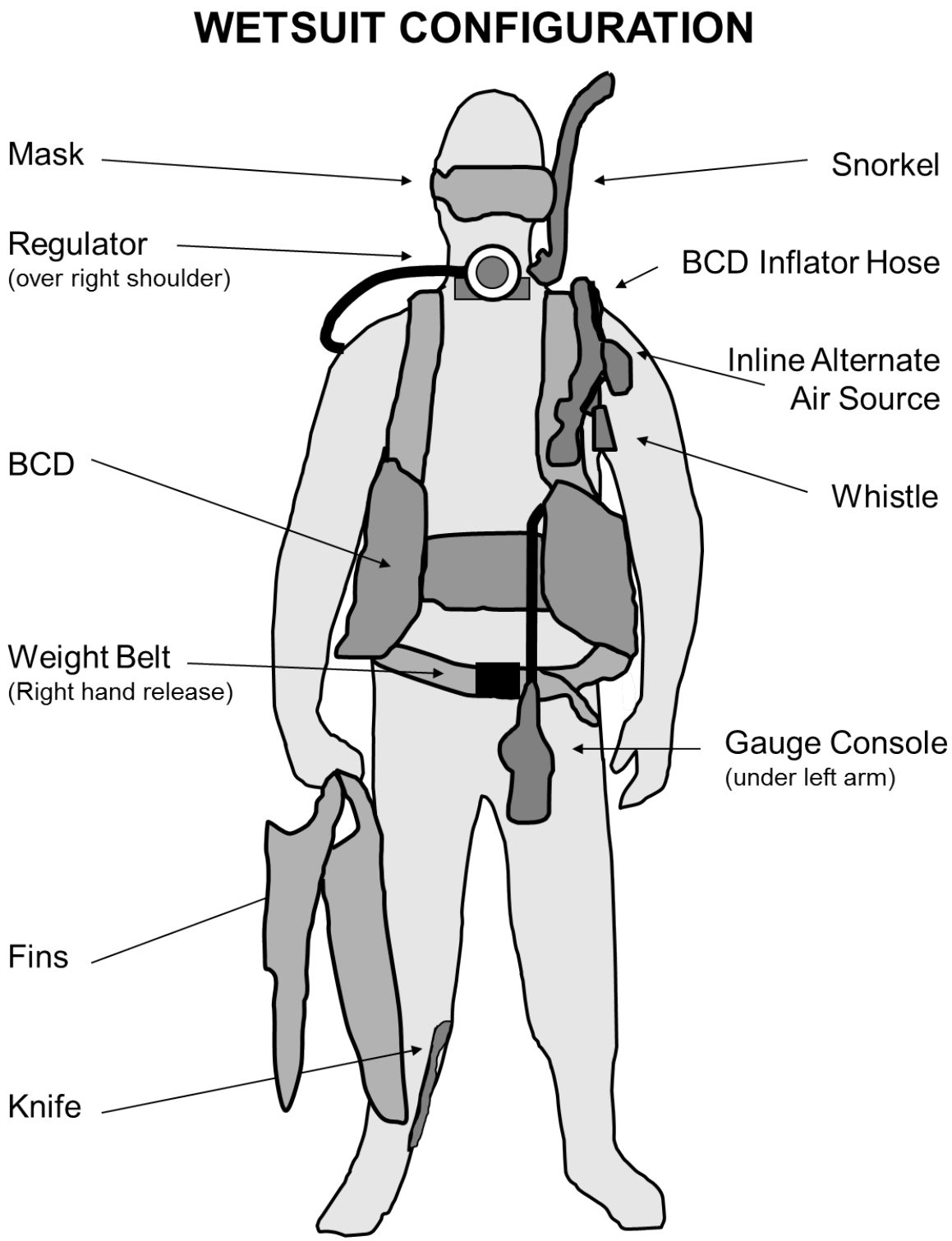
Any 'no' answers will negate the need for review of the dive plan.



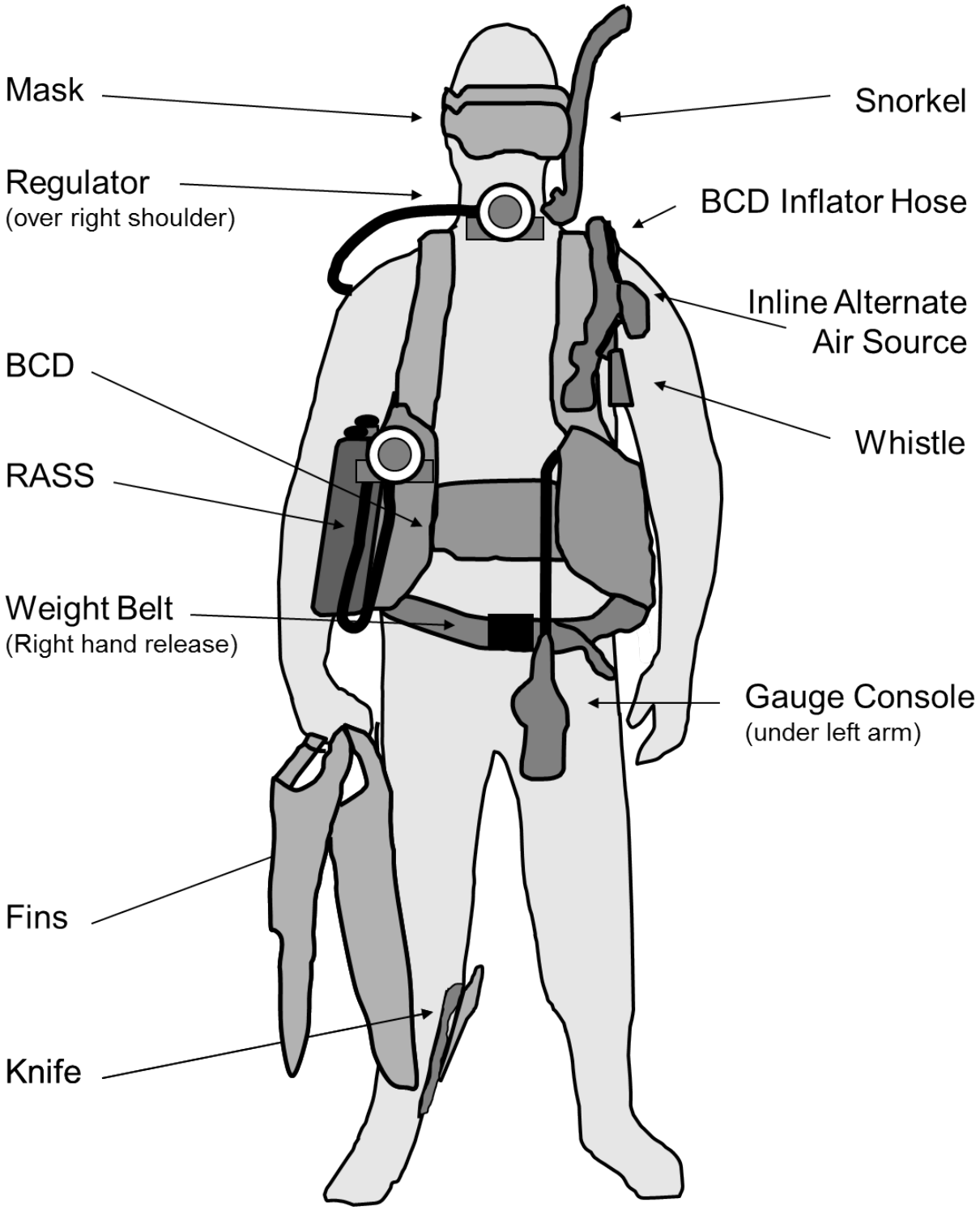
**Appendix 4:** NOAA DIVERS FIRST AID KIT INVENTORY

| **General Items** | **Orthopedic Pack** |
|---|---|
| First Aid pocket book | SAM splint (1) |
| Diver injury report slate / form | Cold compress (1) |
| Neuro exam slate | Triangular bandages (2) |
| Pencil | 2” cloth tape (1 roll) |
| Quart size bottle of vinegar (optional) | 3” elastic bandage (2) |
| | 2” Coban (2) |
| **Personal Protective Equipment** | |
| Non latex gloves (10 pair) | **Drug Pack** |
| Face shield with mask | Ibuprofen tablets, 200 mg (10) |
| Pocket mask | Acetaminophen 500 mg (10) |
| Oral airways (1 each adult sizes) | Aspirin (81 mg or 325 mg) (5) |
| Nasal airways | Diphenhydramine 25 mg (10) |
| Surgical lubricant | Meclizine 25 mg (10) |
| | Sudafed 30 mg (10) |
| **Dressing pack** | Antacids (5) |
| Band aids – 1” x 3” strip type (20) | Loperamide (5) |
| Bacitracin or equivalent ointment (6) | Hydrocortisone cream, 1% (5) |
| Adaptic type non-adhering dressing (3) | Burn gel packets (5) |
| Opsite transparent dressing (3) | |
| Gauze 2” x 2” dressings (5) | **Diagnostic / tools** |
| Gauze 4” x 4” dressings (5) | Blood pressure cuff |
| Non-stick (Telfa) dressings (3) | Stethoscope |
| Kerlix 4” roll (1) | Small flashlight |
| Gauze 2” roller bandage (2) | Thermometer |
| Gauze 4” roller bandage (2) | Scissors (EMT shears) |
| 5” x 9” Abd dressing (1) | Reflex hammer |
| Clot activator impregnated dressings (1) | Ring cutter |
| 1” tape (2 rolls) | Tweezers |
| Waterproof tape (1) | Otoscope (optional) |
| Steri strips (0.25” x 1.5”) | Disposable razor |
| Benzoin ampules (2) | Tongue depressors (3) |
| Cotton tip applicators – sterile (2) | Tourniquet |
| Alcohol prep pads (10) | |
| Chlorhexidine packets (3) | |
| E-Z Scrub brush with chloroxylenol (1) | |
| 20cc syringe for irrigation | |

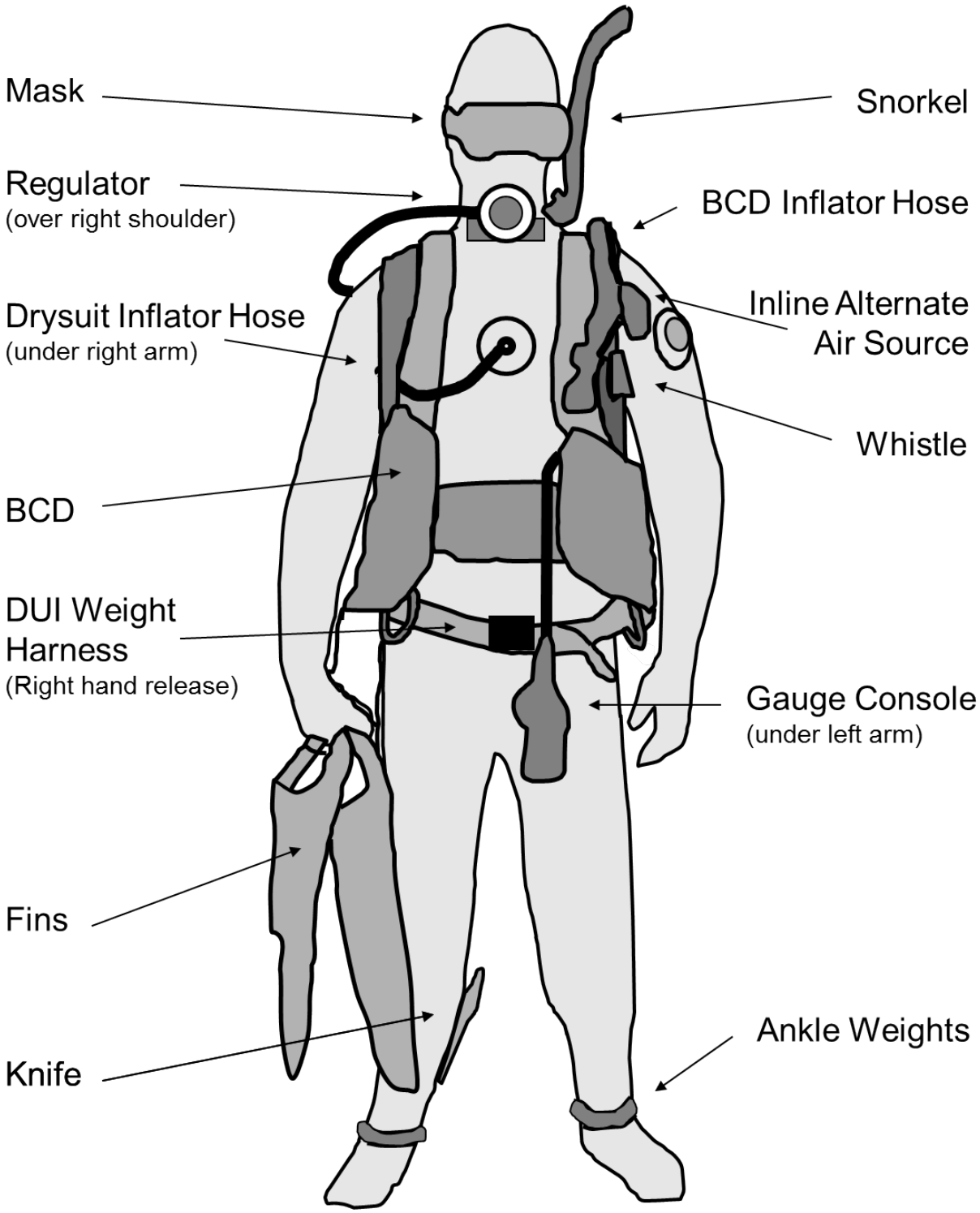
**Appendix 5:** NOAA DIVING EQUIPMENT CONFIGURATIONS



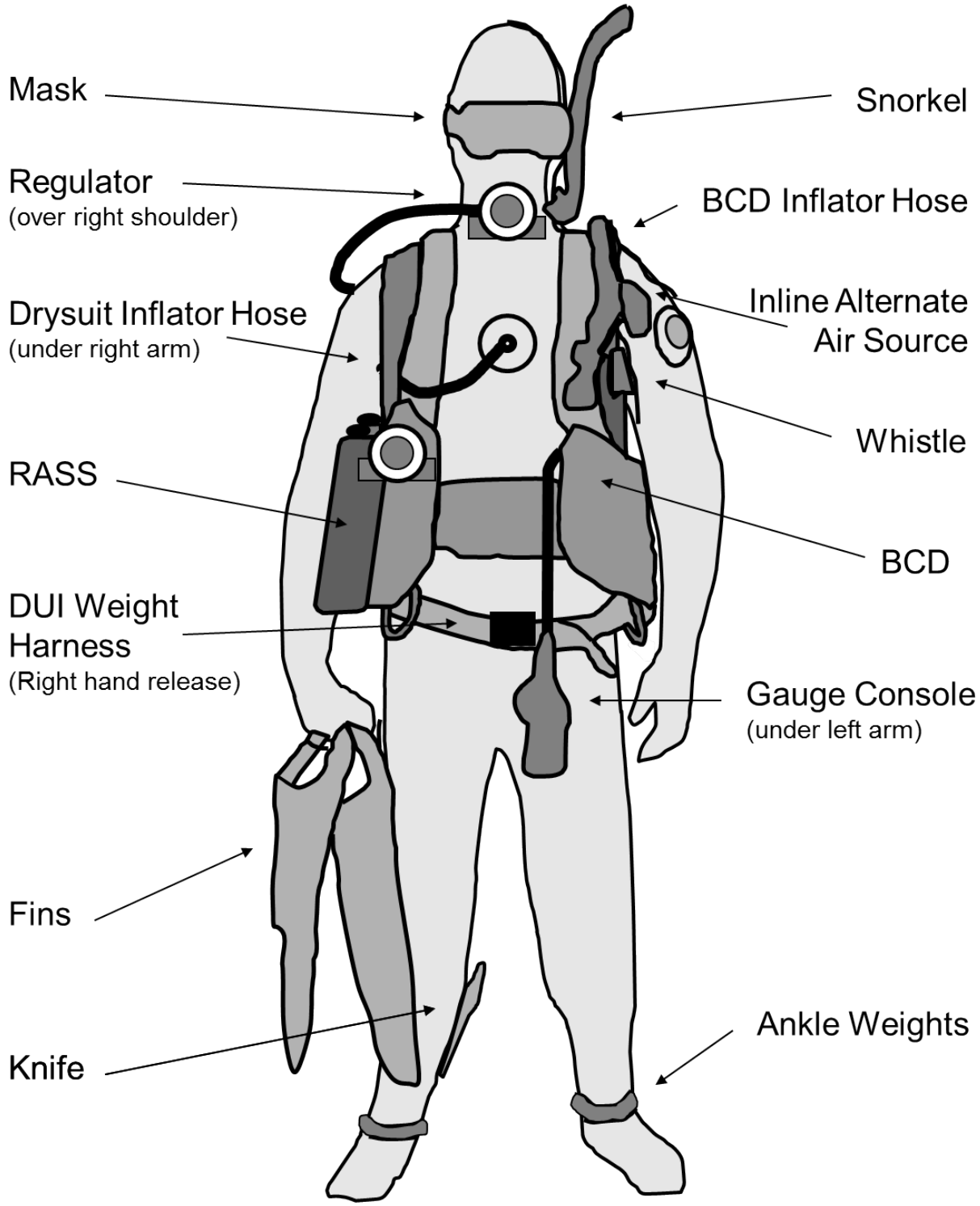
## WETSUIT CONFIGURATION w/OPTIONAL RASS



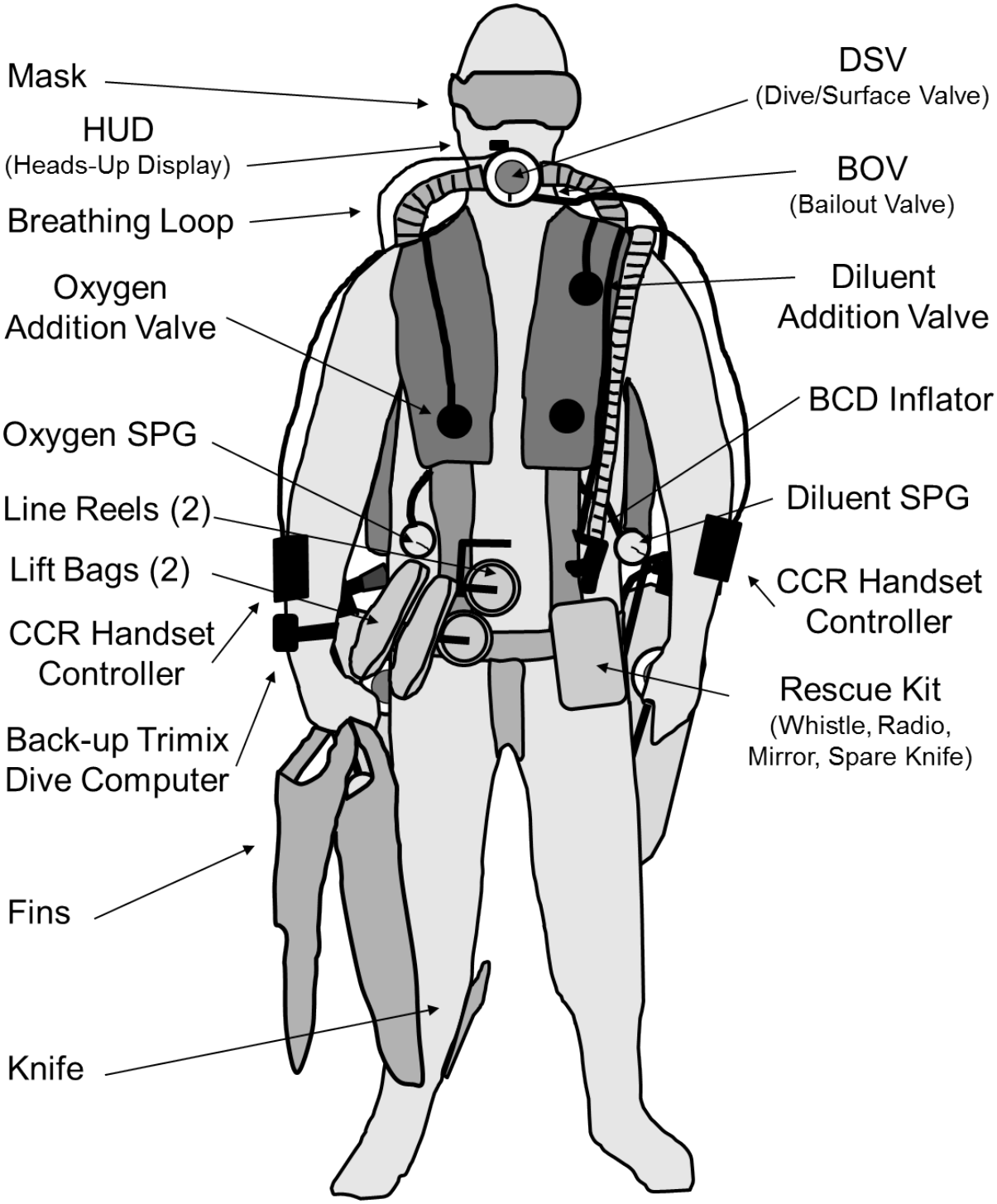
# DRYSUIT CONFIGURATION



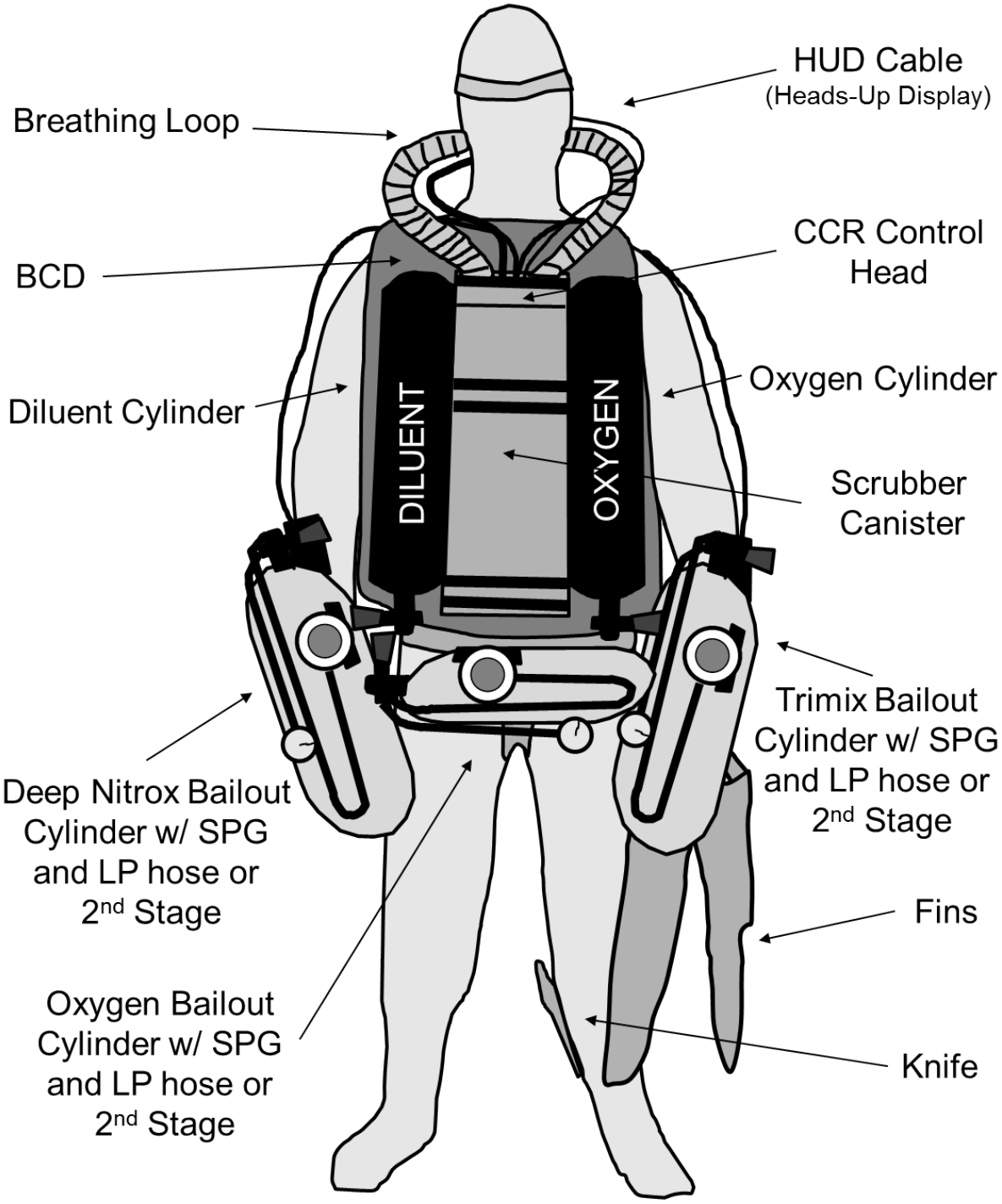
## DRYSUIT CONFIGURATION w/OPTIONAL RASS



## 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:** CODE OF FEDERAL REGULATIONS

# OSHA INSTRUCTION

U.S. DEPARTMENT OF LABOR Occupational Safety and Health Administration

| DIRECTIVE NUMBER: CPL 02-00-151 | EFFECTIVE DATE: June 13, 2011 |
|---|---|
| SUBJECT: 29 CFR Part 1910, Subpart T – Commercial Diving Operations | |

**ABSTRACT**

| | |
|---|---|
| **Purpose:** | This instruction provides guidelines for the occupational safety and health standards for commercial diving operations, 29 CFR Part 1910, Subpart T. |
| **Scope:** | OSHA-wide. |
| **References:** | See section III. |
| **Cancellation:** | CPL 02-00-143, 29 CFR Part 1910, Subpart T – Commercial Diving Operations, August 11, 2006. |
| **State Impact:** | Notice of Intent and Equivalency Required (see section VI). |
| **Action Offices:** | National, Regional, Area and State Plan offices. |
| **Originating Office:** | Directorate of Enforcement Programs. |
| **Contact:** | Director, Office of Maritime Enforcement<br>200 Constitution Ave., N.W., Room N-3610<br>Washington, DC 20210<br>(202) 693-2399 |

By and Under the Authority of

David Michaels, PhD, MPH
Assistant Secretary

ABSTRACT - 1

**Executive Summary**

This instruction provides guidance to Occupational Safety and Health Administration (OSHA) National, Regional, and Area Offices; industry employer and employee groups; State programs; and federal agencies concerning OSHA's policy and procedures for implementing intervention and inspection programs to reduce injuries, illnesses and fatalities, and to eliminate workplace hazards found in commercial diving operations. This instruction provides tools to support intervention and inspection programs in the commercial diving industry. This instruction:

- Supports the reduction of occupational exposure to hazards through direct intervention, and promotes a safety and health culture through compliance assistance, cooperative programs, and strong leadership.
- Maximizes OSHA's effectiveness and efficiency by strengthening its capabilities and infrastructure.

**Significant Changes**

This instruction has been revised and updated to include significant changes as follows:

- Provides OSHA compliance officers, consultants, and other interested government and industry parties with information to support interventions involving commercial diving operations and to minimize employee exposure to hazards.
- Provides additional answers to commonly asked questions related to commercial diving operations in Appendix A. This appendix consolidates all previously issued interpretations of OSHA's commercial diving operations standards.
- Provides additional clarification of the requirements and duties of diver tenders (Appendix E).
- Updates the instruction to ensure that current editions of other OSHA instructions, as well as industry standards and manuals, are referenced (e.g., CPL 02-00-150, Field Operations Manual (FOM), April 22, 2011, and Association of Diving Contractors International, Consensus Standard for Commercial Diving and Underwater Operations (6th Edition)).
- Updates Appendix D of this instruction related to no-decompression air dives based on Revision 6 to the U.S. Navy Diving Manual.
- Adds electronic links to enhance web-based usability.

ABSTRACT - 2

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I. Purpose. This instruction provides OSHA's National, Regional, and Area Offices; industry employer and employee groups; State programs; and federal agencies with guidance concerning OSHA's policy and procedures on the enforcement of safety and health standards for commercial diving. The purpose of this instruction is to provide comprehensive guidance that will allow OSHA offices to establish or support intervention and inspection programs in the commercial diving industry. Further, this instruction provides guidance and information to ensure compliance with commercial diving operations standards and the consistent enforcement of these standards.

II. Scope. This instruction applies OSHA-wide to all programmed and unprogrammed compliance inspections, consultation interventions, and other activities such as compliance assistance, cooperative programs, training, and education related to commercial diving operations.

III. References.

A. 29 CFR Part 1910, General Industry Standards.

B. 29 CFR Part 1915, Shipyard Employment Standards.

C. 29 CFR Part 1917, Marine Terminals Standards.

D. 29 CFR Part 1918, Longshoring Standards.

E. 29 CFR Part 1926, Construction Industry Standards.

F. OSHA Directives.

1. CSP 01-00-002, State-Plan Policies and Procedures Manual, March 21, 2001.

2. CPL 02-00-142, Shipyard "Tool Bag" Directive, August 3, 2006.

3. CPL 02-00-135, Recordkeeping Policies and Procedures Manual (RKM), December 30, 2004.

4. CPL 02-00-051, Enforcement Exemptions and Limitations under the Appropriations Act, May 28, 1998.

5. CPL 02-00-150, Field Operations Manual (FOM), April 22, 2011.

6. CPL 02-01-047, OSHA Authority Over Vessels and Facilities on or Adjacent to U.S. Navigable Waters and the Outer Continental Shelf (OCS), February 22, 2010.

G. Other References.

1. OSHA Maritime Web Page.

2. OSHA Publications.

3. U.S. Navy Diving Manual (Revision 6).

4. Association of Diving Contractors International, Consensus Standard for Commercial Diving and Underwater Operations (6th Edition).

5. 46 CFR, Chapter I, Part 197, Subpart B – U.S. Coast Guard Commercial Diving Operations.

6. Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities (NIOSH/OSHA/USCG/EPA), October, 1985.

7. NOAA Diving Manual – Diving for Science and Technology (Fourth Edition).

IV. Cancellation. This instruction supersedes the following:

CPL 02-00-143, 29 CFR Part 1910, Subpart T – Commercial Diving Operations, August 11, 2006.

V. Action Offices. The policies and procedures set forth in this instruction are effective immediately and will remain in effect until canceled by proper authority.

A. Responsible Office. Directorate of Enforcement Programs (DEP), Office of Maritime Enforcement (OME).

B. Action Office. OSHA Regional Administrators, Area Directors, State-Plan Designees, and National Office Directors must ensure that the policies and procedures set forth in this instruction are followed.

Regional Administrators also must ensure that Consultation Program Managers in their regions are informed of the requirements of this instruction and encourage the involvement of Consultation Programs in commercial diving operations.

VI. Federal Program Change.

Notice of Intent and Equivalency Required. This instruction describes a federal program change which provides comprehensive guidance on the policies and procedures for the enforcement of safety and health standards of Commercial Diving Operations. States with OSHA-approved State Plans must have policies and procedures that are at least as effective as those in this instruction for the enforcement of the commercial diving standard within their jurisdiction. See section XII., paragraph A.9., and Appendix B of this instruction for a discussion of federal and State jurisdiction.

States are required to notify OSHA within 60 days whether they intend to adopt policies and procedures identical to those in this instruction or adopt or maintain different policies and procedures. If a State adopts or maintains policies and procedures that differ from

Federal OSHA's, the State must identify the differences and may either post its new or existing different policies on its State Plan website and provide the link to OSHA or submit an electronic copy to OSHA with information on how the public may obtain a copy from the State. If the State adopts identical policies and procedures, it must provide the date of adoption to OSHA. State adoption must be accomplished within 6 months, with posting or submission of documentation within 60 days of adoption. OSHA will provide summary information on the State responses to this instruction on its website.

VII. Significant Changes. This instruction has been revised and updated to include significant changes as follows:

- Provides OSHA compliance officers, consultants, and other interested government and industry parties with information to support interventions involving commercial diving operations and to minimize employee exposure to hazards.
- Provides additional answers to commonly asked questions related to commercial diving operations in Appendix A. This appendix consolidates all previously issued interpretations of OSHA's commercial diving operations standards.
- Provides additional clarification of the requirements and duties of diver tenders (Appendix E).
- Updates the instruction to ensure that current editions of other OSHA instructions, as well as industry standards and manuals, are referenced (e.g., CPL 02-00-150, Field Operations Manual (FOM), April 22, 2011, and Association of Diving Contractors International, Consensus Standard for Commercial Diving and Underwater Operations ($6^{th}$ Edition)).
- Updates Appendix D of this instruction related to no-decompression air dives based on Revision 6 to the U.S. Navy Diving Manual.
- Adds electronic links to enhance web-based usability.

VIII. Federal Agencies. This instruction describes a change that may affect federal agencies. It is the responsibility of the head of each federal agency to establish and maintain an effective and comprehensive safety and health program. Executive Order 12196, Section 1-201, and 29 CFR 1960.16, require federal agencies to adopt policies and procedures necessary to provide a level of protection equivalent to that provided by Federal OSHA standards and regulations.

IX. Application. This instruction applies OSHA-wide to all interventions, inspections, and violation-abatement assistance related to commercial diving. This instruction also applies to OSHA outreach efforts that include compliance assistance, cooperative programs, training, and education.

Further, this instruction applies to all State consultation programs with authority over commercial diving activities. State consultation programs are expected to provide safety

and health program assistance, training, education, hazard identification, and abatement assistance to employers.

X. Background. The initial standard for commercial diving operations was issued in the Federal Register, July 22, 1977 (see 42 FR 37650). The preamble, from pages 37650 to 37668, contains information and background on the purposes and intent of the standard.

In 1979, 29 CFR 1910.411 *Medical requirements* of the original diving standards promulgated on July 22, 1977, was challenged in a court case, *Taylor Diving & Salvage Company v. Department of Labor*, 599 F.2d 622 (5th Circuit 1979); OSHA subsequently removed this section from 29 CFR Part 1910, Subpart T.

On November 26, 1982, OSHA published a provision (see 29 CFR 1910.401(a)(2)(iv)) exempting scientific diving from coverage under 29 CFR Part 1910, Subpart T (see Federal Register notice 47 FR 53357). This exemption applied only when: (1) the diving operation meets the Agency's definition of scientific diving; (2) the diving operation is part of a diving program that uses a safety manual; and (3) the diving program is directed and controlled by a diving-control board that conforms to specified criteria. However, the United Brotherhood of Carpenters and Joiners (UBCJ) subsequently challenged this exemption in a federal appellate court (see United Brotherhood of Carpenters and Joiners v. Department of Labor, No. 82-2509 (D.C. Cir. 1982)). On April 4, 1984, this court issued an unpublished memorandum and order in which it stated that OSHA must provide the UBCJ with an opportunity to submit evidence to the public record regarding the exemption, and make a clear distinction between commercial and scientific diving. The Agency then reopened the public record to allow the UBCJ and other members of the public to submit additional evidence regarding the exemption, and to propose interpretive guidelines that would be used to distinguish between commercial and scientific diving (see Federal Register notice 49 FR 29105). After carefully considering the new evidence submitted to the record, OSHA published on January 9, 1985, a notice in the Federal Register reinstating the conditions for the scientific exemption specified earlier in 29 CFR 1910.401(a)(2)(iv), and establishing the interpretive guidelines by which it will be determined whether the diving operation is scientific or commercial (see Federal Register notice 47 FR 53357).

On February 17, 2004 (see Federal Register notice 69 FR 7351), OSHA amended 29 CFR Part 1910, Subpart T – Commercial Diving Operations, to allow recreational diving instructors and diving guides to comply with an alternative set of requirements instead of the decompression chamber requirements in the existing 29 CFR Part 1910, Subpart T standards. The final rule applies only when these employees engage in recreational diving instruction and diving-guide duties; use an open-circuit, a semi-closed-circuit, or a closed-circuit self-contained underwater-breathing apparatus supplied with a breathing gas that has a high percentage of oxygen mixed with nitrogen (relative to standard air); dive to a maximum depth of 130 feet of sea water; and remain within the no-decompression limits specified for the partial pressure of nitrogen in the breathing-gas mixture. This final rule became effective on March 18, 2004.

XI. Inspection Guidelines.

A. Compliance Safety and Health Officers (CSHOs) shall not perform any type of diving during the course of an investigation or inspection without the prior approval of the Director, Directorate of Enforcement Programs.

B. It is preferable that CSHOs be familiar with diving operations and equipment before conducting an inspection at a worksite that includes diving operations. More importantly, however, the CSHO should be familiar with other OSHA standards that may pertain to the worksite, such as: construction (e.g., pile driving, cranes and derricks); shipyard employment (e.g., dry-docking a vessel); and general industry (e.g., powerplant inspection and maintenance).

C. Area Offices that have offshore activities may obtain Oil and Gas Development Maps for each State having such operations. These maps are available from the respective State for State territorial seas (example: in Alaska these maps are available from the Alaska Department of Natural Resources – Department of Oil and Gas), and from the U.S. Department of the Interior – Bureau of Ocean Energy Management Regulation and Enforcement (BOEMRE) (formally Minerals Management Service (MMS)) for coastal waters beyond State territorial seas.

D. Normal variance procedures are in effect with respect to the diving standard. When employers indicate that they have a variance request pending that OSHA has not yet acted upon, a citation shall still be issued for any violation. The employer should be informed that the variance request will be taken into account in considering the proper abatement period or proposed penalty. Questions regarding variances shall be referred to OSHA's National Office, Directorate of Technical Support and Emergency Management (DTSEM), Office of Technical Programs and Coordination Activities (OTPCA).

XII. General Inspection Procedures.

A. 29 CFR 1910.401 *Scope and application*.

1. Scope.

This standard applies (except as noted in section XII., paragraph A.5.b., of this instruction) to all commercial diving and related support operations subject to OSHA authority. As with all OSHA standards, the legal responsibility for compliance rests solely on the employer. Employers are expected to comply with all standards or parts of standards that apply to the tasks in which their employees are engaged.

2. Authority.

In general, OSHA authority over commercial diving operations is the same as OSHA authority over any other industry as expressed under Section 4(a) of the Occupational Safety and Health Act of 1970. Since OSHA covers all employment and places of employment within a State that is under Federal OSHA jurisdiction, the Act's requirements apply to both inland commercial

diving operations and any other type of employment within the State territorial seas for coastal States and from other land masses listed in Section 4(a) of the Act (extends seaward for 3-nautical miles from the general coastline; except for Texas, the Gulf Coast of Florida, and Puerto Rico where it extends seaward for 9-nautical miles from the general coastline); in the case of the Great Lakes and St. Lawrence Seaway, the limit extends from the coastline to the established international boundary lines with Canada. Section 4(a) also covers workplaces beyond the State territorial seas that are engaged in employment operations in connection with the Outer Continental Shelf (OCS) lands (NOTE: "lands" not "vessels"), and work related to these operations. See Appendix B of this instruction for further guidance related to authority that is specific to commercial diving operations.

3. Applicable Standards.

Commercial diving operations must be in compliance with 29 CFR Part 1910, Subpart T.

NOTE: 29 CFR 1928.21(b) reads, "Except to the extent specified in paragraph (a) of this section, the standards contained in Subparts B through T and Subpart Z of Part 1910 of this title does not apply to agricultural operations." Agricultural operations include the following Standard Industry Classification (SIC) and North American Industry Classification System (NAICS) codes:

1987 SIC MATCHED TO 2007 NAICS

| 1987 SIC Code | 1987 SIC Description | 2007 NAICS Code | 2007 NAICS Description |
|---|---|---|---|
| 01 | Agricultural Production – Crops | 111 | Crop Production |
| 02 | Agricultural Production – Livestock and Animal Specialties | 112 | Animal Production |
| 071 | Soil Preparation – Services | 115112 | Soil Preparation, Planting, and Cultivating |
| 0721 | Crop Planting, Cultivating and Protecting | 115112 | Soil Preparation, Planting, and Cultivating |
| 0722 | Crop Harvesting, Primarily by Machine | 115113 | Crop Harvesting, Primarily by Machine |
| 0724 | Cotton Ginning | 115111 | Cotton Ginning |

| | | | |
|---|---|---|---|
| 0761 | Farm Labor Contractors and Crew Leaders | 115115 | Farm Labor Contractors and Crew Leaders |
| 0762 | Farm Management Services | 115116 | Farm Management Services |

NOTE: The classification of aquaculture industry operations depends upon specific conditions. Operations that are part of the controlled growing and harvesting of fish, shellfish, and plants in fresh, brackish, and marine waters are covered by the OSHA standards for agriculture, 29 CFR Part 1928. Any aquaculture operations that are not uniquely agricultural and not part of the controlled growing and harvesting of fish, shellfish, and plants would be covered by 29 CFR Part 1910, Subpart T – Commercial Diving Operations. Other types of diving activities (such as inspecting and maintaining underwater piping equipment) also are covered by 29 CFR Part 1910, Subpart T. Diving operations conducted by agricultural employees engaged in employments under the above-listed SIC or NAICS codes may not be covered by 29 CFR Part 1910, Subpart T. Contractors of agricultural employers who do not fall within these SIC or NAICS codes are covered by 29 CFR Part 1910, General Industry Standards.

4. Precedence of Standards.

When a provision of 29 CFR Part 1910, Subpart T, differs or conflicts with any other OSHA standard, the requirements of 29 CFR Part 1910, Subpart T, shall take precedence when applied to diving operations. The CSHO should review 29 CFR 1910.5 for guidance before issuing a citation for a violation of a general industry standard to an employer engaged in diving operations. Questions regarding this procedure shall be referred to OSHA's National Office, Directorate of Enforcement Programs.

5. Citing Standards.

a. The proper standards to cite for violations shall be determined by the type of work that the diving operation requires. For example:

i. Repairs on a vessel requiring a diver to examine damage to the hull. These violations would be cited, as appropriate, under 29 CFR Part 1910, Subpart T (see 1910.401 – 1910.441).

NOTE: 29 CFR Part 1910, Subpart T – Commercial Diving Operations, is incorporated into 29 CFR Part 1915 by 29 CFR 1915.6 (see CPL 02-00-142, Shipyard "Tool Bag" Directive).

ii. Maintenance work requiring a diver to enter a sewer line to free debris from a strainer. These violations would be cited, as appropriate, under 29 CFR Part 1910, Subpart T (see 1910.401 – 1910.441).

iii. Work on a dock that requires a diver to perform construction work (construction work includes the actual erection, alteration, and repair of the dock). These violations would be cited under 29 CFR Part 1926,

Subpart Y, with specific reference to the appropriate section of 29 CFR Part 1910, Subpart T (see 1910.401 – 1910.441).

iv. If the CSHO is not sure which standard applies to the operation, then the CSHO shall cite both standards (one in the alternative).

b. The commercial diving operations standard does not apply to diving operations under the following conditions:

i. 29 CFR 1910.401(a)(2)(i). Diving for instructional purposes by persons using only open-circuit, compressed air, self-contained underwater-breathing apparatus (SCUBA) within the no-decompression limits.

NOTE: OSHA standards do not apply to individuals engaged in recreation or sport diving (generally SCUBA) that is not related to employment.

ii. 29 CFR 1910.401(a)(2)(ii). Diving solely for search, rescue, or related public-safety purposes by or under the control of a government agency.

NOTE: Diving contractors who perform such emergency service not under the control of a government agency, but as an independent contractor for private purposes, do not fall under this exclusion. However, they may be covered by the provisions concerning application of the standard in an emergency (see 29 CFR 1910.401(b)).

iii. 29 CFR 1910.401(a)(2)(iii). Diving operations when performed for research, development, and related activities in which human subjects are involved. These operations are covered by the standards contained in 45 CFR Part 46, Protection of Human Subjects, administered by the U.S. Department of Health and Human Services (previously known as the U.S. Department of Health, Education and Welfare), or equivalent federal standards. Questions of equivalence or applicability shall be referred to OSHA's National Office, Office of Maritime Enforcement.

iv. 29 CFR 1910.401(a)(2)(iv) and 29 CFR Part 1910, Subpart T, Appendix B. Diving operations that are defined as scientific diving and that are under the direction and control of a diving program containing all elements specified in the commercial diving operations standard.

v. Section 4(b)(1) of the OSH Act. Those specific working conditions of diving operations over which other federal agencies exercise statutory authority to prescribe or enforce standards or regulations affecting occupational safety and health. Questions regarding OSHA's authority shall be referred to OSHA's National Office, Office of Maritime Enforcement (see Appendix B of this instruction for additional guidance).

NOTE: Appendix C of this instruction provides additional discussion and information regarding exclusions and exemptions from OSHA's commercial diving standard.

6. Federal Agency Coverage and Application.

a. U.S. Coast Guard.

The U.S. Coast Guard has prescribed diving regulations under 46 CFR, Chapter I, Part 197, Subpart B – Commercial Diving Operations. U.S. Coast Guard regulations state that they apply to commercial diving operations taking place: at any deepwater port or the safety zone thereof as specified by 33 CFR Part 150 (see NOTE below); from any artificial island, installation, or other device on the Outer Continental Shelf (OCS) and the waters adjacent thereto as defined in 33 CFR Part 147, or otherwise related to activities on the OCS; from all vessels with a valid certificate of inspection (COI) issued by the U.S. Coast Guard (i.e., "inspected" vessels), including mobile offshore drilling units (MODUs) regardless of their geographic location; from any vessel connected with a deepwater port or within the deepwater port safety zone; and from any vessel engaged in activities related to the OCS.

NOTE: "Deepwater port" means any fixed or floating man-made structure other than a vessel, or any group of structures, located beyond State territorial seas, and that are used or intended for use as a port or terminal for the transportation, storage, or further handling of oil or natural gas for transportation to any State, and for other uses including the transportation of oil or natural gas from the United States' Outer Continental Shelf. The term includes all components and equipment, including pipelines, pumping stations, service platforms, buoys, mooring lines, and similar facilities to the extent they are located seaward of the general coastline. In the case of natural gas, the term includes all components and equipment, including pipelines, pumping or compressor stations, service platforms, buoys, mooring lines, and similar facilities, to the extent that they are located seaward of the general coastline and do not include interconnecting facilities. The local U.S. Coast Guard Office can provide detailed guidance regarding deepwater ports, the associated safety zones, and the identification of related components and equipment (see http://homeport.uscg.mil or USCG Phonebook).

b. Other Federal Agencies.

The Department of the Navy (DON) requires compliance with the U.S. Navy Diving Manual (Revision 6). For civilian employees, this manual includes additional provisions which provide protection equivalent to the OSHA diving standard. DON civilian divers are identified as all permanent DON employees who have been formally trained at an approved U.S. Navy diving school. Commercial divers contracted by DON who are not

permanent government employees are not subject to these provisions. The additional provisions for DON civilian divers include: limiting the maximum diving depths and in-water decompression times; having a recompression chamber onsite for all SCUBA and surface-supplied air diving deeper than 100 fsw, and for all mixed-gas diving; and having an emergency gas supply ("come-home bottle" or "bail-out bottle") for any dive greater than 60 fsw, planned decompression dives, or any dive for which direct access to the surface is not available. The complete list of DON restrictions for DON civilian diver employees is included in the U.S. Navy Diving Manual (see Volume 2, section 6-8.9; Revision 6). Furthermore, DON civilian diver employees are exempt from regulation by OSHA when conducting uniquely military operations.

NOTE: Other federal agencies, such as the U.S. Army Corps of Engineers and the Federal Highway Administration, have developed diving requirements for their own employees and contractor employees. However, when the diving operations are subject to OSHA authority the OSHA diving standard continues to cover these employees, and commercial diving operations conducted by federal employees or their contractors must meet, but may exceed, the requirements of 29 CFR Part 1910, Subpart T.

7. Inspection Priorities.

Diving operations that do not fall within one of the exemption categories listed in this section, and that involve an employer-employee relationship, are covered by 29 CFR Part 1910, Subpart T. Inspection priorities shall be followed as stated in CPL 02-00-150, Field Operations Manual (FOM), with respect to different types of diving operations.

8. 29 CFR 1910.401(b) Application in Emergencies.

a. This exclusion was included in the standard to allow the designated person-in-charge discretion to deviate from the requirements of the standard in situations where death or serious harm to individuals, or major environmental damage (such as an oil or other hazardous material leak, or repairs to a municipal dam gate to avoid or mitigate flooding), is likely to occur or continue to occur, but only to the extent that such action is immediately necessary to prevent or minimize the harm or damage. This exclusion applies only for the duration of the emergency. The employer is required to notify the nearest OSHA Area Office within 48 hours of the onset of the situation requiring such deviation. The Area Director may request that the employer submit a written record (such as a facsimile, e-mail or letter) of the notification within 48 hours of the request for a written record, or as otherwise agreed to, explaining what deviations from the standard were made and what additional precautions were instituted to provide for the safety and health of the employees during the emergency. Failure of the employer to notify the OSHA Area Office of the emergency situation within the specified time shall be considered a violation of this

provision of the standard. These incidents shall be closely monitored to ensure that this provision is not abused. A pattern of repeated deviations shall be cause for an inspection.

b. This emergency provision does not apply to situations involving only economic or property damage.

9. Federal and State Authority.

a. All State-Plan States have promulgated a commercial diving standard either identical to 29 CFR Part 1910, Subpart T, or at least as effective as the OSHA standard (California, Michigan, Oregon, and Washington have State diving standards that differ from OSHA's). (A description of any differences will be made available by these State-Plan States to affected employers and employees through the State-Plan States' website or other means.)

b. Federal OSHA enforces its diving standard whenever commercial diving operations are being conducted by private-sector employees in States under Federal OSHA enforcement authority, and in maritime operations not covered by a State-Plan State (see the appropriate subpart of 29 CFR Part 1952). The dive location (see section XII., paragraph B.11., of this instruction) determines which entity has authority. Federal OSHA does not have authority over State and local government employees.

c. States with approved plans enforce the diving standard: when commercial diving operations are being conducted by private-sector employees not engaged in shipyard employment or marine terminal activities (e.g., equipment repair, sewer maintenance, or construction); in maritime operations (i.e., shipyard employment and marine terminals) as provided by their plans in California, Minnesota, Vermont, and Washington; and with regard to State and local government employees (see, however, the exemption for search, rescue, and related public-safety diving by or under the control of a government agency in Appendix C of this instruction).

NOTE: See Appendix B of this instruction for additional information related to OSHA's jurisdiction.

B. 29 CFR 1910.402 *Definitions*.

1. Acfm: Actual cubic feet per minute.

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

NOTE: "Equivalent" means equipment that is designed, built, and maintained to standards that will provide employees with at least the same level of

protection as equipment that meets the ASME Boiler and Pressure Vessel Code, Unfired Pressure Vessels, Section VIII. The employer shall be responsible for demonstrating equivalency. Questions regarding equivalency should be referred to OSHA's National Office, Office of Maritime Enforcement.

3. ATA: Atmosphere absolute.

4. 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.

5. Bottom time: The total elapsed time measured in minutes from the time when the diver leaves the surface in descent to the time that the diver begins ascent (i.e., the diver "leaves the bottom").

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

7. Cylinder: A pressure vessel for the storage of gases.

   NOTE: 29 CFR 1910.101(a) adopts 49 CFR Parts 171-179 for cylinder inspection requirements (see 49 CFR Part 173, Subpart G – Gases; Preparation and Packaging, for details). The Department of Transportation (DOT) classifies compressed air as a Division 2.2 Hazardous Material (i.e., non-flammable gas) in the Hazardous Materials Table (49 CFR 172.101) for pressures of 25.9 psig (43.8 psia) or greater at 68°F (49 CFR 173.115(b)(1)). Cylinders typically will be stamped with DOT markings, but also may be stamped with ICC markings. For more comprehensive information regarding SCUBA cylinder markings, refer to paragraph 5.7, of the NOAA Diving Manual.

8. Decompression chamber: A pressure vessel for human occupancy such as a surface decompression chamber, closed bell, or deep diving system used to decompress divers and to treat decompression sickness.

   NOTE: As used in this standard, the term "decompression chamber" refers to any pressure vessel for human occupancy used to decompress divers and to treat decompression sickness. A closed bell, if used as a decompression chamber, shall meet the design criteria stated in 29 CFR 1910.430(f).

9. Decompression sickness: A condition with a variety of symptoms which may result from gas or bubbles in the tissues of divers after pressure reduction.

10. Decompression table: A profile or set of profiles of depth-time relationships for the ascent rates and breathing mixtures to be followed after a specific depth-time exposure or exposures.

11. Dive location: A surface or vessel from which a diving operation is conducted.

NOTE: The term "dive location" refers to the surface location from which diving operations are conducted such as a vessel, barge, wharf, pier, riverbank, or offshore rig, and does not mean the diver's underwater work location.

12. Dive-location reserve breathing gas: A supply system of air or mixed-gas (as appropriate) at the dive location which is independent of the primary supply system and sufficient to support divers during the planned decompression.

13. Dive team: Diver and support employees involved in a diving operation, including the designated person-in-charge (DPIC).

14. Diver: An employee working in water (i.e., regardless of depth) using an underwater apparatus which supplies compressed breathing gas at the ambient pressure.

15. Diver-carried reserve breathing gas: A diver-carried supply of air or mixed-gas (as appropriate) sufficient under standard operating conditions to allow the diver to reach the surface, another source of breathing gas, or to be reached by a standby diver.

16. Diving mode: A type of diving requiring specific equipment, procedures and techniques (SCUBA, surface-supplied air, or mixed-gas).

17. Fsw: Feet of seawater (or equivalent static pressure head).

    NOTE: An example of equivalent static pressure head would be the pressure of air inside a pressurized decompression chamber.

18. Heavy gear: Diver-worn deep-sea dress, including helmet, breastplate, dry suit, and weighted shoes.

    NOTE: Advances in diving equipment and technology have led to heavy gear that does not include a breastplate. Surface-supplied diving gear, including helmet, dry suit, and weighted shoes (i.e., with the helmet directly connected to the dry suit, forming a self-contained pressure envelope for the diver) constitutes heavy gear as well.

19. Hyperbaric conditions: Pressure conditions in excess of surface pressure.

20. Inwater stage: A suspended underwater platform that supports a diver in the water.

21. Liveboating: The practice of supporting a surfaced-supplied air or mixed-gas diver from a vessel which is underway.

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

NOTE: For diving operations, air is a mixture of oxygen and nitrogen with an oxygen content of 19.5% – 23.5%. Breathing gas mixtures with an oxygen content less than 19.5% or greater than 23.5%, or that use gases other than oxygen and nitrogen (excluding trace gases such as those found in compressed atmospheric air), constitute a mixed gas for the purposes of commercial diving. The early terms for nitrogen-oxygen mixtures as used by the U.S. Navy were "nitrogen-oxygen mixtures" or "nitrox." Other terms often used to describe oxygen-rich mixtures include "oxygen-enriched air" (OEA) and "enriched-air nitrox" (EAN or EANx). The "x" in EANx evolved to state the oxygen percentage, as in EAN32 for 32% oxygen content. Additional terms used by NOAA include "NOAA Nitrox I" or "NN32" and "NOAA Nitrox II" or "NN36," referring, respectively, to the 32% and 36% mixtures commonly used in diving.

23. No-decompression limits: The depth-time limits of the "no-decompression limits and repetitive dive group designation table for no-decompression air dives," U.S. Navy Diving Manual or equivalent limits which the employer can demonstrate to be equally effective.

    NOTE: The term "no-decompression limits" applies to those depth-time combinations for which decompression of the diver is not required. The no-decompression tables from the U.S. Navy Diving Manual are included in Appendix D of this instruction.

24. Psi(g): Pounds per square inch (gauge).

25. 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 but not limited to: placing or removing heavy objects underwater; inspection of pipelines and similar objects; construction; demolition; cutting or welding; or the use of explosives.

    NOTE: Additional guidance is provided in Appendix C of this instruction.

26. SCUBA diving: A diving mode independent of surface supply in which the diver uses open-circuit self-contained underwater breathing apparatus.

27. Standby diver: A diver at the dive location available to assist a diver in the water.

    NOTE: The requirement that the standby diver be at the dive location, which is a location on the surface (such as the shore, a pier, or a dock) or on the deck of a vessel, eliminates the possibility that another diver in the water or at another dive location would be considered a standby diver. Standby divers do not necessarily have to be fully dressed, but must be available to render the

necessary assistance in a timely manner. The term "available" means to be clothed and equipped, and ready to enter the water at a moment's notice. Gear such as face masks, air cylinders, and harnesses can be donned quickly, and need not be worn until the standby diver is required to enter the water.

28. Surface-supplied air diving: A diving mode in which the diver in the water is supplied from the dive location with compressed air for breathing.

29. Treatment table: A depth-time and breathing-gas profile designed to treat decompression sickness.

30. Umbilical: The composite hose bundle between a dive location and a diver or diving bell, or between a diver and a diving bell, which supplies the diver or diving bell with breathing gas, communications, power, or heat as appropriate to the diving mode or conditions, and includes a safety line between the diver and the dive location.

31. Volume tank: A pressure vessel connected to the outlet of a compressor and used as an air reservoir.

32. Working pressure: The maximum pressure to which a pressure containment device may be exposed under standard operating conditions.

C. 29 CFR 1910.410 *Qualifications of dive team*.

1. The level of experience or training required by the standard depends upon the job the employees are required to do. All dive-team members must have either experience or training in the use of tools, equipment, systems, techniques, operations, operational procedures, and emergency procedures that are pertinent to, and necessary for, the assigned tasks for the diving mode (i.e., SCUBA, surface-supplied air, or mixed-gas diving). It is essential that those dive-team members who are exposed to hyperbaric conditions, or those members who control the exposure of others, have knowledge of the physiological effects of diving and the related effects of pressure. Accordingly, this standard also requires that employees be trained in diving-related physics and physiology. Employee qualifications achieved through field experience or classroom training, or both, may be used to meet the requirements of the standard. For example:

   a. Most divers begin as tenders and advance to diving status after a period of field experience and/or classroom training. A diving-tender trainee receiving on-the-job training will be assigned as a tender only under the supervision of a qualified diver.

   b. Tenders are members of the dive team who provide surface-support to divers at the diving location. A tender employed in shallow-water air diving is required to have a basic understanding of the breathing-air system, the operating and emergency procedures, and knowledge of the care and use of

equipment. See Appendix E of this instruction for additional guidance regarding the responsibilities and duties of tenders.

c. A mixed-gas diver conducts underwater work using mixed-gas as the breathing medium. Mixed-gas divers are required to have an advanced understanding of diving, including a working knowledge of mixed-gas equipment such as a decompression chamber, diving bell, and mixed-gas breathing supply system, and operational and emergency procedures associated with mixed-gas diving. In addition, the mixed-gas diver must have an understanding of the physics and physiology of mixed-gas diving. See paragraph XII.K., 29 CFR 1910.426 *Mixed-gas diving* of this instruction for additional information.

d. Chamber operators are required to have experience or training in conducting decompression procedures, knowledge of the physics and physiology of decompression, and the operation of the decompression equipment to which they are assigned.

e. Each dive-team member must be trained in cardiopulmonary resuscitation (CPR) and standard first aid. The American Red Cross standard course or equivalent training is specified by the standard. Employees completing this training are issued a card certifying that they have successfully completed the course. Any first-aid training meeting the requirements of 29 CFR 1910.151(b), 1926.50(c), or 29 CFR Part 1915, Subpart F, will meet the requirements of the standard (such as first-aid courses offered by the American Heart Association, American Petroleum Institute, National Safety Council, and American Academy of Orthopedic Surgeons).

2. The following methods may be used to check diving qualifications:

a. Field experience.

i. Employment records.

ii. Written statements from previous employers.

iii. Written statements from diving officers or commanding officers (military).

iv. Field operations records.

v. The employee's diving logs.

b. Diving proficiency.

i. Company field operations records.

ii. Federal service operations records (such as from the Army Corps of

Engineers, NOAA, or military).

iii. The employee's diving logs.

c. Technical training.

i. Federal service qualification certificates (such as from the Army Corps of Engineers, NOAA, or military).

ii. Diving school certificates of completion.

iii. Company training program completion statements or equivalent proof of competency.

iv. Valid commercial diver certification card for the appropriate training level issued by the Association of Diving Contractors International.

3. Under 29 CFR 1910.410(b)(1), employers must generally assign tasks to dive-team members according to their experience and training. Additionally, the phrase "known to the employer" in 29 CFR 1910.410(b)(3) means that the designated person-in-charge must inquire into each dive-team member's health prior to a task assignment. The employer also is required in 29 CFR 1910.421(f)(2) to advise dive-team members of the procedures for reporting physical problems or adverse physiological effects during and after diving. Consistent with these provisions, an employer cannot require dive-team members to dive or otherwise work under hyperbaric conditions when they: (1) have any ailment that is likely to adversely affect the safety or health of any member of the dive team; (2) lack the necessary training or education; or (3) refuse to work under such conditions (i.e., under hyperbaric conditions). However, should a diver request termination during a dive, it may be necessary to prolong the diver's exposure to hyperbaric conditions to complete decompression or medical recompression treatment to avoid serious physical harm or death to the diver.

4. Under 29 CFR 1910.410(c), the designated person-in-charge (DPIC) (commonly referred to as the "diving supervisor" or the "diving foreman") is immediately responsible for the safety and health of the dive team. The DPIC can be the employer or an employer representative chosen by the employer. The DPIC shall have experience in, and knowledge of, all phases of the diving operation for which he/she is responsible. The DPIC shall be stationed at the dive location, and shall not be stationed at another dive location (i.e., he/she must be stationed at one dive location and be responsible only for the diving operation at that location). The DPIC can be a diver, when qualified as a diver, and when another dive-team member is available at the dive location who is trained and capable of performing the necessary functions of the DPIC's duties, when the DPIC is a diver in the water. The qualifications of the DPIC can be checked using the same methods listed in section XII., paragraph C.2., of this instruction.

D. 29 CFR 1910.420 *Safe practices manual*.

1. This standard requires that the employer develop and maintain a safe practices manual that includes information and procedures relating to the safety and health of the dive-team members. The manual must contain a copy of the commercial diving operations standard and a statement of the employer's policy for ensuring compliance with the standard. The manual must be at the dive location and available to all dive-team members.

2. The safe practices manual must provide a written operational procedure for each diving mode used by the employer. The CSHO shall review the manual to determine if it contains safety procedures and checklists for diving operations, assignments and responsibilities of the dive-team members, equipment procedures and checklists, and emergency procedures (at a minimum: fire, equipment malfunction or failure, adverse environmental conditions, and medical illness and injury). The safe practices manual guidance and procedures must be supplemented with additional information specific to each diving operation. This supplemental information is obtained during pre-dive planning and assessment (see 29 CFR 1910.421(d)), and promulgated to the dive-team members during the employee briefing (see 29 CFR 1910.421(f)).

   NOTE: The "Consensus Standards for Commercial Diving and Underwater Operations" published by the Association of Diving Contractors International is recognized as meeting the general requirements of a safe practices manual.

E. 29 CFR 1910.421 *Pre-dive procedures*.

1. The provisions of this section must be followed by the employer for all diving modes, with the designated person-in-charge responsible for overall compliance with these provisions and briefing dive-team members.

2. 29 CFR 1910.421(b) *Emergency aid*. The CSHO shall determine whether the emergency aid list is complete and is available to all dive-team members. This list must contain the telephone or call numbers of: the nearest operational decompression chamber (if a chamber is not required at the dive location); accessible hospital(s); the available physician(s); the means of transportation available for use in the event of an emergency; and the nearest U.S. Coast Guard Rescue Coordination Center.

3. 29 CFR 1910.421(c) *First aid supplies*. The CSHO shall determine whether a first-aid kit is available at the dive location. The first-aid kit provided at the dive location must be appropriate for the diving operations, and approved by a physician. If it is to be used in a pressure chamber, such as a decompression chamber or a diving bell, the first-aid kit must be suitable for use under hyperbaric conditions because some items in a standard kit (such as bottles of liquid, mercury thermometers, or ammonia ampoules) may burst under pressure. In addition to any other first-aid or medical supplies, the kit must include an American Red Cross standard first-aid handbook, or an equivalent handbook,

and a bag-type resuscitator with a transparent hose and mask (so that the operator can see that the diver's air passages are clear).

4. 29 CFR 1910.421(d) *Planning and assessment.* This provision requires the employer to include in the planning of a diving operation an assessment of the safety and health features of the diving mode, surface and underwater conditions and hazards, primary and reserve breathing-gas supply, thermal protection, diving equipment and systems, dive-team assignments and the physical fitness of dive-team members (including any impairments known to the employer), repetitive dive designation or residual inert-gas status of divers, decompression chamber procedures (including any altitude corrections), and emergency procedures. The employer typically assigns this planning task to the designated person-in-charge. Most of the information required by this provision should be in the safe practices manual (see 29 CFR 1910.420). While conducting the planning and assessment, the employer must consider all hazards involved and ensure compliance with other OSHA standards (such as 29 CFR 1910.147 – *The control of hazardous energy (lockout/tagout)*; 29 CFR Part 1910, Subpart H – *Hazardous Materials*; 29 CFR Part 1910, Subpart N – *Materials Handling and Storage*; and 29 CFR Part 1910, Subpart Q – *Welding, Cutting and Brazing*). Some information may not be found in the safe practice manual because it cannot be determined until the dive team reaches the dive location. The CSHO can question the dive-team members to determine that the employer has complied with the requirements of this provision.

   NOTE: 29 CFR 1910.421(d) can be cited for any identified hazard that was not addressed properly by an employer when they planned and conducted an assessment of the diving operation or the work to be performed. For example, the hazards of installing piling underwater remain similar to installing piling above water with respect to maintaining vertical stability, and being positively secured to prevent accidental detachment of the pile from the hoisting equipment (see ANSI/ASSE A10.19-2008 – Safety Requirements for Pile Installation and Extraction Operations and ANSI A10.42-2000 – Safety Requirements for Rigging Qualifications – American National Standard for Construction and Demolition Operations).

   NOTE: The NOAA Diving Manual addresses diving at altitudes above sea level in Section 4.5 (Dealing with Changes in Altitude). Altitude corrections are not typically required for most dives conducted below 1,000 feet (altitude) as discussed in the manual.

5. 29 CFR 1910.421(e) *Hazardous activities.* Hazards encountered during diving operations such as weather, water temperature, current, and bottom conditions must be recognized and taken into account during the planning and execution of the operation. When other operations being conducted in the vicinity (such as dredging, marine traffic, or movement of materials directly above the dive location and/or area of the dive) are likely to interfere with the diving operation, the designated person-in-charge shall plan the operation only after appropriate coordination with persons responsible for the other activities so that any hazard

exposures to the diver(s) or other dive-team members will be eliminated. Failure to plan for such conditions, or to coordinate activities, shall be a basis for a citation.

6. 29 CFR 1910.421(f) *Employee briefing.* The employee briefing is usually conducted by the designated person-in-charge just prior to the diver(s) entering the water. The dive-team members shall be briefed on the tasks to be undertaken, safety procedures for the diving mode, any unusual hazards or environmental conditions likely to affect the safety of the diving operation, and any modifications to operating procedures necessitated by the specific diving operation. The designated person-in-charge also must advise the dive-team members of the procedures for reporting physical problems or adverse physiological effects during and after the dive. It is particularly important that the designated person-in-charge inquire into each dive-team member's current state of physical fitness before making assignments. To determine compliance, the CSHO can question dive-team members and observe the diving operation, if one is ongoing.

7. 29 CFR 1910.421(g) *Equipment inspection.*

   a. The equipment-inspection requirement prior to each dive relates directly to the equipment-checklist requirement in the safe practices manual. The breathing-supply system, including reserve breathing-gas supplies, masks, helmets, thermal protection, and diving bell-handling mechanisms (when appropriate) must be inspected prior to each diving operation. Pre-dive equipment inspection items are those that are critical for the safety of the dive operation. For surface-supplied diving, the breathing-supply system equipment inspection includes diving umbilicals as defined in 29 CFR 1910.402, *Definitions*. An umbilical inspection includes a visual inspection of the breathing-gas hose, communications cable, and the safety line between the diver and the dive location, and power cables and hot-water hoses as appropriate. This inspection ensures that: the umbilical has the required components, the components are properly rigged and married together, and all components are in good working condition (no leaks, tears, or damage). Umbilicals being used for diving operations with missing components or components in a condition that pose a hazard to the diver or dive team (such as a cut breathing-gas hose, power cable with bare wires exposed, or excessively frayed safety line) will be cited under 29 CFR 1910.421(g).

      NOTE: The tender often sets up and checks the diver's equipment prior to conducting the dive. Refer to Appendix E – Requirements and Typical Duties of Diver Tenders, which outlines a list of typical duties and equipment checks (including checking the non-return valve on the diver's mask or helmet) that should be completed prior to dive operations.

   b. Compliance with the pre-dive inspection requirements usually is determined only by observation (such as systems, equipment, processes and

procedures), and questioning the employees. This standard makes no distinction between employer-provided equipment and employee-provided equipment with regard to the pre-dive inspection requirement. While an employee may make such inspections, it is the employer who is responsible for ensuring compliance with all equipment requirements of the standard.

8. 29 CFR 1910.421(h) *Warning signal.*

   a. The following paragraphs describe the two distinctions made in the requirements for displaying the warning signal for commercial diving operations:

      i. 29 CFR 1910.421(h) requires the warning signal to be displayed when diving from surfaces other than vessels such as wharves, piers, pilings, jetties, fixed caissons, levees, dikes, dams, breakwaters, and artificial islands (secured to the sea floor). Violations of this requirement shall be cited under this section.

      ii. The requirement for displaying the warning signal when the dive location is located on a vessel is covered by the U.S. Coast Guard Inland Navigation Rules. These requirements are not enforceable by OSHA. If the CSHO observes violations of the warning signal when the dive location is on a vessel, no citation shall be issued. However, the CSHO shall inform the employer of the violation(s) and recommend abatement(s). The CSHO also shall note the incident on the OSHA-1 Form and notify the nearest U.S. Coast Guard Office of the violation(s) (see http://homeport.uscg.mil or USCG Phonebook).

   b. The warning signal is a rigid replica of the international code Flag "A," and must be at least one meter (3′-3½″) in height (see Appendix F of this instruction).

      NOTE: The red flag with a white diagonal stripe commonly used by recreational SCUBA divers does not satisfy the 29 CFR 1910.421(h) requirements. However, it can be used in addition to the "Alfa" flag to alert others who are familiar with the recreational SCUBA diving flag (e.g., recreational divers and boaters).

F. 29 CFR 1910.422 *Procedures during dive.*

1. 29 CFR 1910.422(b) W*ater entry and exit.* A means capable of supporting the diver (such as an inwater stage or ladder) while entering or exiting the water is required. If it is a fixed structure, such as a ladder, it must extend below the water sufficiently to allow adequate diver access and support (a minimum of one meter is recommended). Portable ladders should be secured to maintain stability and to prevent pinch points. The employer also must provide a means for assisting an injured diver from the water to the surface or into a diving bell (such as an inwater stage, stokes basket, or harness).

2. 29 CFR 1910.422(c) *Communications*. An operational two-way voice communication system is required for communications between each surface-supplied air diver or mixed-gas diver and a member of the dive team at the dive location or in the diving bell (if a diving bell is provided or required). Line-pull signals do not meet this requirement, except for the SCUBA-diving mode. A two-way voice communication system is required for communications between the diving bell and the dive location. Also, an operational, two-way communication system (such as a cell phone, marine radio, or e-mail) must be available for obtaining emergency aid.

3. 29 CFR 1910.422(d) *Decompression tables*. This paragraph requires that decompression, repetitive, and no-decompression tables (as appropriate) be available at the dive location. These tables serve as guides for determining decompression and no-decompression profiles for the diving operation. The CSHO shall check that the decompression tables are available at the dive location (for standard air decompression tables refer to section III., paragraph G.3., of this instruction, and U.S. Navy Diving Manual, Volume 2, Chapter 9, "Air Decompression").

4. 29 CFR 1910.422(e) *Dive profiles*. A written record called a depth-time profile (including any breathing-gas changes, when appropriate) must be maintained for each diver during the dive, including decompression. This record aids the designated person-in-charge (or the dive-team member managing the decompression interval) in implementing the planned dive schedule and decompression interval, and making necessary adjustments in the decompression schedule if changes occur in planned bottom times or depths. The dive profile information may be recorded by whatever means and in whatever form the employer prefers, provided that the information is maintained accurately and completely.

5. 29 CFR 1910.422(f) *Hand-held power tools and equipment*.

   a. The standard does not require hand-held electric power tools used underwater to have a pressure-sensitive manual control switch. However, when electrically powered hand-held tools are used underwater, and the source of power is supplied from the dive location or a diving bell, the hand-held power tool shall not be supplied with power until requested by the diver. When the diver has finished work with the hand-held electric-power tool, the power to the tool will be de-energized from the dive location or the diving bell.

   b. In addition to the requirements of 29 CFR 1910.422(f)(1) and (f)(2), all hand-held electric power tools and equipment must comply with 29 CFR 1910.303(b) and 29 CFR 1910.399.

      Clarification of the term "approval" is given in 29 CFR 1910.303(a) as follows: "The conductors and equipment required or permitted by this

subpart shall be acceptable only if approved."

The term "acceptable" is defined under 29 CFR 1910.399 as follows: "An installation or equipment is acceptable to the Assistant Secretary of Labor, and approved within the meaning of [29 CFR Part 1910, Subpart S – Electrical]." An installation would be acceptable if it meets one of the following three conditions:

- If it is accepted, or certified, or listed, or labeled, or otherwise determined to be safe by a nationally recognized testing laboratory [as defined by 29 CFR 1910.7].

- With respect to an installation or equipment of a kind which no nationally recognized testing laboratory accepts, certifies, lists, labels, or determines to be safe, if it is inspected or tested by another federal agency, or by a State, municipal, or other local authority responsible for enforcing occupational safety provisions.

- With respect to custom-made equipment or related installations which are designed, fabricated for, and intended for use by a particular customer, if determined to be safe for its intended use by the manufacturer on the basis of test data which the employer keeps and makes available for inspection to the Assistant Secretary and [his/her] authorized representatives.

6. 29 CFR 1910.422(g) *Welding and burning.*

   a. A current supply switch must be available to interrupt the current flow to the welding or burning electrode. The switch shall be tended by a dive-team member in voice communication with the diver performing the welding or burning (see 29 CFR 1910.422(g)(1)(i)). The disconnect switch must be in the open position unless the diver is actually welding or burning (see 29 CFR 1910.422(g)(1)(ii)). The CSHO shall determine that the welding machine's frame is properly grounded by means of solid, metal-to-metal contact on all ship's structure and/or shore ground connections (see 29 CFR 1910.422(g)(2) and 1910.254(d)). The ground connection also may be checked with a meter. The CSHO also shall determine that the cables, electrode holders and connections are insulated to prevent overheating or breakdown (see 29 CFR 1910.422(g)(3)). The employer must provide insulated gloves for the diver's protection (see 29 CFR 1910.422(g)(4)). See 29 CFR 1910.137 *Electrical protective equipment,* for selection and use of the proper type of gloves and inspection intervals for the gloves.

   NOTE: Personnel designated to operate electric cutting and welding equipment used in diving operations shall have experience or training in the safe use of this equipment (see 29 CFR 1910.410(a)(2)(i); welding and burning training violations will be cited under 29 CFR 1910.410).

b. This standard does not place any restriction on the use of AC current or rectified AC current arc welding.

c. 29 CFR 1910.422(g)(5). This paragraph states that prior to welding or burning on closed compartments, structures, or pipes that 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 that will not support combustion. "Closed compartments" as used in this paragraph, means any space that is enclosed by bulkheads and overheads (i.e., walls and ceilings), including large diameter pipes and other structures that, because of poor ventilation, could hold or contain a flammable gas or vapor. Prior to hot work, the employer must remove from closed compartments all flammable gases and vapors by ventilating, flooding, or purging with an inert-gas that will not support combustion. Venting alone is not sufficient unless it removes the flammable gases from the compartments. Closed compartments, structures, and pipes already under flow, as in hot tapping operations, meet the requirement for being flooded.

WARNING: A flooded compartment is not necessarily safe for cutting and welding. During the cutting and welding process, oxygen (from the diver's welding/cutting $O_2$ supply hose), hydrogen (electrolysis generated by the work process), and other gases may collect in the overhead of a compartment, if it is not properly vented (made gas free). Should the diver cut or weld into the area where the gas collects, then a serious explosion can occur. By properly venting the space, gas will not collect and the space will remain flooded. When making vertical cuts/welds, it is best to start high (shallow water depth) and finish low (deeper water depth).

7. 29 CFR 1910.422(h) *Explosives*. Explosive charges are used to perform some types of underwater work, including demolition, sheet-pile cutting, cable cutting, and excavating. Explosives suitable for underwater work include Primacord®, various gelatins (gels), plastic blocks, and some liquids. Employers must comply with this provision, as well as the applicable requirements of 29 CFR 1910.109 and 29 CFR 1926.912, when handling, storing, and using explosives. This provision requires divers to be out of the water when detonating an explosive or testing the electrical continuity of the explosive circuits.

NOTE: Only personnel who are properly trained or experienced shall handle explosives (see 29 CFR 1910.410(a)(1) and (a)(2)(i); explosive training violations will be cited under 29 CFR 1910.410).

8. 29 CFR 1910.422(i) *Termination of dive*. This paragraph applies to all diving modes. The designated person-in-charge is responsible for determining when a dive shall be terminated. "Termination" means ending the working interval of a dive. However, it may still be necessary to complete the decompression procedures (when required). The working interval of a dive must be terminated when: the diver so requests; the diver fails to respond correctly to instructions

from the dive team (indicating a possible disability of the diver or an equipment failure); communications with the diver are lost and cannot quickly be reestablished (either between the diver and the dive location or diving bell, or between the diver and the designated person-in-charge and the skipper of the support vessel for liveboating operations); or the diver begins to use the reserve breathing gas. Any of these situations requires termination of the dive. The decompression interval should not be omitted after termination of the dive if doing so would add to the diver's overall physical risk, unless the circumstances make inwater decompression impossible or present a greater physical risk to the diver.

G. 29 CFR 1910.423 *Post-dive procedures*.

1. 29 CFR 1910.423(b) *Precautions*. At the completion of a dive, the employer must: thoroughly check the physical condition of the diver; instruct the diver to report any physical problems or adverse physiological reactions (including decompression sickness symptoms); advise the diver of the location of the nearest decompression chamber; and alert the diver to the hazards of flying too soon after the dive. As a general rule, a diver should wait 12 hours before flying for air diving not involving decompression, and wait 24 hours for air dives involving decompression and all mixed-gas diving. For additional information, see the U.S. Navy Diving Manual or the NOAA Diving Manual. Decompression sickness effects can occur for some time after the completion of the dive, and sleep can conceal the onset of decompression sickness. Consequently, after a dive deeper than 100 fsw, a dive that requires decompression, or after any dive using a mixed-gas breathing mixture, the employer is required to instruct the diver to remain awake and in the vicinity of the decompression chamber at the dive location for at least one hour after the dive, including one hour after any decompression or diving medical treatment (such as medical treatment for decompression sickness or arterial gas embolism).

2. 29 CFR 1910.423(c) *Recompression capability*. Decompression chambers provide the only effective therapy (i.e., recompression) for decompression sickness and arterial gas embolism. A decompression chamber also can reduce a diver's underwater exposure since chambers may be used to decompress the diver on the surface (i.e., procedures known as "surface decompression on air" and "surface decompression on oxygen").

   a. 29 CFR 1910.423(c)(1). This provision requires the use of a decompression chamber capable of recompressing the diver at the surface to a minimum of 165 fsw (6 ATA) at the dive location for: SCUBA dives deeper than 100 fsw; surface-supplied air dives deeper than 100 fsw but shallower than 220 fsw; mixed-gas dives shallower than 300 fsw; or diving outside the no-decompression limits shallower than 300 fsw.

   b. 29 CFR 1910.423(c)(2). A decompression chamber capable of recompressing the diver at the surface to the maximum depth of the dive must be available at the dive location for dives deeper than 300 fsw.

c. 29 CFR 1910.423(c)(3). The decompression chamber must be dual-lock (i.e., having two compartments) so that supplies and personnel may be transferred into and out of the main compartment. The chamber also must be multi-place (i.e., the main compartment must be large enough for two persons), and must be located and ready for use within 5 minutes of the diver's exit from the water.

d. 29 CFR 1910.423(c)(4). The decompression chamber must be equipped with: a pressure gauge for each inner lock and outer lock; a built-in breathing system (BIBS) with at least one mask for each chamber occupant; two-way voice communication between the chamber occupant(s) and a dive-team member at the dive location who is monitoring the decompression; a view port; and sufficient illumination to observe the chamber occupant(s).

e. 29 CFR 1910.423(c)(5) and (c)(6). Treatment tables, oxygen or other appropriate treatment gas, and sufficient gas to pressurize the decompression chamber during the treatment period must be available at the dive location. In addition, a competent dive-team member must be available during the dive, and for one hour afterward, to tend and operate the chamber.

NOTE: To be used as a recompression facility (i.e., in lieu of a chamber), a diving bell must meet all the criteria listed in 29 CFR 1910.423(c). Chambers used for dives that are 300 fsw and deeper must have a pressure capability equal to or greater than the maximum depth of the dive (the CSHO shall check the dive plan and tables for the maximum depth of the dive). 29 CFR 1910.430(f) sets forth additional requirements that apply only to decompression chambers.

3. 29 CFR 1910.423(d) *Record of dive.*

a. 29 CFR 1910.423(d)(1) and (d)(2). The record maintained for each diving operation must include: the names of the dive-team members, including the designated person-in-charge; the date, time, and location of the dive; the diving mode(s) used; a general description of the work performed; the approximate underwater and surface conditions; and the maximum depth and bottom time for each diver. The following additional information is required for dives outside the no-decompression limits, deeper than 100 fsw, or using mixed-gas: depth-time and breathing-gas profiles; decompression tables (including any modifications); and, for repetitive diving, the elapsed time since the last pressure exposure (if less than 24 hours) or the repetitive dive designation for each diver.

NOTE: These provisions do not require a standard form or that the dive records for each individual diver be kept on a separate sheet. When two or more divers are working simultaneously, the information required may be

kept for the divers on one record. However, if the divers have different dive exposures or use different decompression tables, then separate entries must be made for each diver.

b. 29 CFR 1910.423(d)(3). For each dive in which decompression sickness is suspected or symptoms are evident, the following additional information must be recorded and maintained: a description of decompression sickness symptoms (including depth and time of onset); and a description of treatment results. The information required also shall be recorded on the OSHA 300 Log ("Log of Work-Related Injuries and Illnesses"). Employers shall maintain a log of recordable work-related injuries and illnesses. The key word is "recordable." The purpose of this requirement is to document recordable illnesses, including incidents of decompression sickness, even when the initial symptoms include such manifestations as skin itch, slight joint cramps, and slight numbness of the extremities. Although seemingly innocuous, these symptoms are recognized and suspected as mild forms of decompression sickness. Symptoms and treatments must be recorded similarly to any other injury or illness. Refer to Appendix G, of this instruction, for additional reporting and recordkeeping guidance, including the exemption for commercial diving operations.

4. 29 CFR 1910.423(e) *Decompression procedure assessment.* This paragraph requires the employer, within 45 days of occurrence, to investigate and evaluate each incident of decompression sickness, to take appropriate corrective action, and to prepare a written evaluation assessing the incident. The corrective action may include an adjustment of the dive procedures, reassessment of the decompression tables, or a reexamination of the particular dive involved. A check of the dive records should show whether an incident occurred that required an investigation, corrective action, and a written evaluation.

H. 29 CFR 1910.424 – 1910.427 *Specific Operations Procedures*.

The requirements of 29 CFR 1910.424 through 1910.427 are in addition to any other applicable requirements in 29 CFR Part 1910, Subpart T.

I. 29 CFR 1910.424 *SCUBA diving*. Because a SCUBA diver has a limited breathing supply, does not usually have voice communication, and often is not monitored or controlled by surface-support personnel, the limits on this mode of diving are more stringent than for other diving modes.

1. 29 CFR 1910.424(b) *Limits*.

a. 29 CFR 1910.424(b)(1) and (b)(2). The limits for SCUBA diving are more restrictive than for surface-supplied air diving or mixed-gas diving (see Appendix H). The maximum depth for SCUBA diving is 130 fsw (see 29 CFR 1910.424(b)(1)). A decompression chamber is required (i.e., available within 5 minutes from the dive location) when diving deeper than 100 fsw, or when diving outside of the no-decompression limits (see 29 CFR

1910.424(b)(2)).

b. 29 CFR 1910.424(b)(3). Each SCUBA diver must be line-tended when the current exceeds one knot (1.689 feet per second, or about 17 feet per 10 seconds). Three basic types of currents affect diving operations: river or major ocean currents; currents produced by the ebb and flow of the tides (which may add or subtract from any existing current); and underwater or rip currents caused by the rush of water returning from waves breaking along a shoreline. The CSHO shall determine that the employer has ascertained the strength of the local currents at the dive location from Tide and Current Tables, Coast and Geodetic Survey Charts, Coast Pilot Publications, or other sources. A SCUBA diver is seriously encumbered when swimming against a current exceeding one knot, and the standard prohibits such activity unless the diver is line-tended. A SCUBA diver may, however, swim downstream with a current when means are provided to pick the diver up (such as retrieval with a boat).

NOTE: When two SCUBA divers are in the water, one tending line to the surface is sufficient when the two divers are connected by a "buddy line."

c. 29 CFR 1910.424(b)(4). Each SCUBA diver must be line-tended from the surface when diving in an enclosed or physically confining space (i.e., any underwater location where the diver cannot ascend directly to the surface; commonly referred to as "free access to the surface").

NOTE: For vessels without longitudinal (horizontal) stabilizers, "free access to the surface" means that the diver is diving above the turn of the bilge; for vessels with longitudinal stabilizers (usually found on military combat vessels), "free access to the surface" means that the diver is diving above the stabilizers.

2. 29 CFR 1910.424(c) *Procedures*.

a. 29 CFR 1910.424(c)(1). This paragraph requires that a standby diver be available for all SCUBA diving operations. An "available" standby diver means that the diving gear for the standby diver is at the dive location and ready for use (i.e., set up and fully checked out), with a qualified diver at the dive location available to be the standby diver. A second diver ("buddy diver") in the water does not satisfy the requirement for a standby diver. One employee can be both the standby diver and tender, provided that this employee is a qualified diver; for a three-person dive team, the designated person-in-charge (DPIC) would assume tending duties when the standby diver (tender) is in the water. A DPIC also can be the standby diver, provided that: (1) he/she is a qualified diver, and (2) another dive-team member at the dive location is trained and capable of performing necessary DPIC functions while the DPIC is in the water as the standby diver.

b. 29 CFR 1910.424(c)(2). This paragraph requires that a SCUBA diver be

line-tended from the surface when in the water or that the SCUBA diver be accompanied by, and in continuous visual contact with, another diver during the diving operation.

NOTE: While line-tending the SCUBA diver from the dive location is considered preferable to "buddy diving," it is recognized that "buddy diving" is an accepted practice. The safety advantage of having two divers in the water tending each other ("buddy diving") is lost if they cannot maintain continuous visual contact; without visibility, divers cannot tend each other adequately.

c. 29 CFR 1910.424(c)(3). When diving is conducted in an enclosed or physically confining space, a diver shall be stationed at the underwater point of entry to assist in tending the diver in the space.

NOTE: The diver stationed at the underwater point of entry is required in addition to any standby diver at the dive location.

d. 29 CFR 1910.424(c)(4) and (c)(5). Each SCUBA diver is required to have: (1) a diver-carried reserve breathing-gas supply that consists of a manual reserve (J-valve), or (2) an independent reserve cylinder that has a separate regulator or that is connected to the underwater breathing apparatus (see 29 CFR 1910.424(c)(4)). The valve of the reserve breathing-gas supply must be in the closed position prior to the dive (see 29 CFR 1910.424(c)(5)) to ensure that the air reserve will not be depleted inadvertently during the dive.

NOTE: A Spare Air® bottle, or equivalent device, that is attached positively to the diver by a suitable line (so that the bottle is not lost if dropped) is sufficient as an independent reserve cylinder, provided that it meets the emergency air volume requirements for the dive profile. Spare Air® is the trade name for a small, high-pressure air bottle with an attached breathing regulator that is designed for use as an emergency-air source.

3. Commercial SCUBA air diving with one diver in the water requires a minimum of three dive-team members: a designated person-in-charge (DPIC) (see 29 CFR 1910.410(c)), a standby diver (see 29 CFR 1910.424(c)(1)), and a line-tended diver (see 29 CFR 1910.424(c)(2)). Commercial SCUBA diving with two divers in the water requires a minimum of four dive-team members: a DPIC (see 29 CFR 1910.410(c)), a standby diver (see 29 CFR 1910.424(c)(1)), and two divers (see 29 CFR 1910.424(c)(2)).

NOTE: Additional guidance regarding minimum dive-team requirements is provided in Appendix A, Questions #2 and #3, of this instruction.

NOTE: In establishing the number of dive-team members required for a dive, proper consideration must be given to 29 CFR 1910.421(d) *Planning and assessment*, 29 CFR 1910.421(e) *Hazardous activities*, and 29 CFR 1910.422(b)(3). This latter provision requires employers to provide a means to

assist an injured diver from the water (such as an inwater stage, small boat, or stokes basket) or into a diving bell, that may necessitate additional dive-team members.

J. 29 CFR 1910.425 *Surface-supplied air diving*.

1. 29 CFR 1910.425(b) *Limits*.

a. 29 CFR 1910.425(b)(1). The maximum depth for surface-supplied air diving is 190 fsw, except that surface-supplied air dives with bottom times of less than 30 minutes may be conducted to a maximum depth of 220 fsw.

b. 29 CFR 1910.425(b)(2). A decompression chamber is required (available within 5 minutes from the dive location) for dives deeper than 100 fsw, or any dive that requires planned decompression.

NOTE: Decompression chambers and closed diving bells, when used as a recompression facility, shall meet the criteria specified by 29 CFR 1910.423(c) and 29 CFR 1910.430(f).

c. 29 CFR 1910.425(b)(3). A diving bell is required for dives with an inwater decompression time greater than 120 minutes, except when heavy gear is worn or diving is conducted in physically confining spaces.

2. 29 CFR 1910.425(c) *Procedures*.

a. 29 CFR 1910.425(c)(1). Each diver is required to be continuously tended while in the water.

NOTE: 29 CFR 1910.425(c)(1)(i) requires that a separate dive-team member tend each diver in the water when the dive exceeds 100 fsw or is outside the no-decompression limits. The increased hazards and complexity associated with deeper or longer dives may compromise diver safety if a tender is responsible for tending more than one diver.

b. 29 CFR 1910.425(c)(2). When diving is conducted in enclosed or physically confining spaces, another diver shall be stationed at the underwater point of entry.

NOTE: The diver stationed at the underwater point of entry is required in addition to any standby diver at the dive location.

c. 29 CFR 1910.425(c)(3). This paragraph requires that each diving operation have a primary breathing-gas supply that is sufficient to support divers for the duration of the planned dive, including decompression.

d. 29 CFR 1910.425(c)(4)(i), (c)(4)(ii), and (c)(4)(iii). For dives deeper than 100 fsw or outside the no-decompression limits, each diver must: be tended

by a separate dive-team member; have a standby diver available at the dive location while the diver is in the water; and have a diver-carried reserve breathing-gas supply, except when heavy gear is worn.

e. 29 CFR 1910.425(c)(4)(iv). A reserve breathing-gas supply is required at the dive location for dives deeper than 100 fsw or outside the no-decompression limits.

NOTE: The reserve breathing-gas supply required at the dive location must be on-line and ready for use, and its source must be independent of the primary breathing-gas supply. The reserve breathing-gas supply must be of sufficient quantity and pressure to allow each diver to complete any planned decompression schedule.

f. 29 CFR 1910.425(c)(5)(i) and (c)(5)(ii). For surface-supplied air diving with heavy gear, deeper than 100 fsw, or outside the no-decompression limits, an extra breathing-gas hose must be available to the standby diver, and the hose must be capable of supplying breathing gas to the diver in an emergency. Also, an inwater stage must be provided for the diver(s) in the water.

g. 29 CFR 1910.425(c)(6). A diver-carried reserve breathing-gas supply must be provided to a diver in the water when the diver is prevented by the configuration of the dive area from ascending directly to the surface (i.e., when the diver does not have "free access to the surface"), except when the diver wears heavy gear or when the physical space does not permit the use of such a breathing-gas supply. The diver-carried reserve must be sufficient under operating conditions to allow the diver to reach the surface, or another source of breathing gas, or to be reached by a standby diver. Heavy-gear diving is exempted from these provisions because the gear carries its own reserve.

NOTE: For vessels without longitudinal (horizontal) stabilizers, "free access to the surface" means that the diver is diving above the turn of the bilge; for vessels with longitudinal stabilizers (usually found on military combat vessels), "free access to the surface" means that the diver is diving above the stabilizers.

3. Commercial surface-supplied air diving with one diver in the water requires a minimum of three dive-team members: a DPIC (see 29 CFR 1910.410(c)), and a diver "who shall be continuously tended [by a tender other than the DPIC] while in the water" (see 29 CFR 1910.425(c)(1)). For surface-supplied air diving that is 100 feet or less and does not involve planned decompression, a standby diver is not a specified requirement for every dive. However, based on the requirements of 29 CFR 1910.421(d) *Planning and assessment*, the hazard analysis and assessment of the dive will dictate the use of a standby diver when underwater conditions and hazards or potential hazards involve: proximity to underwater differential pressure flow (e.g., pump intake suction, gravity drain,

or an open sluice gate on a dam), no free access to the surface, the possibility of diver entanglement or entrapment, or unknown bottom conditions. If a standby diver is required (such as when these conditions are present or for depths that exceed 100 fsw), these duties may be performed by the DPIC or the tender. A tender who is a qualified diver can be the standby diver; for a three person dive-team, the DPIC would assume tending duties when the standby diver (tender) is in the water. A DPIC who is a qualified diver also can be the standby diver, provided that another dive-team member is at the dive location who is trained and capable of performing the necessary functions of the DPIC when the DPIC is in the water as the standby diver.

NOTE: In establishing the number of dive-team members required for a dive, proper consideration must be given to 29 CFR 1910.421(d) *Planning and assessment*, 29 CFR 1910.421(e) *Hazardous activities*, and 29 CFR 1910.422(b)(3). This latter provision requires employers to provide a means to assist an injured diver from the water (such as an inwater stage, small boat, or stokes basket) or into a diving bell, that may necessitate additional dive-team members.

K. 29 CFR 1910.426 *Mixed-gas diving*.

1. 29 CFR 1910.426(b) *Limits*.

   a. 29 CFR 1910.426(b)(1)(i). Mixed-gas diving requires a decompression chamber to be ready for use at the dive location for all dives (available within 5 minutes from the dive location). Decompression chambers and closed diving bells, when used as a recompression facility, must meet the criteria stated in 29 CFR 1910.423(c). 29 CFR 1910.430(f) sets forth additional requirements that apply only to decompression chambers. A diving bell (open diving bell or closed diving bell) is required for dives in the range of 220 – 300 fsw or involving inwater decompression lasting longer than 120 minutes, except when heavy gear is worn or when diving in physically confining spaces.

   NOTE: See Appendix C of 29 CFR Part 1910, Subpart T, for exceptions to the decompression chamber requirement pertaining to recreational diving instructors and diving guides when other alternative requirements are met.

   b. 29 CFR 1910.426(b)(ii). A closed diving bell is required for dives deeper than 300 fsw, except when diving is conducted in physically confining spaces.

2. 29 CFR 1910.426(c) *Procedures*.

   a. 29 CFR 1910.426(c)(1) and (c)(2). A separate dive-team member is required to tend each mixed-gas diver in the water. A standby diver must be available while a diver(s) is in the water.

NOTE: A separate tender must be assigned to each mixed-gas diver at all times, and a standby diver must be available to assist the mixed-gas diver(s) in the water. Therefore, for mixed-gas diving, a tender cannot be a standby diver unless a qualified dive-team member is available to assume the tender's duties.

b. 29 CFR 1910.426(c)(3). When diving is conducted in enclosed or physically confining spaces, another diver must be stationed at the underwater point of entry to assist in tending the diver in the space.

NOTE: The diver stationed at the underwater point of entry is required in addition to any standby diver at the dive location.

c. 29 CFR 1910.426(c)(4). This paragraph requires a primary breathing-gas supply sufficient to support divers for the duration of any planned dive, including decompression.

d. 29 CFR 1910.426(c)(5). A reserve breathing-gas supply is required at the dive location for all mixed-gas dives.

NOTE: The reserve breathing-gas supply required at the dive location must be on-line and ready for use, and its source must be independent of the primary breathing-gas supply. The reserve breathing-gas supply must be of sufficient quantity and pressure to allow each diver to complete any planned decompression schedule.

e. 29 CFR 1910.426(c)(6)(i) and (c)(6)(ii). When a mixed-gas diver wearing heavy gear is in the water, an extra breathing-gas hose must be available to the standby diver, and the hose must be capable of supplying breathing-gas to the diver in the water during an emergency. Also, an inwater stage must be provided for a diver wearing heavy gear.

f. 29 CFR 1910.426(c)(7). An inwater stage is required for divers who do not have access to a diving bell for dives deeper than 100 fsw or dives outside the no-decompression limits.

g. 29 CFR 1910.426(c)(8). When a closed diving bell is used, a dive-team member must be available in the diving bell to tend the diver in the water.

h. 29 CFR 1910.426(c)(9). A diver-carried reserve breathing-gas supply is required when diving deeper than 100 fsw or outside the no-decompression limits, or when the diver is prevented by the configuration of the dive area from directly ascending to the surface (i.e., when the diver does not have "free access to the surface"), except when heavy gear is worn or when the physical space does not permit the use of such a breathing-gas supply.

NOTE: For vessels without longitudinal (horizontal) stabilizers, "free access to the surface" means that the diver is diving above the turn of the

bilge; for vessels with longitudinal stabilizers (primarily found on military combat vessels), "free access to the surface" means that the diver is diving above the stabilizers.

NOTE: In establishing the number of dive-team members required for a dive, proper consideration must be given to 29 CFR 1910.421(d) *Planning and assessment*, 29 CFR 1910.421(e) *Hazardous activities*, and 29 CFR 1910.422(b)(3). This latter provision requires employers to provide a means to assist an injured diver from the water (such as an inwater stage, small boat, or stokes basket) or into a diving bell, that may necessitate additional dive-team members.

L. 29 CFR 1910.427 *Liveboating*. Supporting a surface-supplied air or mixed-gas diver from a vessel that is underway is known as liveboating. This operation is one of the most hazardous diving operations, and it is restricted to surface-supplied diving only (liveboating operations cannot be performed with SCUBA equipment).

1. 29 CFR 1910.427(b) *Limits*. Liveboating is not permitted for diving operations that: have an inwater decompression time of more than two hours; use surface-supplied air at depths greater than 190 fsw (except that surface-supplied air dives with a bottom time of less than 30 minutes may be conducted to depths of 220 fsw or less); use mixed-gas at depths deeper than 220 fsw; occur in rough seas that would impede the diver's mobility or ability to perform the assigned work; or take place during non-daylight hours.

2. 29 CFR 1910.427(c) *Procedures*.

   a. 29 CFR 1910.427(c)(1). The propeller of the vessel must be stopped before the diver enters or exits the water.

   b. 29 CFR 1910.427(c)(2). With a vessel underway, a diver's hose can become entangled in the vessel's propeller. Therefore, when inspecting a liveboating operation, the CSHO shall verify the availability and use of a device designed to minimize the possibility of the diver's hose becoming entangled in the vessel's propeller. Such a device may be a propeller shroud, a weighted fairlead system, or an air tugger with a heavy weight. The use of a tender to prevent hose entanglement without some mechanical support is not sufficient to satisfy this requirement. When a floating hose is used, the hose shall be checked carefully to ensure that the requirements for breathing-gas supply hoses are met (see 29 CFR 1910.430(c)).

   c. 29 CFR 1910.427(c)(3). This paragraph requires the use of two-way voice communications between the designated person-in-charge and the person controlling the vessel while the diver is in the water.

   d. 29 CFR 1910.427(c)(4). A standby diver is required for all liveboating operations.

e. 29 CFR 1910.427(c)(5). A diver-carried reserve breathing-gas supply shall be carried by each diver engaged in liveboating operations.

M. 29 CFR 1910.430 *Equipment*.

1. 29 CFR 1910.430(a) *General*. Every equipment modification, repair, test, calibration, or maintenance service must be recorded in a log or by means of a tagging system. The tag or log entry must include the date, the type of work performed on the equipment, and the name or initials of the person who performed the work. The CSHO shall check to ensure that the employer has recorded the information required by this provision. This information is used to determine whether the equipment meets the requirements of 29 CFR 1910.430 or is in need of maintenance, testing, or replacement. These records (logs or tags) must be kept by the employer until replaced by a subsequent up-to-date record, or until the equipment is withdrawn from service.

2. 29 CFR 1910.430(b) *Air compressor system.*

a. 29 CFR 1910.430(b)(1) and (b)(2). Air compressor systems used to supply air to the diver must be equipped with a volume tank (VT), a check valve on the inlet side of the VT (to prevent loss of air if the compressor fails), a VT pressure gauge, a VT relief valve (to prevent excessive pressure buildup), and a VT drain valve (to drain or "bleed" accumulated moisture from the VT). In addition, the air compressor intakes must be located away (upwind) from any internal combustion engine exhaust or other contamination source to protect the diver's breathing air.

NOTE: Generally, an upwind horizontal separation of at least twelve feet should be maintained between the air compressor intake and the engine exhaust. In addition, the air intake should be located at least six feet above the ground, deck, or other low-lying area that could collect contaminants that are heavier than air. Even if a system is designed to keep the exhaust downwind of the intake (e.g., floating, weathervaning system), these horizontal and vertical distances should be maintained.

b. 29 CFR 1910.430(b)(3) and (b)(4). The employer is responsible for checking the output of the air compressor system every 6 months to ensure that the diver's breathing air does not contain more than 20 ppm (parts per million) by volume of carbon monoxide (CO), more than 1,000 ppm by volume of carbon dioxide ($CO_2$), 5 milligrams per cubic meter of oil mist (except that non-oil-lubricated compressors need not be tested for oil mist), or a pronounced or noxious odor. The CSHO shall interview appropriate employees and examine the records indicating the results of such tests. The CSHO also shall check to ensure that the air sample was taken at the connection to the distribution system (manifold). The CSHO or industrial hygienist should obtain a sample of the breathing air for later evaluation or, when possible, test for contaminants onsite.

NOTE: Unlike compressors used with air-respiratory systems that are not normally monitored, diving compressors are continually monitored by the dive team and are not required to have CO and high-temperature alarms.

NOTE: See section XII., paragraph M.5., *Compressed gas cylinders* regarding the use of third-party air compressors to fill SCUBA cylinders.

3. 29 CFR 1910.430(c) *Breathing-gas supply hoses*.

a. 29 CFR 1910.430(c)(1)(i), (c)(1)(ii), (c)(1)(iii), and (c)(1)(iv). Under paragraph (c)(1)(i), each breathing-gas hose must have a working pressure at least equal to the working pressure of the total breathing-gas system. Therefore, a hose connected to the low-pressure or downstream side of a regulating valve must meet the working pressure of that part of the system. For instance, the hose working pressure does not have to be equal to the pressure of the gas storage-bank cylinders, but must be equal to the working pressure downstream from the regulator. The working pressure rating of the hose usually will be found on a decal or stencil with the manufacturer's name at regular intervals along the hose length.

Paragraph (c)(1)(ii) requires that each breathing-gas supply hose have a rated bursting pressure at least four times the maximum working pressure (see the definition of "bursting pressure," section XII., paragraph B.6., of this instruction). Paragraphs (c)(1)(iii) and (c)(1)(iv) specify, respectively, that each breathing-gas supply hose must be tested annually to at least 1.5 times of its working pressure, and that the open ends of a hose must be taped, capped, or plugged when the hose is in storage or not in use to prevent foreign matter from contaminating the hose.

b. 29 CFR 1910.430(c)(2)(i), (c)(2)(ii), and (c)(2)(iii). Connectors for diver's breathing-gas systems must be made of corrosion-resistant material and have a rated working pressure equal to the maximum working pressure of the hose to which they are connected. Connectors must be resistant to accidental disengagement.

NOTE: Installation of cadmium-plated or other corrosion-resistant plated fittings is acceptable and meets the requirements of "corrosion-resistant" to the extent that the plating remains intact. However, when the plating becomes worn and the parent metal becomes pitted, the connector must be replaced.

c. 29 CFR 1910.430(c)(3)(i), (c)(3)(ii), and (c)(3)(iii). Umbilicals must be marked in 10-foot increments from the diver to 100 feet, and in 50-foot increments thereafter. Hoses in umbilicals (i.e., breathing-gas hoses, hot water hoses, or other hoses that carry air or liquids) must be kink resistant. The breathing-gas hose in the umbilical also must meet other applicable hose requirements of 29 CFR 1910.430(c)(1) and (c)(2). The maximum allowable working pressure of the umbilical breathing-gas hose can be

calculated by: subtracting the maximum depth (in psi) of the supply source (surface or diving bell) from the maximum depth (in psi) of the dive for which it will be used; and then adding 100 psi to this figure.

NOTE: Additional guidance is available in the ADCI *Consensus Standards for Commercial Diving and Underwater Operations (Section 6 of the 6th Edition)*.

4. 29 CFR 1910.430(d) *Buoyancy control*. The following equipment must have exhaust valves: helmets or masks connected directly to a dry suit or other buoyancy-changing equipment, and dry suits or other buoyancy-changing equipment not directly connected to the helmet or mask. A buoyancy compensator used for SCUBA diving must have an inflation source separate from the breathing-gas supply. SCUBA diving requires the use of a personal flotation device capable of maintaining the diver at the surface in a face-up position; this device also must be capable of oral inflation, have an exhaust valve, and have a manually activated inflation source independent of the breathing-gas supply.

5. 29 CFR 1910.430(e) *Compressed gas cylinders*. Employers must follow the OSHA standards for general industry that regulate the design, construction, and maintenance of compressed gas cylinders (see 29 CFR 1910.101 and 29 CFR 1910.169). In addition, the cylinders must be stored in a ventilated area away from excessive heat, and must be secured from falling. When the cylinders are in use, they must be equipped with a shut-off valve and a protective cap. The protective cap is not required when the cylinders: are designed with recessed shut-off valves, are connected to a manifold, or are used for SCUBA diving.

   NOTE: 29 CFR 1910.101(a) adopts 49 CFR Parts 171-179 for cylinder inspection requirements (see 49 CFR Part 173, Subpart G – Gases; Preparation and Packaging, for details). The Department of Transportation (DOT) classifies compressed air as a Division 2.2 Hazardous Material (i.e., non-flammable gas) in the Hazardous Materials Table (49 CFR 172.101) for pressures of 25.9 psig (43.8 psia) or greater at 68°F (49 CFR 173.115(b)(1)). Cylinders typically will be stamped with DOT markings, but also may be stamped with ICC markings. For more comprehensive information regarding SCUBA cylinder markings, refer to paragraph 5.7, of the NOAA Diving Manual.

   NOTE: When SCUBA cylinders are filled using an air compressor not owned by the employer (such as at a local dive shop), the employer of the dive team must obtain a copy of the air sample results that comply with 1910.430(b)(3) and (4).

6. 29 CFR 1910.430(f) *Decompression chambers*. Each decompression chamber manufactured after October 20, 1977, must be built and maintained in accordance with the ASME Code, or an equivalent standard (the meaning of the term "ASME or equivalent code" is covered under section XII., paragraph B.2., of this instruction). Decompression chambers manufactured on or prior to

October 20, 1977, must be built and maintained in conformity with the code requirements to which they were built, or to an equivalent standard or code. Decompression chambers must have: a means of maintaining the atmosphere below 25 percent oxygen by volume; noise mufflers on the intake and exhaust lines (to facilitate communication and to protect against hearing loss) that are regularly inspected and maintained; suction guards on the exhaust line openings; and a means for extinguishing fire. Ignition sources and combustible material must be kept to a minimum inside the chamber.

NOTE: Appropriate means to maintain the oxygen level below 25 percent may include a ventilation system or an overboard dump system. An overboard dump system exhausts the occupant's expired breathing gases from the built-in breathing system (BIBS) (used for breathing purposes inside a decompression chamber) to prevent a buildup of oxygen inside the chamber above 25 percent by volume.

7. 29 CFR 1910.430(g) *Gauges and timekeeping devices*. To monitor a diver's depth-time profile, a gauge indicating diver depth that can be read at the dive location is required for all dives except SCUBA (SCUBA divers carry their own depth gauges). To maintain accuracy, each mechanical depth gauge must be dead-weight tested or calibrated against a master gauge every 6 months, and when a discrepancy larger than 2 percent of full scale occurs between any two equivalent gauges. A cylinder pressure gauge that the diver can monitor must be carried by each SCUBA diver. Also, a timekeeping device must be kept at the dive location for recording time intervals during each dive to maintain an accurate depth-time profile for each diver.

   NOTE: For depth and pressure gauges that are digital, employers must comply with the manufacturer's recommendations for verifying accuracy.

8. 29 CFR 1910.430(h) *Masks and helmets*. Surface-supplied air and mixed-gas masks and helmets must have a non-return valve, that closes readily and positively, at the attachment point between the helmet or mask and hose, as well as an exhaust valve. Surface-supplied air and mixed-gas masks and helmets must have a minimum ventilation rate capability of 4.5 acfm for any depth at which they are used, or the capability of maintaining the diver's inspired carbon dioxide partial pressure below 0.02 ATA when the diver is producing carbon dioxide at a rate of 1.6 standard liters per minute (LPM).

   NOTE: The purpose of this helmet and mask provision is to ensure that breathing gas is supplied to the diver at a rate sufficient to meet the breathing requirements of the diver, and to dilute or flush exhaled breathing gas from the diver's mask or helmet. This provision serves as a guide for the design and selection of masks and helmets, not as a basis for routine operational tests or field verification. Although this provision does not require employers to perform any test on helmets and masks, it does require employers to ensure that the appropriate ventilation rate is maintained during operational use. Citations shall be issued under this provision only after consulting with OSHA's National

Office, Office of Maritime Enforcement.

9. 29 CFR 1910.430(i) *Oxygen safety*. Equipment used with oxygen or breathing-gas mixtures containing over 40 percent oxygen (by volume) must be designed for oxygen service. Components (except umbilicals) exposed to oxygen or breathing-gas mixtures containing over 40 percent oxygen (by volume) must be cleaned of flammable materials before use. Oxygen systems over 125 psig and compressed air systems over 500 psi must have slow-opening shut-off valves (such as a needle valve).

   NOTE: The purpose of this provision is to ensure that equipment exposed to oxygen is cleaned of flammable materials and hydrocarbon contaminants before placing that equipment into oxygen service. Similarly, before new or replacement components are placed into service in an oxygen-cleaned system, they also must be cleaned before being connected to the system.

10. 29 CFR 1910.430(j) *Weights and harnesses*. The requirements for weights and harnesses do not apply when a diver wears heavy gear (except as delineated in the NOTE below). In all other cases, each diver must be equipped with a weight belt or assembly that has a quick-release feature. Except for SCUBA diving and when the diver wears heavy gear, the diver must wear a safety harness with a positive buckling device, an attachment point for the umbilical (to prevent strain on the mask or helmet), and a lifting point (to distribute the pull force of the umbilical and harness over the diver's body).

    NOTE: When OSHA issued the commercial diving standard in 1977, harnesses were exempted from heavy gear since this gear was used with a harness-type weight belt that incorporated an attachment point for the umbilical. Advances in diving equipment and technology have led to heavy gear that uses an outer garment to carry necessary weights in pockets that are designed for that purpose (see NOTE to the definition of "heavy gear," section XII., paragraph B.18., of this instruction); such gear requires a harness with an attachment point for the umbilical, and a lifting point(s).

N. 29 CFR 1910.440 *Recordkeeping requirements*. The provisions of this standard specify the recordkeeping requirements for commercial diving operations.

1. 29 CFR 1910.440(a)(2). The employer must record any diving-related injury or illness that results in a dive-team member being hospitalized for a period of 24 hours or longer. The record must describe the circumstances of the incident and the extent of the injuries or illnesses.

   NOTE: These incidents do not have to be reported to OSHA (unless three or more hospitalizations are involved), but the record must be made available to a CSHO upon request. Frequency of injuries and illnesses may be an indication of improper planning or improper dive procedures.

   NOTE: Employers must report any fatality, and multiple hospitalizations (three

or more), by telephone or in person to the nearest OSHA Area Office, or by using OSHA's toll-free hotline at 1-800-321-OSHA. The caller making the accident report must talk directly to a person at OSHA (i.e., they cannot leave a message on the phone, send a fax, or send an e-mail). The maximum time allowed by 29 CFR 1904.39(a) for reporting a fatality or multiple hospitalizations is eight (8) hours; employers should report such cases as soon as possible after the occurrence (see Appendix G of this instruction for additional reporting guidance).

2. 29 CFR 1910.440(b)(1). This provision provides a CSHO with the authority to inspect and copy any record(s) required by this standard.

3. 29 CFR 1910.440(b)(2). This provision requires employers to retain, and to provide to their employees, their employees' designated representatives, and OSHA (usually during an inspection), records and documents in accordance with paragraphs (a) – (e), and (g) – (i), of 29 CFR 1910.1020 *Access to employee exposure and medical records* (this standard was re-designated in 1996 from 29 CFR 1910.20 to 29 CFR 1910.1020). These records include: safe practices manual (see 29 CFR 1910.420); depth-time profiles (see 29 CFR 1910.422); decompression procedure-assessment evaluations (see 29 CFR 1910.423); and hospitalization records (see 29 CFR 1910.440). Additionally, this provision specifies that employers must retain and make available to their employees and their employees' designated representatives any equipment-inspection and equipment-testing records required under 29 CFR 1910.430 that pertain to these employees.

4. 29 CFR 1910.440(b)(3). This paragraph requires employers to maintain the following records and documents: a safe practices manual (current document); depth-time profile of each dive (until completion of the dive, or completion of the decompression-procedure assessment in the event of a decompression-sickness incident); the dive record (for 1 year, except 5 years for dives involving a decompression-sickness incident); decompression-procedure assessment evaluations (for 5 years); equipment-inspection and equipment-testing records (current entry or tag, or until the equipment is withdrawn from service); and hospitalization records (for 5 years).

5. Additional guidance regarding injury and illness reporting and recordkeeping for commercial diving operations is provided in Appendix G of this instruction.

O. 29 CFR Part 1910, Subpart T, Appendix A – *Examples of Conditions Which May Restrict or Limit Exposure to Hyperbaric Conditions*.

This appendix lists disorders that may restrict or limit occupational exposure to hyperbaric conditions. The extent of the restriction depends on severity, presence of residual effects, response to therapy, number of occurrences, diving mode, and/or degree and duration of isolation.

P. 29 CFR Part 1910, Subpart T, Appendix B – *Guidelines for Scientific Diving*.

This appendix contains guidelines that are used in conjunction with 29 CFR 1910.401(a)(2)(iv), to determine those scientific diving programs that are exempt from the requirements of 29 CFR Part 1910, Subpart T.

Q. 29 CFR Part 1910, Subpart T, Appendix C – *Alternative Conditions Under 29 CFR 1910.401(a)(3) for Recreational Diving Instructors and Diving Guides (Mandatory)*.

This appendix lists the conditions addressed by 29 CFR 1910.401(a)(3). This paragraph specifies that employers of recreational diving instructors and diving guides who comply with all of the conditions listed in this appendix, need not provide a decompression chamber for these divers as required under 29 CFR 1910.423(b)(2) or (c)(3), or 29 CFR 1910.426(b)(1).

R. Other Commercial Diving Resources.

While OSHA considers the industry standards set forth below to be a valuable resource for safe and healthful workplace practices in the commercial diving industry, such standards are for information purposes only and employers accessing such information still must comply with the requirements of the Occupational Safety and Health (OSH) Act and standards promulgated pursuant to the OSH Act. Therefore, applying these recommendations or practices does not necessarily constitute compliance with the OSH Act and OSHA standards, including 29 CFR Part 1910, Subpart T. In addition, OSHA does not control the publication of information on the websites listed in this section, and cannot guarantee the accuracy, reliability, or timeliness of the information contained in these websites.

1. Association of Diving Contractors International (ADCI). The ADCI is an international association, with headquarters in Houston, Texas, that represents employers in the commercial diving industry. The ADCI *Consensus Standards for Commercial Diving and Underwater Operations* include technical standards, and operational information, guidance and procedures in support of safe diving practices.

   The following previously issued ADCI standards were incorporated into the ADCI *Consensus Standards for Commercial Diving and Underwater Operations (5th Edition)* in 2004, which was revised and updated in 2011 to the *6th Edition*.

   - ADCI Standard 01-1994, In-Service Maintenance and Repairs of PVHOs
   - ADCI Standard 02-1994, PVHO Window Cleaning, Inspection, Installation and Maintenance Instructions
   - ADCI Standard 03-1995, Recommended Divers Supply Pressure
   - ADCI Standard 04-1995, Duration of Bail-Out Cylinder
   - ADCI Standard 05-1995, Recommended First Aid Kit Contents
   - ADCI Standard 06-1995, Color Coding Guidance
   - ADCI Standard 07-1996, Minimum Rest Hour Policy

- ADCI Standard 08-2000, High Pressure Water Blasting
- ADCI Standard 09-2000, Handling Systems Guidance on the Design, Installation and Testing for the Launch and Recovery of Divers
- ADCI Standard 10-1999, Commercial Diver Certification Card
- ADCI Standard 11-1998, Commercial Diving in Potable Water Facilities

ADCI also distributes the following safety videos:

- ADCI Video, Why a 3-Man Crew?
- ADCI Video, The Hazards of Diving in Delta-P (Differential-Pressure) Work Environments
- ADCI Video, The Hazards of Underwater Burning

Most ADCI products are available in Spanish (en Español). Additional information is available at the association's website, http://www.adc-int.org/.

2. Dive Lab. Located in Panama City, Florida, Dive Lab tests surface-supplied diving helmets, full facemasks, and associated life-support equipment for Kirby Morgan Diving Systems International (KMDSI) of Santa Maria, California. Dive Lab also provides repair, maintenance, and configuration training courses for the commercial, military, and scientific diving communities worldwide. They have produced several technical papers, including surface-supplied breathing requirements.

   Additional information is available at the company's website, http://www.divelab.com.

S. Relationship to Other Federal Agencies and Transportation to Off-Shore Diving Sites.

1. In general, OSHA Area Directors should coordinate inspection activities with local U.S. Coast Guard counterparts in a manner that minimizes the duplication of agency resources and maximizes the protection of affected employees.

2. Consistent with operational efficiency and the safety of agency personnel, transportation necessary to conduct off-shore inspections should be obtained in accordance with the following priorities:

   a. Appropriate federal agency, on an "as available" basis.

   b. Private contractor.

   c. Employer at the off-shore site.

3. Accident-investigation reports, statistical data, and other pertinent enforcement-related information may be freely exchanged with other agencies at the local level, consistent with existing rules and regulations.

## APPENDIX A: Commercial Diving Operations Questions and Answers

This appendix consolidates OSHA interpretations related to commercial diving operations that have been issued and remain valid as of the date of this instruction. Previously issued interpretations were reviewed to determine their current validity and accuracy. Interpretations for which standard references have changed were updated to reflect the current standard reference.

OSHA requirements are set by statute, standards, and regulations. The Agency's interpretations explain these requirements and how they apply to particular circumstances, but they cannot create additional employer obligations. These responses constitute OSHA's interpretations of the requirements discussed. Note that our enforcement guidance may be affected by changes to OSHA rules. Also, from time to time we update our guidance in response to new information. To keep apprised of such developments, you can consult OSHA's website at: http://www.osha.gov.

**Question #1: Are diving operations involving the underwater inspection of bridges and other submerged structures considered to be "scientific diving" under 29 CFR 1910.401(a)(2)(iv), and if this diving is "scientific diving," what standards apply to these divers?**

Answer: The underwater inspection of bridges and other structures by divers is governed by OSHA regulations for commercial diving, 29 CFR Part 1910, Subpart T – Commercial Diving Operations. The exemption from OSHA's commercial diving standard for scientific diving would not be applicable to underwater inspections of bridges or other submerged structures.

**Question #2: What are the minimum number of dive-team members required to support air dives using SCUBA equipment and surface-supplied diving equipment, with one diver in the water?**

Answer: In establishing the number of dive-team members required for a dive, proper consideration must be given to 29 CFR 1910.421(d) *Planning and assessment*, 29 CFR 1910.421(e) *Hazardous activities*, and 29 CFR 1910.422(b)(3). This latter provision requires employers to provide a means to assist an injured diver from the water (such as an inwater stage, small boat, or stokes basket) or into a diving bell, that may necessitate additional dive-team members.

Commercial SCUBA air diving with one diver in the water requires a minimum of three dive-team members: a designated person-in-charge (DPIC) (see 29 CFR 1910.410(c)), a standby diver (see 29 CFR 1910.424(c)(1)), and a line-tended diver (see 29 CFR 1910.424(c)(2)). A tender who is a qualified diver can be the standby diver; for a three-person dive-team, the DPIC would assume tending duties when the standby diver (tender) is in the water. A DPIC also can be the standby diver, provided that: (1) he/she is a qualified diver, and (2) another dive-team member at the dive location is trained and capable of performing necessary DPIC-functions while the DPIC is in the water as the standby diver.

Commercial surface-supplied air diving with one diver in the water requires a minimum of three dive-team members: a DPIC (see 29 CFR 1910.410(c)), and a diver "who shall be continuously

tended [by a tender other than the DPIC] while in the water" (see 29 CFR 1910.425(c)(1)). For surface-supplied air diving that is 100 feet or less and does not involve planned decompression, a standby diver is not a specified requirement for every dive. However, based on the requirements of 29 CFR 1910.421(d) *Planning and assessment*, the hazard analysis and assessment of the dive will dictate the use of a standby diver when underwater conditions and hazards or potential hazards involve: proximity to an underwater suction, no free access to the surface, the possibility of diver entanglement or entrapment, or unknown bottom conditions. If a standby diver is required (such as when these conditions are present or for depths that exceed 100 fsw), these duties may be performed by the DPIC or the tender. A tender who is a qualified diver can be the standby diver; for a three-person dive team, the DPIC would assume tending duties when the standby diver (tender) is in the water. A DPIC also can be the standby diver, provided that: (1) he/she is a qualified diver, and (2) another dive-team member at the dive location is trained and capable of performing necessary DPIC-functions while the DPIC is in the water as the standby diver.

**Question #3: What is the minimum number of dive-team members required to support SCUBA diving when two divers are in the water, and when are SCUBA divers required to be line-tended?**

Answer: Commercial SCUBA air diving with two divers in the water requires a minimum of four dive-team members: a designated person-in-charge (DPIC)(see 29 CFR 1910.410(c)), a standby diver (see 29 CFR 1910.424(c)(1)), and two divers (see 29 CFR 1910.424(c)(2)). The two divers must be in continuous visual contact with each other or line-tended from the surface. The two divers require a tending line to the surface if they are required to work against a current exceeding one knot (1.689 feet per second, or about 17 feet per 10 seconds). When required or deemed necessary, one tending line to the surface is sufficient when the two divers are connected by a "buddy line." When the standby diver is deployed, he/she is required to be line-tended from the surface. A tender who is a qualified diver can be the standby diver; for a four-person dive team with two divers, the DPIC would assume tending duties when the tender is in the water serving as the standby diver. A DPIC also can be the standby diver, provided that: (1) he/she is a qualified diver, and (2) another dive-team member at the dive location is trained and capable of performing necessary DPIC-functions while the DPIC is in the water as the standby diver.

**Question #4: What commercial diving schools, national diver-training consensus standards, and commercial diving licenses or certifications does OSHA accept as meeting the requirements of 29 CFR 1910.410 *Qualifications of dive team*?**

Answer: OSHA considers an employer to be in compliance with the requirements of 29 CFR 1910.410 when documentation shows that the diver completed training to the appropriate level (such as a surface-supplied air diver certificate, or a surface-supplied mixed-gas diver certificate) at a commercial (private), military, or other federal (such as the Army Corps of Engineers) diving school, or a school accredited by the Association of Commercial Diving Educators (ACDE). An employer also is in compliance when documented evidence shows that a diver's training meets the requirements specified by the national consensus standard published by the American National Standards Institute (ANSI) and the Association of Commercial Diving Educators (ACDE)(i.e., ANSI/ACDE-01-2009, *American National Standard for Divers – Commercial Diver Training – Minimum Standard*). No commercial diver-licensing programs exist in the United States; however, the Association of Diving Contractors International (ADCI)

issues commercial diver certification cards in accordance with the ADCI *Consensus Standards for Commercial Diving and Underwater Operations (Section 3.0, 6th Edition (2011)).* OSHA considers an employer to be in compliance with the 29 CFR 1910.410 diver-training requirements when the employed divers have a valid ADCI commercial diver certification card indicating the appropriate training level.

**Question #5: Do the *Consensus Standards for Commercial Diving and Underwater Operations* published by the Association of Diving Contractors International (ADCI) comply with OSHA and U.S. Coast Guard requirements for commercial diving operations? For diving operations that are not covered by OSHA or U.S. Coast Guard regulations, such as maintenance and repair of pressure vessels for human occupancy (PVHO) or handling systems for diving bells, what does OSHA recognize as the best industry practice?**

Answer: OSHA recognizes the ADCI *Consensus Standards for Commercial Diving and Underwater Operations* as meeting the general requirements of 29 CFR 1910.420 for a safe practices manual. The contents of this document meet or exceed the requirements of 29 CFR Part 1910, Subpart T. For diving-related operational, maintenance, and testing matters that are not addressed by OSHA standards, OSHA recognizes ADCI standards as the best established industry practice.

OSHA's recognition of the ADCI standards is consistent with the position taken by the U.S. Coast Guard. In a letter from the U.S. Coast Guard, Chief, Office of Compliance, to the ADCI dated February 9, 2005, the U.S. Coast Guard stated, "Of significance, ADCI's *Consensus Standards for Commercial Diving and Underwater Operations* fully meet and exceed the Coast Guard's regulatory requirements for commercial diving operations found in 46 CFR 197. Now in its Fifth Edition, the ADCI *Consensus Standards* are considered commercial diving industry best practices and are recognized and used by the United States Coast Guard as our comprehensive guidance document."

NOTE: The ADCI *Consensus Standards for Commercial Diving and Underwater Operations* is now in its *6th Edition* (2011).

**Question #6: How is a determination made of a safe or minimum operating pressure for commercial diving surface-supplied equipment?**

Answer: The minimum safe operating pressure for any surface-supplied diving system is dependent upon three principal factors: (1) the depth of the dive; (2) pressure loss through the diving air-supply hose; and (3) the pressure requirements for the diving helmet or mask. Equally important is the flow (volume) of air supplied to the diver. Employers must comply with the manufacturers' recommended operating pressures and flow requirements for diving helmets and masks, and all diving systems must be analyzed by a competent person to ensure that the systems will support the diving operations adequately.

As required by 29 CFR 1910.430(h)(2), a surface-supplied air helmet or mask must have a minimum ventilation rate capability of 4.5 acfm at the depth of the dive, or the capability of maintaining the diver's inspired carbon-dioxide partial pressure below 0.02 ATA when the diver is producing carbon dioxide at a rate of 1.6 standard liters per minute. Diving system flow requirements must be analyzed as follows: (1) the flow volume of breathing gas needed by the

diver (discussed above); and (2) the flow requirements of the piping, hoses, and associated fittings and components, that must collectively be capable of supporting instantaneous peak flow rates of 7.0 acfm when demand-breathing diving helmets and masks are used.

Diving helmets and masks that incorporate an oral-nasal cavity with a demand-breathing arrangement are mechanically simple, easy to operate, and require significantly less air volume per unit of time, than required by steady-flow ventilated helmets and masks. However, to instantaneously match flow rates to diver breathing patterns, these helmets and masks require diving pressures and piping flow capacities that are significantly higher than needed in steady-flow equipment used in comparable service. Also, since oral-nasal and demand-breathing masks have limited volume and no storage capability, OSHA recommends that divers use an emergency air bottle ("come-home bottle" or "bail-out bottle") when diving with such masks.

Too much air pressure to a helmet or mask can be just as dangerous as not having enough air pressure. For most demand-breathing regulators, the range between the minimum and maximum (free-flow) pressure is only about 75 psi, and the range between the optimum pressure and the maximum pressure is only about 50 psi. To avoid pressure-related hazards, the employer should consult the manufacturer of the diving helmet or mask to verify the minimum, optimum, and maximum pressure limits of the demand-breathing regulator.

When selecting a diving air compressor, it is important to determine the required output pressure (psig) and the output volume (scfm). These calculations are based on the pressure and flow available at the manifold (i.e., where the diver's umbilical connects topside to the air-supply system). Allowances must be made for pressure reduction caused by the piping system components between the volume tank and diver's manifold. For example, each filter can induce a 5 to 15 psi drop in system pressure.

Additional guidance is available in section XII., paragraph R., Other Commercial Diving Resources.

**Question #7: Are "hookah rigs" (i.e., an air compressor supplying air through a hose directly to the second-stage of a SCUBA regulator) allowed by OSHA standards? Is it acceptable to use the second-stage regulator from a SCUBA regulator assembly approved by the U.S. Navy for a "hookah rig"?**

Answer: Hookah rigs, as described in this question, are not in compliance with the OSHA commercial diving standard because such rigs prohibit diver-to-topside communications, which is a requirement for all surface-supplied diving operations (see 29 CFR 1910.422(c)(1)(i)). Further, assembling a hookah rig by using a second-stage regulator from a SCUBA regulator assembly can pose a severe hazard to divers. Second-stage SCUBA regulators are designed to function properly when supplied with pressure in a specified range (such as from 125 to 150 psi over the ambient water pressure). In a SCUBA regulator assembly, the first-stage SCUBA regulator has a mechanism that compensates for the ambient water pressure and maintains a constant pressure, in a specified range, to the second-stage regulator. Without the first-stage SCUBA regulator, as in the case with a hookah rig as described, the inlet air pressure to the second-stage regulator is not automatically compensated to maintain a constant over-bottom pressure (psi-ob); therefore, as the diver goes deeper, the air flow from the second-stage regulator decreases. Eventually, as the diver goes deeper, the diver will receive little or no air

from the second-stage regulator, which can result in asphyxiation of the diver.

Regulators authorized by the U.S. Navy are for use only in the specified configuration. Consequently, the use of a second-stage SCUBA regulator independent of the first-stage SCUBA regulator is not approved by the Navy. Also, Navy approval is for Navy equipment used in Navy diving operations; this approval does not extend to the use of such equipment by commercial divers or other organizations.

**Question #8: Are employers in compliance with OSHA standards when they rely on employees who own their own diving equipment to maintain this equipment?**

Answer: OSHA supports and encourages employees to maintain, inspect, and ensure the safe operation of the equipment that they own and use in their employers' diving operations. However, these actions do not relieve employers of their responsibilities under OSHA standards to ensure the proper use, maintenance, testing, and other required actions regarding diving equipment used in the course of employment. Accordingly, OSHA makes no distinction between "employer-owned" equipment and "employee-owned" equipment. If the equipment is not in compliance with OSHA standards, and it is being used in the course of employment, then the employer is in violation of the standards.

**Question #9: When a decompression chamber is not available at the dive location, can employers administer 100 percent oxygen to a diver who experiences decompression sickness or arterial gas embolism while the diver is being transported to a decompression chamber? Can an oxygen mask with a mouthpiece-held demand inhalator valve be used for unconscious patients?**

Answer: OSHA standards require a multi-place recompression chamber at the dive location for any planned decompression dive, any dive deeper than 100 fsw, or any dive on a breathing medium other than standard air. However, divers who are not covered by these recompression chamber requirements (such as conducting no-decompression dives less than 100 fsw) can incur decompression sickness (i.e., "bends") or an arterial gas embolism. In these situations, when no recompression chamber is immediately available, the following guidelines apply. When transporting a breathing diving patient from the dive location to an available chamber for treatment, or when transporting any other breathing diving patient from one treatment facility to another, a portable oxygen supply consisting of an E cylinder (approximately 669 liters of oxygen) and a transparent mask is recommended. When transporting a non-breathing diving patient from the dive location to an available chamber for treatment, a mechanical-bag resuscitator with a pure oxygen supply is recommended; the oxygen supply should be administered only by trained personnel. Under these circumstances, OSHA does not recommend the use of an emergency-oxygen kit having a replacement oxygen mask with a mouthpiece-held demand inhalator valve, because it is not suitable for an unconscious patient, and oxygen is incompatible with the rubber parts of the mouthpiece assembly.

Although the use of pure-oxygen treatment for a diving patient may be beneficial, it is not a substitute for recompression treatment. When a diver incurs any diving illness that requires recompression treatment (such as decompression sickness, or arterial gas embolism), the diver must be treated at a recompression facility. Oxygen treatment may be necessary or desired

during transport to a recompression facility, but it must never be used as a replacement for recompression treatment when such treatment is required.

**Question #10: Are detector-tube test kits suitable for compliance with 29 CFR 1910.430(b)(3) and (b)(4), which require that the output air from a diving compressor be tested every 6 months for carbon monoxide, carbon dioxide, and oil mist contaminants?**

Answer: The use of detector tubes to perform the sampling required by 29 CFR 1910.430(b)(3) and (b)(4) is acceptable when the manufacturer's instructions and limitations are followed, and employers comply with the recordkeeping requirements of 29 CFR 1910.440(b)(2) and (b)(3)(vi). The OSHA Technical Manual, TED 01-00-015, January 20, 1999, Section II ("Sampling, Measurement Methods and Instruments"), provides additional guidance concerning the use and known limitations of detector tubes. When such limitations exist, detector tubes may not be used, and the specified alternative methods (such as laboratory-tested air samples) shall be used instead. OSHA encourages employers to send compressor air samples to laboratories periodically for analysis to validate the results of detector-tube testing, and to conduct diver's air sampling more frequently than semiannually.

**Question #11: How long must an employer retain records or documents required by 29 CFR 1910.440?**

Answer: See chart below.

**Retention Periods for Commercial Diving Records Required by 29 CFR 1910.440**

| Record or Document | Retention Period |
|---|---|
| Safe practices manual | Current document only |
| Depth-time profile | Until completion of the dive record; or if decompression sickness occurs during the dive, until completion of decompression-procedure assessment |
| Dive record | 1 year; 5 years for records involving decompression sickness |
| Decompression procedure assessment evaluations | 5 years |
| Equipment inspection and testing records | Current entry or tag, unless the equipment is withdrawn from service (i.e., then no retention requirement) |
| Hospitalization records | 5 years |

**Question #12: 29 CFR 1910.430(b)(2) requires that air compressor intakes be located away from areas containing exhaust or other contaminants. In some smaller compressor systems, the air intake is near the exhaust. How far apart should the air intake and exhaust be from each other?**

Answer: Generally, an upwind horizontal separation of at least twelve feet should be maintained

between the air compressor intake and the engine exhaust. In addition, the air intake should be located at least six feet above the ground, deck, or other low-lying area that could collect contaminants that are heavier than air. Even if a system is designed to keep the exhaust downwind of the intake (e.g., floating, weathervaning system), these horizontal and vertical distances should be maintained.

**Question #13: Is "free diving" or "breath-hold diving" covered under 29 CFR Part 1910, Subpart T?**

Answer: No. 29 CFR 1910.402 defines a diver as, "An employee…using underwater apparatus which supplies compressed breathing gas at the ambient pressure." Since a "free diver" or "breath-hold diver" is not using an underwater apparatus that supplies compressed breathing gas, he/she is not considered a diver; therefore, the 29 CFR Part 1910, Subpart T standards do not apply to this type of diving.

**Question #14: Is an employee under the age of 18 years old permitted to fill SCUBA bottles?**

Answer: Various State labor laws preclude employees under the age of 18 years old from handling compressed air which is classified as a hazardous material, with some specified exceptions such as inflating tires and party balloons. Compressed air is classified as a Division 2.2 Hazardous Material (i.e., non-flammable gas) in the Hazardous Materials Table (49 CFR 172.101) for pressures of 25.9 psig (43.8 psia) or greater at 68ºF (49 CFR 173.115(b)(1)). Contact the specific State Labor Office for details on a specific State. Department of Labor's Wage and Hour Division lists the Commissions, Directors, and Secretaries for each State Labor Office.

**Question #15: Is air that is enriched with extra oxygen ($O_2$) considered to be a mixed-gas regulated by the 29 CFR 1910.426 – Mixed-gas diving standards?**

Answer: Yes. Mixed-gas diving is defined in 29 CFR 1910.402 as, "A diving mode in which the diver is supplied in the water with a breathing gas other than air." Therefore, if additional oxygen ($O_2$) content is added to breathable air that raises the $O_2$ content above 23.5%, it is considered to be a mixed-gas, and the 29 CFR 1910.426 standards would apply.

NOTE: The early terms for nitrogen-oxygen mixtures as used by the U.S. Navy were "nitrogen-oxygen mixtures" or "nitrox." Other terms often used to describe oxygen-rich mixtures include "oxygen-enriched air" (OEA) and "enriched-air nitrox" (EAN or EANx). The "x" in EANx evolved to state the oxygen percentage, as in EAN32 for 32% oxygen content. Additional terms used by NOAA include "NOAA Nitrox I" or "NN32" and "NOAA Nitrox II" or "NN36," referring, respectively, to the 32% and 36% mixtures commonly used in diving.

**Question #16: Where can I find information on faulty dive equipment that has been recalled?**

Answer: The Boating Safety Resource Center, sponsored by the U.S. Coast Guard, has this information for recreational boats and equipment (i.e., recalls, product assurance branch, etc.). ADCI routinely issues Safety Notices that are posted on their website that may contain product

information. In addition, the U.S. Consumer Product Safety Commission maintains a website, organized by hazard type, that lists recalled products (see www.cpsc.gov/cgi-bin/haz.aspx).

**Question #17: Is an elevated potable water tank in which diving occurs considered a permit-required confined space in accordance with 29 CFR 1910.146?**

Answer: Yes. In addition to 29 CFR 1910.146, employers must ensure that divers are protected to the appropriate levels required in 29 CFR 1910.134. For example, diving in an immediately dangerous to life and health (IDLH) atmosphere requires either a surface-supplied diving system, or SCUBA with a full facemask (i.e., SCUBA with a standard mask and second stage regulator would not meet 1910.134(d)(2)). General information regarding potable water diving is available in American Water Works Association (AWWA) *Standard C652-92, Section 5: Disinfection Procedures When Conducting Underwater Inspection of Potable-Water-Storage Facilities*. In addition, ADCI has a chapter titled, "Potable Water Diving Operations" in its 6th Edition of the *Consensus Standard for Commercial Diving and Underwater Operations*.

# APPENDIX B: Summary of OSHA Authority

## RESTRICTIONS AND LIMITATIONS ON OSHA's AUTHORITY

### GEOGRAPHICAL RESTRICTIONS

Federal OSHA's authority is restricted to the following geographical limits:

- State Territorial Seas – Extends three (3) nautical miles (nm)(1 nm = 6,080 ft.) from the general coastline for all coastal areas, except Puerto Rico, Texas, and the Gulf Coast of Florida, which extend nine (9) nm from the general coastline.

  NOTE: The State territorial seas for the East Coast of Florida extend three (3) nm and for the Gulf Coast of Florida extend nine (9) nm.

- International Boundary with Canada – All waters in the Great Lakes and St. Lawrence Seaway within the United States boundary line with Canada are included (i.e., no three (3) nm or nine (9) nm restriction since the Great Lakes and St. Lawrence Seaway are part of U.S. Inland Waters).

- Outer Continental Shelf (OCS) Lands – Begins at the outer limit of the State territorial seas and extends to the edge of the U.S. continental shelf (NOTE: the continental shelf varies in distance). OSHA authority on the OCS only applies to the sea floor or any structure attached thereto (it does not include the water above the sea floor, nor does it include vessels operating on the OCS).

### APPROPRIATIONS ACT LIMITATIONS

Current appropriations legislation exempts small employers in relatively low-hazard industries from programmed ("general schedule") OSHA inspections. For purposes of this appropriations exemption, a small employer is one that employs ten (10) or fewer employees. To qualify, the employer must be part of an industrial classification having a Days Away, Restricted, or Transferred (DART) rate, as determined from the OSHA 300 Log and an occupational illness and injury rate less than the national average rate for that industry as most recently published by BLS. The exemption does NOT affect OSHA's authority to take action relating to occupational health hazards; employee complaints of unsafe or unhealthful working conditions; fatalities, catastrophes, or imminent dangers; or investigations of discrimination under Section 11(c) of the OSH Act. OSHA Directive CPL 02-00-051 provides information on the current status of this Congressional exemption, while Appendix A to that instruction provides a list of industries with illness and injury rates currently below the national average.

## OSHA AND U.S. COAST GUARD AUTHORITY

### INSPECTED VESSELS

Under a 1983 Memorandum of Understanding between OSHA and the U.S. Coast Guard, the occupational safety and health of seamen on inspected vessels is the exclusive responsibility of the U.S. Coast Guard. The U.S. Coast Guard has safety and health authority over seamen working on an inspected vessel that is: (1) on the navigable waters of the U.S. (all U.S. Inland Waters and State territorial seas), and (2) owned in the U.S. and operated on the high seas (world-wide coverage).

OSHA has safety and health authority over working conditions of employees working on an inspected vessel, EXCEPT the working conditions of seamen and the working conditions of divers when the dive location is on an inspected vessel. Accordingly, the U.S. Coast Guard *Commercial Diving* regulations apply to diving operations when the dive location is on an inspected vessel (i.e., when diving operations are conducted from an inspected vessel). For inspected vessels, the OSHA standards most frequently involved are:

- Shipyard employment under 29 CFR Part 1915 – Covers all employees (other than seamen, and divers when the dive location is on an inspected vessel) who are engaged in shipbuilding, ship repair, or shipbreaking, or exposed to the hazards of such operations.

- Longshoring operations under 29 CFR Part 1918 – Covers all employees (other than seamen) who are engaged in longshoring operations or exposed to the hazards of such operations.

### UNINSPECTED VESSELS

The U.S. Coast Guard has exercised limited authority and issued limited regulations over the safety and health of employees working on an uninspected vessel, i.e., vessels that are not inspected vessels or recreational vessels. All of the following areas for uninspected vessels fall under the authority of the U.S. Coast Guard: fire extinguishers; life preservers and other lifesaving devices; flame arresters (backfire traps) on internal gas-driven engines; and venting of engine bilges and fuel tank compartment. Also, for commercial uninspected fishing industry vessels, the U.S. Coast Guard has issued various other requirements (46 CFR Part 28) dependent upon the type of vessel and the vessel's geographical area of operation (such as the vessel operates beyond the "boundary line" (see 46 CFR Part 7)).

OSHA has safety and health authority over an uninspected vessel for all occupational risks not covered by the U.S. Coast Guard. The OSHA standards most frequently involved for uninspected vessels include:

- Shipyard employment under 29 CFR Part 1915 – Covers all employees who are engaged in shipbuilding, ship repair, or ship breaking, or exposed to the hazards of such operations.

- Longshoring operations under 29 CFR Part 1918 – Covers all employees who are engaged in longshoring operations or exposed to the hazards of such operations.

- Commercial diving operations under 29 CFR Part 1910 – Covers all diving when the dive location is on an uninspected vessel. This includes diving from an uninspected vessel, and

doing work on an inspected vessel, such as hull scrubbing, propeller change, hull repair, etc.

NOTE: When the dive location is on an inspected vessel, the U.S. Coast Guard *Commercial Diving* regulations apply.

UNINSPECTED COMMERCIAL FISHING INDUSTRY VESSELS

The U.S. Coast Guard exercises limited authority and has issued limited regulations (see 46 CFR Part 28) over the safety and health of employees working on an uninspected commercial fishing industry vessel (see CPL 02-01-047, *OSHA Authority Over Vessels and Facilities on or Adjacent to U.S. Navigable Waters and the Outer Continental Shelf (OCS), February 22, 2010*). As per 46 CFR Part 28, the following limits are defined by the U.S. Coast Guard for uninspected commercial fishing industry vessels:

- Fish processors of 5,000 tons or less (only one vessel, the SS Ocean Phoenix, is currently known to exceed these limits; this vessel is an inspected vessel);
- Fish tenders of 500 tons or less; and
- Fishing vessels (all).

OSHA has safety and health authority over all employees, and for all working conditions, on an uninspected commercial fishing industry vessel that are not covered by the U.S. Coast Guard (see CPL 02-01-047, *OSHA Authority Over Vessels and Facilities on or Adjacent to U.S. Navigable Waters and the Outer Continental Shelf (OCS), February 22, 2010*). For uninspected commercial fishing industry vessels, the areas of OSHA coverage most frequently involved are:

- Uninspected commercial fishing industry vessels (see CPL 02-01-047, *OSHA Authority Over Vessels and Facilities on or Adjacent to U.S. Navigable Waters and the Outer Continental Shelf (OCS), February 22, 2010*) – Covers all employees who are engaged in work on uninspected commercial fishing industry vessels (fish processor vessels, fish tender vessels, and fishing vessels).
- Shipyard employment under 29 CFR Part 1915 – Covers all employees who are engaged in shipbuilding, ship repair, or shipbreaking, or are exposed to the hazards of such operations.
- Longshoring operations under 29 CFR Part 1918 – Covers all employees who are engaged in longshoring operations or exposed to the hazards of such operations.
- Commercial diving operations under 29 CFR Part 1910 – Covers all diving when the dive location is on an uninspected fishing industry vessel. This includes diving from an uninspected commercial fishing industry vessel when the divers are doing work on an inspected vessel (such as hull scrubbing, propeller change, hull repair).

  NOTE: When the dive location is on an inspected vessel, then the U.S. Coast Guard *Commercial Diving* regulations apply.

  NOTE: For commercial fish processor vessels over 5,000 tons (inspected vessels), the U.S. Coast Guard has authority over seaman engaged in any work activity.

COMMERCIAL DIVING

The U.S. Coast Guard regulations for commercial diving operations are specified in 46 CFR, Chapter I, Part 197, Subpart B. U.S. Coast Guard regulations state the following coverage:

- At Deepwater Ports or the safety zone (to 5 nautical miles) thereof as per 33 CFR Part 150.
- From any artificial island, installation, or other device on the Outer Continental Shelf.
- From all vessels that have a valid certificate of inspection (inspected vessels).
- From any vessel engaged in activities related to Outer Continental Shelf lands.

OSHA covers commercial diving operations within OSHA's geographical authority when such operations are not covered by the U.S. Coast Guard. As delineated in 29 CFR 1910.401(a)(2), OSHA exempts from coverage of the commercial diving operations standard: SCUBA instructors conducting SCUBA air dives within the no-decompression limits; diving performed for search, rescue, and public safety purposes; human research diving subjects; and scientific diving. To qualify for the scientific diving exemption, all of the requirements in 29 CFR 1910.401(a)(2)(iv) and Appendix B to 29 CFR Part 1910, Subpart T, must be met. More comprehensive guidance regarding exclusions and exemptions from the commercial diving operations standard is provided in Appendix C of this instruction.

**FEDERAL AND STATE AUTHORITY**

Federal OSHA's commercial diving standard covers private-sector employers in federal enforcement States, and employers who dive in association with maritime standards (i.e., shipyard employment, longshoring, and marine terminals) when these operations are not covered by a State with an OSHA-approved State-Plan; State and local government employees are covered by the commercial diving standard only in States with State-Plans.

Twenty-one States and one Territory have OSHA-approved State-Plans covering both private- and public-sector employment: Alaska, Arizona, California, Hawaii, Indiana, Iowa, Kentucky, Maryland, Michigan, Minnesota, Nevada, New Mexico, North Carolina, Oregon, Puerto Rico, South Carolina, Tennessee, Utah, Vermont, Virginia, Washington, and Wyoming.

Four States and one Territory (Connecticut, Illinois, New Jersey, New York, and the U.S. Virgin Islands) have approved plans covering State and local government employment only.

California, Michigan, Oregon, and Washington have published and promulgated State diving standards which differ from the federal standards. The other State-Plans have promulgated diving standards identical to the federal standards at 29 CFR Part 1910, Subpart T.

NOTE: See the consolidated State Plan Matrix at the end of this appendix.

California, Minnesota, Vermont, and Washington cover certain private-sector maritime operations (i.e., shore-based shipyard employment and marine terminals) under their State-Plans. State coverage is set out in the text of this directive and in the appropriate subparts of 29 CFR

Part 1952, and is generally limited to shore-based activities not on the U.S. navigable waters (graving docks, shiplifts, and marine railways are part of U.S. navigable waters). For specific guidance, see section XII., paragraph A.9.c., of this directive. Also, Oregon covers commercial diving from all shore-side locations (for the definition of "dive location" see section XII., paragraph B.11.), even in maritime operations such as shipyard employment and marine terminals.

## Federal and State Coverage for Commercial Diving

| State/Territory | Diving Standard | OSHA Plan Coverage |
|---|---|---|
| Alabama | Federal OSHA | FEDERAL: Private Sector Only |
| Alaska | Identical to Federal OSHA | STATE: Private Sector + State/Local Gov't Employees |
| Arizona | Identical to Federal OSHA | STATE: Private Sector + State/Local Gov't Employees |
| Arkansas | Federal OSHA | FEDERAL: Private Sector Only |
| California [Notes 1, 2] | State Diving Standard | STATE: Private Sector + State/Local Gov't Employees |
| Colorado | Federal OSHA | FEDERAL: Private Sector Only |
| Connecticut | Federal OSHA / Identical to Federal OSHA | FEDERAL: Private Sector//STATE: State/Local Gov't Employees |
| Delaware | Federal OSHA | FEDERAL: Private Sector Only |
| Florida | Federal OSHA | FEDERAL: Private Sector Only |
| Georgia | Federal OSHA | FEDERAL: Private Sector Only |
| Hawaii | Identical to Federal OSHA | STATE: Private Sector + State/Local Gov't Employees |
| Idaho | Federal OSHA | FEDERAL: Private Sector Only |
| Illinois | Federal OSHA / Identical to Federal OSHA | FEDERAL: Private Sector//STATE: State/Local Gov't Employees |
| Indiana | Identical to Federal OSHA | STATE: Private Sector + State/Local Gov't Employees |
| Iowa | Identical to Federal OSHA | STATE: Private Sector + State/Local Gov't Employees |
| Kansas | Federal OSHA | FEDERAL: Private Sector Only |
| Kentucky | Identical to Federal OSHA | STATE: Private Sector + State/Local Gov't Employees |
| Louisiana | Federal OSHA | FEDERAL: Private Sector Only |
| Maine | Federal OSHA | FEDERAL: Private Sector Only |
| Maryland | Identical to Federal OSHA | STATE: Private Sector + State/Local Gov't Employees |
| Massachusetts | Federal OSHA | FEDERAL: Private Sector Only |
| Michigan [Note 1] | State Diving Standard | STATE: Private Sector + State/Local Gov't Employees |
| Minnesota [Note 2] | Identical to Federal OSHA | STATE: Private Sector + State/Local Gov't Employees |
| Mississippi | Federal OSHA | FEDERAL: Private Sector Only |
| Missouri | Federal OSHA | FEDERAL: Private Sector Only |
| Montana | Federal OSHA | FEDERAL: Private Sector Only |
| Nebraska | Federal OSHA | FEDERAL: Private Sector Only |
| Nevada | Identical to Federal OSHA | STATE: Private Sector + State/Local Gov't Employees |
| New Hampshire | Federal OSHA | FEDERAL: Private Sector Only |
| New Jersey | Federal OSHA / Identical to Federal OSHA | FEDERAL: Private Sector//STATE: State/Local Gov't Employees |
| New Mexico | Identical to Federal OSHA | STATE: Private Sector + State/Local Gov't Employees |
| New York | Federal OSHA / Identical to Federal OSHA | FEDERAL: Private Sector//STATE: State/Local Gov't Employees |
| North Carolina | Identical to Federal OSHA | STATE: Private Sector + State/Local Gov't Employees |
| North Dakota | Federal OSHA | FEDERAL: Private Sector Only |
| Ohio | Federal OSHA | FEDERAL: Private Sector Only |
| Oklahoma | Federal OSHA | FEDERAL: Private Sector Only |
| Oregon [Note 1] | State Diving Standard | STATE: Private Sector + State/Local Gov't Employees |
| Pennsylvania | Federal OSHA | FEDERAL: Private Sector Only |
| Puerto Rico | Identical to Federal OSHA | STATE: Private Sector + State/Local Gov't Employees |
| Rhode Island | Federal OSHA | FEDERAL: Private Sector Only |
| South Carolina | Identical to Federal OSHA | STATE: Private Sector + State/Local Gov't Employees |
| South Dakota | Federal OSHA | FEDERAL: Private Sector Only |
| Tennessee | Identical to Federal OSHA | STATE: Private Sector + State/Local Gov't Employees |
| Texas | Federal OSHA | FEDERAL: Private Sector Only |
| Utah | Identical to Federal OSHA | STATE: Private Sector + State/Local Gov't Employees |
| Vermont [Note 2] | Identical to Federal OSHA | STATE: Private Sector + State/Local Gov't Employees |
| Virginia | Identical to Federal OSHA | STATE: Private Sector + State/Local Gov't Employees |
| Virgin Islands | Federal OSHA / Identical to Federal OSHA | FEDERAL: Private Sector//STATE: State/Local Gov't Employees |
| Washington [Notes 1, 2] | State Diving Standard | STATE: Private Sector + State/Local Gov't Employees |
| West Virginia | Federal OSHA | FEDERAL: Private Sector Only |
| Wisconsin | Federal OSHA | FEDERAL: Private Sector Only |
| Wyoming | Identical to Federal OSHA | STATE: Private Sector + State/Local Gov't Employees |

| |
|---|
| Note 1: Four States (CA, MI, OR, WA) have published unique State diving standards. |
| Note 2: Four States (CA, MN, VT, WA) have shore-side coverage of maritime industries. |

## APPENDIX C: Exclusions and Exemptions from OSHA's Commercial Diving Standard

This appendix provides a summary review of the history, scope, and application of exclusions and exemptions to 29 CFR Part 1910, Subpart T – Commercial Diving Operations. Federal Register notices relevant to the development of the original OSHA diving standard and the subsequent amendment for the scientific diving exemption are cited in this summary; reference to these notices will provide a more comprehensive understanding of the issues involved.

### THE ORIGINAL COMMERCIAL DIVING STANDARD AND SCOPE OF OSHA's STATUTORY AUTHORITY

On July 22, 1977, the U.S. Department of Labor's Occupational Safety and Health Administration (OSHA) issued final public notice of the adoption of a permanent diving standard that became effective on October 20, 1977 (see Federal Register notice 42 FR 37650). This original diving standard, 29 CFR Part 1910, Subpart T – Commercial Diving Operations, established mandatory occupational safety and health requirements for commercial diving operations. The standard applies wherever OSHA has statutory authority. Consequently, the standard covers commercial diving in any natural or artificial inland body of water, as well as diving along the coasts (i.e., State territorial seas) of the United States and its possessions listed in Section 4(a) of the Occupational Safety and Health (OSH) Act (29 U.S.C. 655 *et al.*). For coastal States and Territories, the State territorial seas extend three (3) nautical miles seaward from the coastline, except for the Gulf Coast of Florida, Texas, and Puerto Rico, where the State territorial seas extend for nine (9) nautical miles from the general coastline. For States bordering the Great Lakes and St. Lawrence Seaway, all waters in the Great Lakes and associated rivers, up to the international boundary line with Canada, are U.S. navigable waters (U.S. Inland Waters).

### ORIGINAL EXCLUSIONS FROM OSHA's COMMERCIAL DIVING STANDARD

The original OSHA diving standard provided three specific exclusions which remain in effect as follows:

1. Instructional diving utilizing only open-circuit compressed air SCUBA within the no-decompression limits. OSHA concluded that a valid distinction existed between SCUBA diving instructors and commercial divers which warranted an exclusion. The SCUBA diving instructor, who is an employee, is student oriented – not task oriented. The dive location is not determined by the location of a particular job as it is in commercial applications, where operations must of necessity be conducted under environmental conditions that are often adverse. The SCUBA diving instructor, by contrast, selects a location which is usually clear, shallow, and warm. Indeed, a swimming pool is the dive location for most SCUBA diving instruction. Such dives are discontinued if the slightest difficulty occurs. SCUBA diving instructors do not utilize construction tools, handle explosives, or use welding or burning tools. As a result of these factors, SCUBA diving instructors are rarely exposed to adverse sea states, temperature extremes, great depths, poor visibility, or heavy workloads, some or all of which are common to the majority of commercial diving operations. However, OSHA took into consideration that

some diving techniques and conditions pose greater potential hazards than others, regardless of the purpose of the dive. Thus, this exclusion for SCUBA diving instruction was limited to a restricted diving range, a particular diving mode, and specific equipment. The exclusion from the standard applies only to instructional diving which uses open-circuit compressed air SCUBA and is conducted within the no-decompression limits. The standard defines no-decompression limits as the depth-time limits of the "no-decompression limits and repetitive dive group designation table for no-decompression air dives" of the U.S. Navy Diving Manual, or equivalent limits that the employer can demonstrate to be equally effective. No distinction *per se* is made between instructors of prospective recreational divers and instructors of prospective commercial divers. However, the training for commercial divers involves diving that is surface-supplied, uses mixed-gas as a breathing gas, requires decompression, often involves adverse environmental conditions, or involves the use of underwater tools and equipment; each of these factors potentially increases the hazards of the operation. It is emphasized that when recreational diving instruction exceeds the specified limits, the OSHA diving standard applies. It is noted that individuals engaged in recreational diving not otherwise related to their respective employments, are not within the authority of the OSH Act, and, are outside the scope of OSHA's diving standard. On the other hand, SCUBA diving for a commercial rather than instructional purpose is covered by the OSHA diving standard, regardless of equipment or depth-time range.

2. Search, rescue, and related public-safety diving by or under the control of a governmental agency. OSHA received a number of comments from persons engaged in diving incidental to police and public-safety functions, and the Agency concluded that an exclusion was appropriate for such applications. The purpose of the "by or under the control of a governmental agency" language is to make the exclusion applicable to all divers whose purpose is to provide search, rescue, or public-safety diving services under the direction and control of a governmental agency (such as local, State, or federal government) regardless of whether or not such divers are, strictly speaking, government employees. In excluding these search and rescue operations, OSHA determined that safety and health regulation of the police and related functions are best carried out by the individual States or their political subdivisions. It is pointed out that this exclusion does not apply when work other than search, rescue, and related public-safety diving is performed (such as divers repairing a pier). Diving contractors who occasionally perform emergency services, and who are not under the control of a governmental agency engaging their services, do not come under this exclusion. Such divers may, however, be covered by the provision concerning application of the standard in an emergency (see 29 CFR 1910.401(b) and section XII., paragraph A.8., in this instruction).

3. Diving governed by the Protection of Human Subjects regulations of the Department of Health and Human Services (HHS)(previously known as the Department of Health, Education and Welfare (HEW)) or equally effective rules or regulations of another federal agency. Diving operations which are governed by 45 CFR Part 46 are not within the scope of OSHA's commercial diving standard. Such operations involve research and development or related scientific activities requiring human subjects, and receive HHS grants or contracts. Compliance with HHS regulations is mandatory for such employers or contractors, and the regulations are designed to promote safety and health. Similarly, any other federal agency that adopts rules or regulations that are equally effective (i.e., similar in design, purpose, and effect to those of HHS) are covered by this exclusion. The exclusion is supported in the record on the grounds that it would permit continued scientific research designed to extend the safe limits of diving physiology and technology. The long-term safety and health interests of divers are best served

by this research, and such diving cannot reasonably be expected to comply in every respect with a standard that is designed to reflect current commercial diving operational practice.

EMERGENCY PROVISION OF OSHA's COMMERCIAL DIVING STANDARD

The original OSHA diving standard also included a provision for emergency situations (see 29 CFR 1910.401(b)), which remains in effect, when the overriding consideration is the preservation of life and the protection of the environment.

The "emergency provision" permits deviations from the requirements of OSHA's diving standard in situations where death, serious physical harm, or major environmental damage is likely, but only to the extent that such action is immediately necessary to prevent or minimize the harm. No exemption is provided by the emergency provision for situations where purely economic or property damage is likely. Although temporarily exempt from substantive portions of the standard that are inappropriate in such emergency situations, employers are required to notify the nearest OSHA Area Office within 48 hours of the emergency event. Further, upon the request of the Area Director, employers must submit a record of the notification, with an indication and explanation of what deviations from the standard were taken as a result of the emergency. This reporting requirement enables OSHA to monitor the use of this exemption.

NOTE: The emergency provision is not a substitute for the variances specified under Section 6(d) of the OSH Act. These variances permit alternative means of compliance that are not exemptions from a standard, and that afford employees at least the same degree of protection that the standard provides; these variances typically address well-defined, non-emergency circumstances. The emergency provision applies to unique, unplanned emergency circumstances for which diving services are sometimes needed on a temporary basis, thus making an OSHA variance unnecessary and inappropriate.

SCIENTIFIC DIVING EXEMPTION – BACKGROUND AND DEVELOPMENT

The original OSHA standard for commercial diving operations did not exempt diving performed solely for scientific research and development purposes. Subsequent to the publication of OSHA's original standard, the Agency received numerous requests from various individuals and organizations to reconsider the applicability of the standard to educational/scientific diving. Proponents for exempting educational/scientific diving noted that it was customary for the educational/scientific diving community to follow well-established, consensual standards of safe practice. They pointed out that the first set of consensual diving standards was developed by the Scripps Institution of Oceanography of the University of California in the early 1950s. Further, in 1973, diving safety boards and committees from ten major educational institutions involved in education/scientific diving met and accepted the University of California "*Guide for Diving Safety*" as a minimum standard for their individual programs. Therefore, it was contended that most diving programs at educational institutions were complying with this consensual standard, with limited modifications for regional and operational variations in diving, before the publication of the original OSHA diving standard. The educational/scientific diving community pointed to their excellent safety record prior to OSHA's publication of a diving standard, and attributed their safety record to the effectiveness of self regulation by their community. Further, they noted that significant differences exist between educational/scientific diving and commercial diving. The educational/scientific diver is an observer and data gatherer who

chooses the work area and diving conditions that will minimize environmental stresses, and maximize the safety and efficiency of gathering data. In contrast, it was noted that the commercial diver is an underwater construction worker, builder, and trouble shooter whose work area and diving conditions are determined by the location and needs of the project.

Based on the concerns expressed by the educational/scientific diving community, on August 17, 1979, OSHA published an advance notice of proposed rulemaking (ANPR) (see Federal Register notice 44 FR 48274) to obtain additional information concerning which provisions of the OSHA diving standard were causing the most difficulty, and what modifications to the standard should be considered. The responses to the ANPR, together with other information and data contained in OSHA's commercial diving record, convinced the Agency that there was a significant difference between educational/scientific diving and commercial diving; that the safety record of the educational/scientific diving community represented evidence of its successful self-regulation; and, as a result, an exemption for educational/scientific diving might be justified. Accordingly, on March 26, 1982, OSHA published a notice of proposed rulemaking (see Federal Register notice 47 FR 13005) to exempt diving "performed solely for marine scientific research and development purposes by educational institutions" from the OSHA diving standard. Although it was proposed to exempt only educational institutions which perform scientific diving, in the notice of proposed rulemaking OSHA requested responses to three specific questions to solicit data and information for determining if the exemption should include other segments of the scientific diving community. The original closing date for the comment period for this notice of proposed rulemaking was May 10, 1982; however, on May 26, 1982, OSHA published a notice (see Federal Register notice 47 FR 22972) extending the comment period as requested by the American Academy of Underwater Sciences to June 18, 1982, and scheduled informal public hearings for June 29-30, 1982, in Washington, DC, and July 7-9, 1982, in Los Angeles, California. Following completion of the public hearings, the submission of post-hearing comments, and receipt of arguments and briefs relating to the hearing issues, the Administrative Law Judge certified the record on September 3, 1982.

Based on the overwhelming support from comments and hearing testimony, as well as other information contained in the record, OSHA concluded that an exemption was justified for all scientific diving, not just solely scientific diving performed by educational institutions. Therefore, OSHA decided to broaden the exemption to include all segments of the scientific diving community. Based on the record, OSHA's exemption for scientific diving included specified conditions that scientific diving programs must meet before members of the scientific diving community may avail themselves of the exemption. On November 26, 1982, OSHA exempted scientific diving from coverage under 29 CFR Part 1910, Subpart T – Commercial Diving Operations, provided that the diving meets the Agency's definition of scientific diving and is under the direction and control of a diving program utilizing a safety manual and a diving control board meeting certain specified criteria (see Federal Register notice 47 FR 53357 and 29 CFR 1910.401(a)(2)(iv)).

The November 1982 scientific exemption was subsequently challenged by the United Brotherhood of Carpenters and Joiners (UBCJ) under Section 6(f) of the OSH Act. The union filed a petition for judicial review of the final rule regarding the scientific exemption, and on April 4, 1984, the U.S. Court of Appeals for the District of Columbia Circuit issued a memorandum and court order that required further action regarding this final rule. In compliance with the court's memorandum and order, OSHA published a notice on July 18, 1984

(see Federal Register notice 49 FR 29105), that reopened the record, and required a determination of the interpretive guidelines that OSHA proposed to use in determining which enterprises may avail themselves of the exemption for scientific diving. Final action regarding this court order was concluded and published by OSHA on January 9, 1985 (see Federal Register notice 50 FR 1046), *Commercial Diving Operations – Exemption for Scientific Diving – Final Guidelines*. This notice established the final guidelines that OSHA uses, in conjunction with the exemption criteria contained in the final rule (see Federal Register notice 47 FR 53357 and 29 CFR 1910.401(a)(2)(iv)), to determine whether a scientific diving program can avail itself of the exemption from the OSHA commercial diving standard. The absence of any factor specified in the guidelines (see Appendix B to 29 CFR Part 1910, Subpart T – Commercial Diving Operations), or the final rule (see 29 CFR 1910.401(a)(2)(iv)), renders a diving program ineligible for the exemption.

SCIENTIFIC DIVING EXEMPTION – DISCUSSION OF THE FINAL RULE AND GUIDELINES

The final rule at 29 CFR 1910.401(a)(2)(iv), which became effective on November 26, 1982, exempts any diving operation that is defined as scientific diving, and that is under the direction and control of a diving program containing at least the following elements:

(A) Diving safety manual that 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 shall, at a minimum, have the authority to: approve and monitor diving projects; review and revise the diving safety manual; ensure 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 (i.e., a diver is accompanied by, and is in continuous contact, with another diver in the water) for SCUBA diving.

In addition to the final rule, Appendix B to 29 CFR Part 1910, Subpart T – Commercial Diving Operations, titled "Guidelines for Scientific Diving," became effective on January 9, 1985. This appendix provides guidelines that are used in conjunction with the final rule to determine those scientific diving programs that are exempt from OSHA's diving standard. The guidelines are as follows:

1. "The Diving Control (safety) Board consists of a majority of active scientific divers and has autonomous and absolute authority over the scientific diving program's operations."

The first guideline concerns organizational structure. OSHA concluded that the organizational structure of the scientific diving community's consensual standard program is not only vital to the integrity of scientific diving programs, but effectively serves to segregate scientific diving from commercial diving. The Diving Control Board required for scientific diving programs must contain several elements that distinguish the exempt scientific diving programs from commercial diving. These distinctive elements include absolute authority over diving operations, the autonomy inherent in the Diving Control Board's decision making powers and responsibilities, and peer review. OSHA's intent was for the Diving Control Board, primarily

consisting of the divers themselves, to regulate the diving activities in a manner consistent with that described by the scientific diving community during the rulemaking process. Therefore, OSHA requires that Diving Control Boards have this autonomous and absolute authority over scientific diving operations. OSHA also concluded that the peer review system has successfully regulated scientific diving programs and, therefore, OSHA mandated that the majority of members of the Diving Control Board be active divers. OSHA's intent with respect to this "peer review" was that the active divers required to make up the Diving Control Board would be scientists who actively dive, since at issue was the control of a scientific program. Thus, OSHA interprets the membership requirement as it was intended in the final rule. The "majority of active divers" on the Diving Control Board also must be scientists.

2. "The purpose of the project using scientific diving is the advancement of science; therefore, information and data resulting from the project are non-proprietary."

The second guideline concerns the restricted purpose of the project. In part, the definition of scientific diving is "diving performed solely as a necessary part of a scientific, research, or educational activity" (see Federal Register notice 47 FR 53365 and 29 CFR 1910.402). The National Oceanic and Atmospheric Administration (NOAA) Diving Manual notes that "marine research using diving as a tool has been important in understanding the ocean, its organisms, and its dynamic processes." Such diving includes the study of fish behavior, ecological surveys, and benthic surveys (the aggregate of organisms living on or at the bottom of a body of water). Scientific diving is an adjunct used in the advancement of underwater science. For example, representatives from the scientific diving community noted during public hearings and in written comments, "Our objective is to promote the advancement of science and the use of underwater methods," and "Research and the furtherance of scientific knowledge are their (the divers) primary goals," results are "shared worldwide," and, further, that coverage of the scientific diving community by 29 CFR Part 1910, Subpart T – Commercial Diving Operations, may cause "irreparable damage to the underwater scientific effort of the United States." Because of the exemplary safety record, OSHA restricted the purpose of the scientific diving exemption to the advancement of science. OSHA recognizes that the advancement of science cannot occur unless such studies are made available to contribute to, and enhance, scientific knowledge. Therefore, OSHA's intent was to restrict the exemption to scientific research dives that result in non-proprietary information, data, knowledge, or other work product. The requirement that information be non-proprietary applies to scientific, research, and educational activities engaged in by scientific divers. Material available to the public for review is non-proprietary, whether or not it is published; material not available for review is proprietary.

3. "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."

The third guideline concerns the tasks performed. The scientific diving definition in the standard states that such diving must be done by employees whose sole purpose for diving is to perform scientific research tasks. Also contained in the definition is a list of those tasks that are traditionally considered commercial, with emphasis on construction and the use of construction tools (such as heavy equipment, power tools, explosives, welding equipment, burning equipment). As OSHA discussed in the final rule (see Federal Register notice 47 FR 53357), a commercial diver is typically an underwater construction worker, builder, and troubleshooter; a

scientific diver is an observer of natural phenomena or responses of natural systems, and a gatherer of data for scientific analysis. The tasks performed by the scientific diver usually are light and short in duration; if any hand tools are used, they are simple ones (such as a small hammer, collecting jars, special hand-held measuring devices, plastic core tubes, hand net, suction fish collector, camera, or slate pencil). As was indicated in a Federal Register notice (49 FR 29105), an example of task distinction might involve a scientific study of kelp. The construction of the kelp bed used in the project is not scientific diving since construction activities are commercial diving tasks; however, the consequent studies made of the kelp would be scientific diving tasks. Another example of task distinction was provided in the discussion of the final guidelines (see Federal Register notice 50 FR 1046). Lowering a large object into the water (such as the Project Aquarius habitat), even though a part of a scientific project, is not scientific diving. The special skills of an underwater scientist, including observation and data-collection skills, do not contribute to the placement of a large object underwater. OSHA avoided the possibility of the exemption applying to scientific divers who undertake such tasks while participating in a scientific research project by focusing the definition on the sole purpose of the dive (i.e., scientific research tasks), eliminating dives with mixed purposes, and further indicating typical examples of what OSHA considers to be commercial tasks. It is noted that the scientific diving community supported this limited definition (see the *amicus* brief in United Brotherhood of Carpenters and Joiners v. Department of Labor, No. 82-2509 (D.C. Cir. 1982)).

4. "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."

The fourth guideline concerns special qualifications. As was previously noted, a scientific diver is an observer and data gatherer involved in studying the underwater environment, its organisms, and its dynamic processes, to promote underwater science. OSHA concluded, based on the nature of these activities, that these divers must be able to use scientific expertise in studying and analyzing the underwater environment. Consequently, OSHA requires these divers to be scientists or scientists in training. For example, a project to map segments of the ocean floor might hire commercial divers to undertake certain mapping tasks. These commercial divers are neither scientists nor scientists in training as prescribed by this guideline and, therefore, would not be eligible for the exemption. If, however, scientific expertise was needed to effectively accomplish tasks associated with the mapping (such as specialized geological knowledge), and a geologist trained as a diver performed the special geological tasks associated with the mapping, then such diving tasks would meet this particular criterion. As stated previously, however, all program criteria and guidelines must be met for this diving scenario to qualify for the exemption. In promulgating the exemption, OSHA rejected using credentials to determine who is a scientist. However, the Agency accepted the limitation that divers covered by the exemption had to be scientists because this limitation reflects the scientific diving community's underwater activities, and it prevents obvious commercial diving from being construed as scientific diving.

## APPENDIX D: No-Decompression Limits and Repetitive-Group Designation Table for No-Decompression Air Dives

The information in this appendix (including the table on page D-3) was adapted from the U.S. Navy Diving Manual (Revision 6), Volume 2 ("Air Decompression"), Section 9-7 ("No-Decompression Limits and Repetitive Group Designators for No-Decompression Air Dives").

The table (Table 9-7) at the end of this appendix serves three purposes. First, it shows that dives to 20 fsw and shallower have unlimited (no-decompression) bottom times. Second, it summarizes all the depth and bottom-time combinations for which the no-decompression limits apply. Third, it provides the repetitive-group designation for each of these dives. Any dive to 25 fsw or deeper that has a bottom time greater than the no-decompression limits provided in this table is a decompression dive, and must comply with the appropriate air decompression table.

Even though decompression is not required when diving within the no-decompression limits listed in the table, some nitrogen remains in the diver's tissues for up to 12 hours following an air dive. Consideration must be given to this residual nitrogen in the diver's tissues when calculating decompression for subsequent (i.e., repetitive) dives.

Each depth listed in the table has a corresponding no-decompression limit listed in minutes. This limit is the maximum bottom time that a diver can spend at that depth without requiring decompression. Use the columns to the right of the column marked "No-Stop Limit" to obtain the repetitive-group designation. A repetitive-group designation must be assigned to a diver after every dive. To find repetitive-group designations, follow these steps:

1. Enter the table at the depth equal to, or next greater than, the recorded maximum depth of the dive.

   NOTE: 2 fsw is added to the recorded maximum depth of the dive.

2. Follow that row to the right to find the bottom time equal to, or just greater than, the actual bottom time of the dive.

   NOTE: Seconds of time are rounded to the next greater minute of time.

3. Follow the column up to the repetitive-group letter designation.

Example. The employer wants a diver to conduct a brief inspection of the work site, located at a depth of 152 fsw. Determine the maximum no-decompression limit (bottom time) and the repetitive-group designation for the diver.

1. Locate the dive depth in the column marked "Depth (fsw)." Since no entry is provided for 154 (152 +2) fsw, round the depth to the next deepest depth shown in the column (i.e., 160 fsw).

2. Move horizontally across the table to find the maximum no-decompression limit in the column marked "No-Stop Limits." The maximum no-decompression limit for this depth is 5

minutes. Therefore, to avoid decompression, the diver must descend to 152 fsw, make the inspection, and begin the ascent within 5 minutes of leaving the surface.

3. To find the repetitive-group designation for this dive, move horizontally to the right of the 160-fsw entry in the "Depth (fsw)" column to the figure "5" under the columns marked "Repetitive Group Designation" ("5" represents the 5-minute bottom time for this dive). Then move upwards in this column to the letter ("C") at the top of the column. "C" is the repetitive-group designation for this dive.

   NOTE: This table, "No-Decompression Limits and Repetitive Group Designators for No-Decompression Air Dives" is based on an ascent rate of 60 feet per minute or 1 foot per second.

*Table 9-7. No-Decompression Limits and Repetitive Group Designators for No-Decompression Air Dives.*

| Depth (fsw) | No-Stop Limit | Repetitive Group Designation | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | Z |
| 10 | Unlimited | 57 | 101 | 158 | 245 | 426 | * | | | | | | | | | | |
| 15 | Unlimited | 36 | 60 | 88 | 121 | 163 | 217 | 297 | 449 | * | | | | | | | |
| 20 | Unlimited | 26 | 43 | 61 | 82 | 106 | 133 | 165 | 205 | 256 | 330 | 461 | * | | | | |
| 25 | 595 | 20 | 33 | 47 | 62 | 78 | 97 | 117 | 140 | 166 | 198 | 236 | 285 | 354 | 469 | 595 | |
| 30 | 371 | 17 | 27 | 38 | 50 | 62 | 76 | 91 | 107 | 125 | 145 | 167 | 193 | 223 | 260 | 307 | 371 |
| 35 | 232 | 14 | 23 | 32 | 42 | 52 | 63 | 74 | 87 | 100 | 115 | 131 | 148 | 168 | 190 | 215 | 232 |
| 40 | 163 | 12 | 20 | 27 | 36 | 44 | 53 | 63 | 73 | 84 | 95 | 108 | 121 | 135 | 151 | 163 | |
| 45 | 125 | 11 | 17 | 24 | 31 | 39 | 46 | 55 | 63 | 72 | 82 | 92 | 102 | 114 | 125 | | |
| 50 | 92 | 9 | 15 | 21 | 28 | 34 | 41 | 48 | 56 | 63 | 71 | 80 | 89 | 92 | | | |
| 55 | 74 | 8 | 14 | 19 | 25 | 31 | 37 | 43 | 50 | 56 | 63 | 71 | 74 | | | | |
| 60 | 60 | 7 | 12 | 17 | 22 | 28 | 33 | 39 | 45 | 51 | 57 | 60 | | | | | |
| 70 | 48 | 6 | 10 | 14 | 19 | 23 | 28 | 32 | 37 | 42 | 47 | 48 | | | | | |
| 80 | 39 | 5 | 9 | 12 | 16 | 20 | 24 | 28 | 32 | 36 | 39 | | | | | | |
| 90 | 30 | 4 | 7 | 11 | 14 | 17 | 21 | 24 | 28 | 30 | | | | | | | |
| 100 | 25 | 4 | 6 | 9 | 12 | 15 | 18 | 21 | 25 | | | | | | | | |
| 110 | 20 | 3 | 6 | 8 | 11 | 14 | 16 | 19 | 20 | | | | | | | | |
| 120 | 15 | 3 | 5 | 7 | 10 | 12 | 15 | | | | | | | | | | |
| 130 | 10 | 2 | 4 | 6 | 9 | 10 | | | | | | | | | | | |
| 140 | 10 | 2 | 4 | 6 | 8 | 10 | | | | | | | | | | | |
| 150 | 5 | 2 | 3 | 5 | | | | | | | | | | | | | |
| 160 | 5 | | 3 | 5 | | | | | | | | | | | | | |
| 170 | 5 | | | 4 | 5 | | | | | | | | | | | | |
| 180 | 5 | | | 4 | 5 | | | | | | | | | | | | |
| 190 | 5 | | | 3 | 5 | | | | | | | | | | | | |

* Highest repetitive group that can be achieved at this depth regardless of bottom time.

This table is from the U.S. Navy Diving Manual (Revision 6).

D-3

## APPENDIX E: Requirements and Typical Duties of Diver Tenders

**Requirements for Tending a Diver**

Tending a diver is addressed in 29 CFR Part 1910, Subpart T – Commercial Diving Operations, as follows:

- 29 CFR 1910.424(b)(3) requires SCUBA divers to be line-tended against currents exceeding one (1) knot (1.689 feet per second, or about 17 feet per 10 seconds).

  NOTE: This requirement applies even when one diver is accompanied by another diver. One surface-tending line (safety line) is sufficient provided that the two divers are connected via a "buddy-line."

  NOTE: Currents are typically measured at the surface. However, currents may be stronger below the surface, depending on what is generating the current and the geometric layout of the flow. For example, the maximum current in a small tidal estuary stream with brackish water is typically located at ⅓ of the total depth of the water column (e.g., 8 feet below the surface in a 24-foot deep channel).

- 29 CFR 1910.424(b)(4) and 1910.424(c)(3) require SCUBA divers to be line-tended when they are in an enclosed or physically confining space, and a diver must be stationed at the underwater point of entry to the enclosed or physically confining space.

- 29 CFR 1910.424(c)(2) requires SCUBA divers to be either line-tended from the surface, or accompanied by another diver in the water who is in continuous visual contact with the SCUBA diver during the diving operation.

- 29 CFR 1910.425(c)(1) requires that each diver be continuously tended during surface-supplied air dives of 100 fsw or less.

- 29 CFR 1910.425(c)(4) requires that a separate dive-team member tend each diver in the water during surface-supplied air dives deeper than 100 fsw, or that exceed the no-decompression limits.

- 29 CFR 1910.426(c)(1) requires that a separate dive-team member shall tend each diver in the water for all mixed-gas diving.

**Typical Duties of a Diver Tender**

The following discussion details the typical duties of a diver tender for a surface-supplied diving operation.

The general duties of a tender are to: assist the diver with checking and donning equipment; continuously tend the diver's umbilical during water entry/exit; continuously tend the diver's umbilical and be aware of the diver's depth and location at all times while the diver is in the water; assist the diver in undressing; and continually monitor the diver after completion of the

dive as directed by the DPIC (i.e., designated person-in-charge; commonly referred to as the diving supervisor) (NOTE: the diver normally is monitored for a minimum period of ten minutes following a dive). The tender shall not be assigned any task other than tending the diver, unless specifically directed to do otherwise by the DPIC and properly relieved as tender by another dive-team member. Specifically, the diver tender:

- Assists the diver in donning diver-worn equipment. The following is a typical dressing procedure for surface-supplied diving operations:
    - Don diving dress (such as a wet suit, dry suit, hot-water suit, or chaffing garment).
    - Don diver's harness, secure, and adjust.
    - If weighted diving shoes or ankle weights are used, they are placed on the diver by the tender and secured.
    - Don necking and secure if helmet is to be used.
    - Don and adjust weight belt.
    - Secure knife to belt, leg, or arm as per diver's preference.
    - With the diver or a second dive-team member holding the mask or helmet, secure the emergency gas cylinder (when used).
    - Secure the umbilical assembly to harness.
    - Don mask or helmet and secure mask harness or helmet clamp.
    - After properly dressing the diver, ensure that all equipment is functioning properly, and inform the DPIC that the diver is ready.

- When the diver is ready to dive, the tender directs and assists the diver from the dressing area to the water-entry point (such as an inwater stage, ladder, or ramp). The tender always keeps one hand on the umbilical close to the diver, and the other hand on the diver's helmet or body harness, while assisting the diver during water entry (i.e., maintains positive control of the diver to check the diver should the diver slip or begin to fall).

- As the diver enters the water, the tender handles the umbilical. The tender must be careful to keep the diver's umbilical away from sharp edges, rotating machinery, and other hazards that could result in damage to, or fouling of, the umbilical. The umbilical must never be allowed to run free or be secured around a cleat, bitt, or other object. The tender must pay out the umbilical at a steady rate to permit the diver to enter the water smoothly and in a controlled manner (i.e., the tender must hold the umbilical tightly enough to check a fall or slip, but allow sufficient slack for the diver to move freely).

- When ready to leave the surface, the diver communicates by voice (such as "Leaving the surface") via the diver's intercom with the DPIC or the dive-team member assigned as the diver's phone-talker, and by using line-pull signals with the tender. The tender then notifies the DPIC that the diver has left the surface. The DPIC is responsible for maintaining the diving logs and records, and keeping track of the diver's bottom time for each dive conducted. When a descending line is used by the diver, the tender should handle the umbilical from a point at least ten feet from the descending line. When an inwater stage is being used, the tender must coordinate with the stage-winch operator or line handlers to ensure a smooth descent for the diver.

- During the dive, the tender must be alert for, and immediately report to the DPIC, conditions

or situations that may be hazardous or unsafe to the diving operations.

- During the dive, the tender must maintain continuous, positive control of the umbilical by having at least one hand on the umbilical at all times, and never allowing it to run free or be secured around a cleat, bitt, or other object. The tender also must control the diver's rate of descent by keeping excess slack out of the umbilical, and track the diver's relative position by continuously monitoring the tautness and location of the umbilical, direction and movement of surface bubbles, and the diver's depth (by using a pneumofathometer). Throughout the dive, the tender must keep slack out of the umbilical while at the same time holding it taut, but not so taut as to interfere with the ability of the diver to work. Two or three feet of slack will permit the diver freedom of movement, while preventing the diver from being pulled off his/her feet by surging of the support craft or the force of any current acting on the umbilical. Occasionally, the tender should "fish" the diver by drawing in gently on the short slack until the tender senses the weight of the diver, and then pay out several feet of slack to the diver. This procedure ensures that movement by the diver has not resulted in excessive slack. (See NOTE below for hull-scrubbing operations.) Too much slack in the line will make signaling difficult, hinder the tender from catching a falling diver, and increase the possibility of fouling the umbilical. When the diver is underwater, umbilical line-pull signals are the only communications link with the diver if the intercom fails; therefore, the tender must always hold the diver's umbilical firmly with at least one hand to receive the line-pull signals.

  NOTE: During hull-scrubbing operations, a diver typically operates a hydraulic or high-pressure water-blasting machine to remove marine growth. If a tender was to "fish" for the diver and pull the diver away from the hull or the equipment, then severe injury could occur. Also during hull-scrubbing operations, it is common for the diver's air hose and umbilical to be married to the lines of the hull-scrubbing equipment. This arrangement results in an extremely heavy umbilical that may not be practical for a tender to manipulate by hand. However, a tender still needs to remain on station at the dive location to "keep an eye" on the diver by monitoring air bubbles and ensuring that the umbilical does not get fouled or snagged. In addition, the tender needs to be aware of surface hazards such as a crane working nearby and any surface traffic (e.g., boats or debris) that could affect the diver.

- When appropriate, the tender should make use of umbilical-management techniques to ensure diver safety. Some techniques include: (1) the location of the tender, and (2) limiting the scope of umbilical that can be paid out to the diver. For example, a diver is tasked with cleaning the trash racks at a dam with four upstream gates. Assume the trash rack at Gate No. 1 (i.e., the westernmost gate) was recently cleaned and must remain open to allow flow through the dam. To ensure the safety of the diver, the tender should first locate himself/herself at a point away from the water flow (i.e., Gate No. 4 – the easternmost gate). Secondly, the tender should determine the maximum length of umbilical the diver will need to reach Gate No. 2. The tender should then devise a positive means to ensure the diver's umbilical does not exceed that maximum length. This action will prevent the diver from reaching the dangerous area near Gate No. 1, which may have significant water current.

- To detect a diver's line-pull signals during the dive, the tender must monitor the umbilical using at least one hand, and monitor by sight any descending line or marker buoy used by the diver. As directed by the DPIC, the tender communicates with the diver using the diver's intercom. Periodically, the tender should seek a "Diver okay" acknowledgement from the

diver by voice communication or by using line-pull signals (such as sending the diver one line-pull signal and receiving one line-pull signal). Line-pull signals consist of a series of sharp, distinct pulls, strong enough for the diver or tender to detect, but not so strong as to pull the diver away from his/her work. When communications are lost with the diver via the intercom (such as a bad connection or flooded mask), line-pull signals provide the only available communications with the diver; therefore, line-pull signals must be maintained continuously during the dive by keeping at least one hand on the umbilical. In the event that a diver does not respond to any voice or line-pull signal communications, it should be repeated. If the diver still does not respond to voice or line-pull signal communications, or responds incorrectly, the DPIC shall terminate the dive as required by 29 CFR 1910.422(i).

- Throughout the dive, the tender constantly monitors the diver's progress and keeps track of the diver's relative position by:
    - Watching and tracking the diver's exhaust bubbles. For example, bubbles surfacing in a single location indicate that the diver is working in place, while bubbles moving in a regular pattern indicate that the diver is searching the bottom. Bubbles moving rapidly in a straight line in one direction could mean that the diver has fallen.
    - Using his/her hands to monitor the line-pull signals on the umbilical (discussed above).
    - Watching the pneumofathometer pressure gauge to keep track of the operating depth. The gauge provides a direct reading (without the need to add air to the gauge) when the diver remains at a constant depth or ascends. However, when the diver descends, the pneumofathometer hose must be cleared by adding air before making a new reading.
    - Monitoring the gauges on powered equipment and other cues. For example, the ammeter on an electric-welding unit indicates a power drain when the arc is in use, and the gas-pressure gauges for a gas torch will register fuel flow. Additionally, the "pop" made by a gas torch being lighted probably will be audible over the diver intercom, and bubbles from the torch will break on the surface, releasing small quantities of smoke.
    - Detecting vibrations in the air-powered lines of pneumatic tools.

- The tender must monitor the diver's activity continually. For example, if the tender is near the communications box, then he/she can frequently evaluate the diver's exertion by counting the number of breaths the diver takes per minute. In this regard, experienced tenders know the diver's normal breathing rate. A significant increase in the diver's breathing rate may indicate an over-exertion situation. When necessary, the tender advises the DPIC to stop the diver's work, allow the diver to rest, and ventilate the diver's mask or helmet. A tender also could monitor and evaluate the diver's exertion based on when, and how frequently, the diver activates the free flow of the mask or helmet.

- When the diver leaves the bottom, he/she notifies topside by voice (e.g., "Leaving the bottom") via the diver's intercom with the DPIC or the dive-team member assigned as the diver's phone-talker, and by line-pull signals with the tender. The tender then notifies the DPIC that the diver has left the bottom. During surfacing, the tender closely monitors and tends the diver's umbilical as the diver ascends, and helps control the rate of ascent as directed by the DPIC.

- When the dive is complete and the diver is ready to leave the water, the tender: assists the diver to the water-exit point (such as an inwater stage, ladder, ramp); keeps excess slack out

of the umbilical while the diver is lifted by stage to the deck; maintains a taut-tension on the umbilical while the diver climbs the ladder; and provides assistance as requested by the diver when the diver exits by other means. When the diver returns to the dive location, the tender always keeps one hand on the umbilical close to the diver and one hand on the diver's helmet or body harness (i.e., positive control of the diver) while assisting the diver to the derigging/undressing area.

**Additional Duties of a Diver Tender**

Other duties that are commonly assigned to the diver tender during commercial diving operations include:

- As directed by the DPIC, assemble and test the diving equipment (such as an air compressor, high-pressure cylinders, umbilical assembly, diver-worn equipment, communications equipment, non-return valves on diver's masks or helmets) and related support equipment (such as a welding generator and equipment, or cutting equipment).

- When no decompression chamber is at the diving station and the DPIC so directs, contact the nearest operational decompression-chamber facility to verify and confirm chamber availability and other contact information. Available modes of transportation must be identified, and a route from the dive location to the chamber should be mapped out.

- When a decompression chamber is available at the diving station, and as directed by the DPIC, ensure that the decompression chamber is clean, properly outfitted, and ready for use.

- Assist in topside work as required, or as specifically directed by the DPIC, during the dive (such as lower or retrieve tools and equipment for the diver, bleed moisture from diver's air-supply volume tank).

  NOTE: When directed by the DPIC to perform other specific tasks while the diver is underwater, the tender must be able to continuously tend the diver while performing the tasks. If not, the tender must be relieved properly as the tender by another dive-team member. The DPIC is allowed to relieve the tender and perform the tender's duties for short periods of time while the tender performs the assigned tasks.

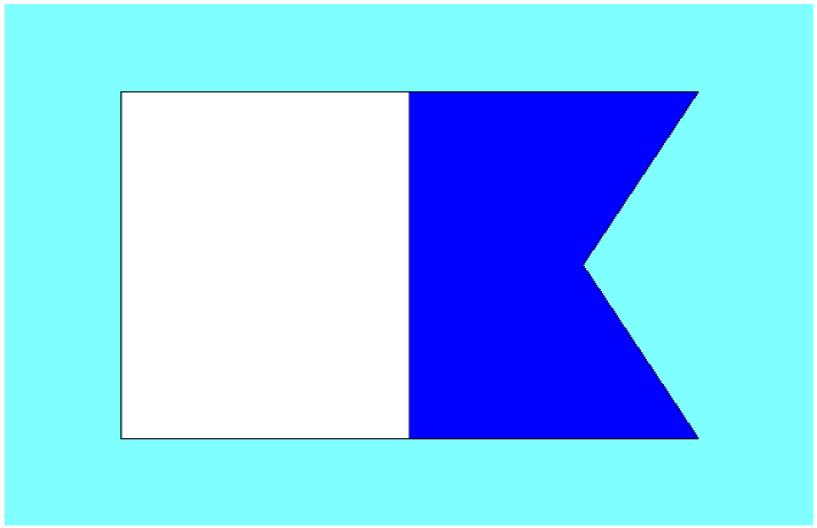
- Perform routine maintenance and repair of diving equipment as directed by the DPIC.

- When qualified, and as directed by the DPIC, operate a decompression chamber for surface decompression or emergency treatment.

## APPENDIX F: International Code Flag "A" ("Alpha" Flag)

29 CFR 1910.421(h) *Warning signal.* When diving from surfaces other than vessels in areas capable of supporting marine traffic, a rigid replica of the international code flag "A" at least one meter (3'-3½") in height shall be displayed at the dive location in a manner which allows all-round visibility, and shall be illuminated during night diving operations.

**International Code Flag "A":** Alfa;
Diver below (when stationary);
Keep clear.



**Color: White and Blue (notched portion)**



NOTE: The red flag with a white diagonal stripe commonly used by recreational SCUBA divers does not satisfy the 29 CFR 1910.421(h) requirements. However, it can be used in addition to the "Alfa" flag to alert others who are familiar with the recreational SCUBA diving flag (e.g., recreational divers and boaters).

## APPENDIX G: OSHA Injury and Illness Reporting and Recordkeeping

**REPORTING**. Under 29 CFR 1904.39 *Reporting fatalities and multiple hospitalization incidents to OSHA*, employers are required to report any occupational fatality or incident involving inpatient hospitalization of three (3) or more employees within eight (8) hours of the incident. The report must include the following information: company name; location and time of the incident; number of fatalities or hospitalized employees; contact person for the company; phone number(s) for the company contact person; and a brief description of the incident.

NOTE: States operating under OSHA-approved safety and health plans have injury and illness recordkeeping and reporting regulations comparable to those of Federal OSHA (for the names of these States, see the section titled *Federal and State Authority* in Appendix B of this instruction). State Plans may have different rules covering recordkeeping exemptions (see the section titled *Recordkeeping* below), procedures for reporting of fatalities and hospitalizations, record retention, and other procedural requirements. Employers conducting activities within a State-Plan State must comply with the requirements of that State Plan, and must report fatalities and multiple injuries to the appropriate State agency.

Reporting is required by employers who have employees aboard vessels (such as ships and barges), or on off-shore oil rigs and platforms, when such vessels or rigs and platforms are located on or within U.S. navigable waterways and State territorial seas.

- State territorial seas extend three (3) nautical miles from the general coastline for all States and U.S. Territories except: Texas, Puerto Rico, and the Gulf Coast of Florida, which extend nine (9) nautical miles from the general coastline; and the Great Lakes and St. Lawrence Seaway States where the U.S. Inland "navigable waters" include all waters up to the international boundary line with Canada.

- Reporting to OSHA is required when the incident occurs within OSHA's authority, regardless of which federal agency regulates the working conditions.

- Determination of geographical authority shall be based on the location of the employee at the time of the incident.

- Exemptions from fatality and multiple-hospitalization reporting do not exist. Although exemptions apply for some illness and injury recordkeeping requirements (such as employers with 10 or fewer employees, and "low-hazard" industries), these exemptions do not apply to the requirement to report fatality and multi-hospitalization incidents to OSHA.

- Employers must report fatalities and multiple hospitalizations by telephone or in person to the nearest OSHA Area Office, or by using OSHA's toll-free hotline at 1-800-321-OSHA. The caller making the accident report must talk directly to a person at OSHA (i.e., they cannot leave a message on the phone, send a fax, or send an e-mail).

**RECORDKEEPING**. Employers, including employers covered by 29 CFR Part 1910, Subpart T, must establish and retain the employee illness and injury records required by 29 CFR Part 1904. As specified by 29 CFR 1904.31, employees include temporary employees (such as

employees hired from temporary-employment agencies or leasing companies) who are not on an employer's payroll, but whom the employer supervises on a day-to-day basis.

OSHA exempts the following employers from some of these illness and injury recordkeeping requirements: (1) employers who had no more than 10 employees (including temporary employees) at any time during the last calendar year (see 29 CFR 1904.1); or (2) employers classified in "low-hazard" industries specified by 29 CFR 1904.2. Nevertheless, even these exempted employers must comply with the following recordkeeping requirements:

- Under 29 CFR 1904.39, report any work-related fatality or the inpatient hospitalization of three (3) or more employees resulting from a single work-related incident; and

- Maintain a log of occupational injuries and illnesses under 29 CFR Part 1904, and make reports under 29 CFR 1904.41 and 1904.42, upon being notified in writing by OSHA or the U.S. Bureau of Labor Statistics of having been selected to participate in a survey of occupational injuries and illnesses.

**DIVING INDUSTRY REPORTING AND RECORDKEEPING**. The North American Industrial Classification System (NAICS) Code for "Diving Services on a Contract or Fee Basis" is 561990 (previously SIC 7389). This classification is part of NAICS Code 56199 "All Other Support Services," which is defined as a "low-hazard" industry. Therefore, a diving company with a primary NAICS Code 561990 is exempted from most OSHA recordkeeping requirements under 29 CFR 1904.2 (NOTE: Minnesota and Puerto Rico do not allow this "low-hazard" industry exemption). A company that performs diving, but has multiple NAICS Codes and is classified under a primary NAICS Code other than 561990, will be subject to all OSHA recordkeeping requirements if not covered by an exemption (such as employs 10 or fewer employees, or is in a "low-hazard" industry). The primary NAICS Code is defined as the major work function or process performed by the establishment. OSHA may challenge the company's assignment of a primary NAICS Code if it appears that such an NAICS Code assignment was made erroneously or arbitrarily.

For diving companies under primary NAICS Code 561990, the following reporting and recordkeeping requirements apply:

- Must report to OSHA within eight (8) hours any work-related accident, occurring within OSHA's geographical authority that results in a fatality or the hospitalization of three (3) or more employees.

- Must comply with the requirements of 29 CFR 1903.2 *Posting of notice; availability of the Act, regulations and applicable standards*.

- Must comply with the recordkeeping requirements of 29 CFR 1910.1020 *Access to employee exposure and medical records* (in 1996, 29 CFR 1910.20 was redesignated as 29 CFR 1910.1020).

- Must comply with any recordkeeping and reporting requirements specified by other OSHA occupational safety and health standards (such as the recordkeeping requirements specified

by 29 CFR Part 1910, Subpart T – Commercial Diving Operations).

- If notified by OSHA in writing, must participate in OSHA's Annual Occupational Injury and Illness Survey. Participation in this survey involves maintaining a log of occupational injuries and illnesses under 29 CFR 1904.4 (OSHA 300 Log), and making reports under 29 CFR 1904.41.

- If the employer receives a Survey of Occupational Injuries and Illnesses Form from the Bureau of Labor Statistics (BLS), or a BLS designee, the employer must promptly complete the form and return it following the instructions contained on the survey form and as specified by 29 CFR 1904.42.

For diving companies under primary NAICS Code 561990, the following reporting and recordkeeping requirements do not apply:

- Requirement as per 29 CFR 1904.4 to maintain a log and summary of all recordable occupational injuries and illnesses at each of its establishments (OSHA 300 Log, or equivalent).

- Requirement as per 29 CFR 1904.29 to complete a supplemental record for each occupational injury or illness that occurs at each of its establishments (OSHA 301 Incident Report, or equivalent).

- Requirement as per 29 CFR 1904.29 to post an annual summary of occupational injuries and illnesses for each of its establishments.

## APPENDIX H: Comparison of Requirements for the Primary Diving Modes

Symbols:
knot = 1 nautical mile per hour fsw = feet of sea water < = less than
thanno-D = no-decompression limits DPIC = Designated Person In Charge > = greater than
>no-D = decompression required

| Requirements | SCUBA | Surface-supplied Air | Mixed-Gas |
|---|---|---|---|
| Limits | Maximum depth = 130 fsw; >1 knot, then line-tended; enclosed space, then line-tended. | Maximum depth = 190 fsw; except for dives <30 minutes, may dive up to 220 fsw. | Not applicable. |
| Tender | Either line-tended from surface or by another diver in continual visual contact. | Continually tended at all depths; 1 tender per diver when >100 fsw or >no-D. | 1 tender per diver. 1 diver in bell as tender. |
| Standby | Yes | >100 fsw or >no-D. | Yes |
| Diver-Carried Reserve | Yes (manual reserve or independent reserve cylinder). | >100 fsw or >no-D. No direct ascent (except heavy gear and no space). | >100 fsw or >no-D. No direct ascent (except heavy gear and no space). |
| Dive-Location Reserve | Not applicable. | >100 fsw or >no-D. | Yes |
| Inwater Stage | Not applicable. | Heavy gear. | Heavy gear >100 fsw or >no-D (if no bell). |
| Chamber | >100 fsw or >no-D. | >100 fsw or >no-D. | Yes |
| Bell | Not applicable. | Open or closed bell >120 minutes (except heavy gear and confined space). | Open or closed bell >220 fsw or >120 minutes (except heavy gear and confined space). Closed bell >300 fsw (except confined space). |
| Communications | Emergency assistance. | Emergency assistance. Between diver and dive location, diver and bell, bell and dive location. | Emergency assistance. Between diver and dive location, diver and bell, bell and dive location. |
| Miscellaneous | Diver at point of confined space entry. Require DPIC. | Diver at point of confined space entry. For heavy gear need extra hose at dive location. Require DPIC. | Diver at point of confined space entry. For heavy gear need extra hose at dive location. Require DPIC. |

## APPENDIX I: Checklist for Commercial Diving Operations

This checklist consists of the 29 CFR Part 1910, Subpart T standards (verbatim) in a matrix format. The checklist can be used "as is" or copied into a Word® document and tailored for a specific inspection by deleting unnecessary paragraphs. For example, if the diving operation only involves SCUBA diving, then paragraphs such as 1910.425 *Surface-supplied air diving*; 1910.426 *Mixed-gas diving*; and 1910.427 *Liveboating*, can be deleted. As a Word® document, the column widths can be adjusted and the user has the option of selecting a "landscape" or "portrait" layout.

| | **1910.410 *QUALIFICATIONS OF DIVE TEAM.*** | **Comments/Remarks/Notes** |
|---|---|---|
| | **(a) *General.*** | |
| | (1) Each dive-team member shall have the experience or training necessary to perform assigned tasks in a safe and healthful manner. | |
| | (2) Each dive-team member shall have experience or training in the following:<br>(i) The use of tools, equipment and systems relevant to assigned tasks;<br>(ii) Techniques of the assigned diving mode; and<br>(iii) Diving operations and emergency procedures. | |
| | (3) All dive-team members shall be trained in cardiopulmonary resuscitation and first aid (American Red Cross standard course or equivalent). | |
| | (4) Dive-team members who are exposed to or control the exposure of others to hyperbaric conditions shall be trained in diving-related physics and physiology. | |
| | **(b) *Assignments.*** | |
| | (1) Each dive-team member shall be assigned tasks in accordance with the employee's experience or training, except that limited additional tasks may be assigned to an employee undergoing training provided that these tasks are performed under the direct supervision of an experienced dive-team member. | |
| | (2) The employer shall not require a dive-team member to be exposed to hyperbaric conditions against the employee's will, except when necessary to complete decompression or treatment procedures. | |
| | (3) The employer shall not permit a dive-team member to dive or be otherwise exposed to hyperbaric conditions for the duration of any temporary physical impairment or condition which is known to the employer and is likely to affect adversely the safety or health of a dive-team member. | |
| | **(c) *Designated person-in-charge.*** | |
| | (1) The employer or an employee designated by the employer shall be at the dive location in charge of all aspects of the diving operation affecting the safety and health of dive-team members. | |
| | (2) The designated person-in-charge shall have experience and training in the conduct of the assigned diving operation. | |

| | **1910.420 *SAFE PRACTICES MANUAL.*** | **Comments/Remarks/Notes** |
|---|---|---|
| | **(a) *General.*** The employer shall develop and maintain a safe practices manual which shall be made available at the dive location to each dive-team member. | |
| | (1) The safe practices manual shall contain a copy of this standard and | |

| | | |
|---|---|---|
| | the employer's policies for implementing the requirements of this standard [29 CFR Part 1910, Subpart T]. | |
| | (2) For each diving mode engaged in, the safe practices manual shall include:<br>(i) Safety procedures and checklists for diving operations;<br>(ii) Assignments and responsibilities of the dive-team members;<br>(iii) Equipment procedures and checklists; and<br>(iv) Emergency procedures for fire, equipment failure, adverse environmental conditions, and medical illness and injury. | |

| | **1910.421 *PRE-DIVE PROCEDURES.*** | **Comments/Remarks/Notes** |
|---|---|---|
| | **(a) *General.*** The employer shall comply with the following requirements prior to each diving operation, unless otherwise specified. | |
| | **(b) *Emergency aid.*** A list shall be kept at the dive location of the telephone or call numbers of the following: | |
| | (1) An operational decompression chamber (if not at the dive location); | |
| | (2) Accessible hospitals; | |
| | (3) Available physicians; | |
| | (4) Available means of transportation; and | |
| | (5) The nearest U.S. Coast Guard Rescue Coordination Center. | |
| | **(c) *First aid supplies.*** | |
| | (1) A first aid kit appropriate for the diving operation and approved by a physician shall be available at the dive location. | |
| | (2) When used in a decompression chamber or bell, the first aid kit shall be suitable for use under hyperbaric conditions. | |
| | (3) In addition to any other first aid supplies, an American Red Cross standard first aid handbook or equivalent, and a bag-type manual resuscitator with transparent mask and tubing shall be available at the dive location. | |
| | **(d) *Planning and assessment.*** Planning of a diving operation shall include an assessment of the safety and health aspects of the following: | |
| | (1) Diving mode; | |
| | (2) Surface and underwater conditions and hazards; | |
| | (3) Breathing-gas supply (including reserves); | |
| | (4) Thermal protection; | |
| | (5) Diving equipment and systems; | |
| | (6) Dive-team assignments and physical fitness of dive-team members (including any impairments known to the employer); | |
| | (7) Repetitive dive designation or residual inert-gas status of dive-team members; | |
| | (8) Decompression and treatment procedures (including altitude corrections); and | |
| | (9) Emergency procedures. | |
| | **(e) *Hazardous activities.*** To minimize hazards to the dive-team, diving operations shall be coordinated with other activities in the vicinity which are likely to interfere with the diving operation. | |
| | **(f) *Employee briefing.***<br>(1) Dive-team members shall be briefed on:<br>(i) The tasks to be undertaken;<br>(ii) Safety procedures for the diving mode;<br>(iii) Any unusual hazards or environmental conditions likely to affect the safety of the diving operation; and<br>(iv) Any modifications to operating procedures necessitated by the specific diving operation. | |

| | | |
|---|---|---|
| | (2) Prior to making individual dive-team member assignments, the employer shall inquire into the dive-team member's current state of physical fitness, and indicate to the dive-team member the procedure for reporting physical problems or adverse physiological effects during and after the dive. | |
| | **(g) *Equipment inspection.*** The breathing-gas supply system including reserve breathing-gas supplies, masks, helmets, thermal protection, and bell handling mechanism (when appropriate) shall be inspected prior to each dive. | |
| | **(h) *Warning signal*.** When diving from surfaces other than vessels in areas capable of supporting marine traffic, a rigid replica of the international code flag "A" at least one meter in height shall be displayed at the dive location in a manner which allows all-round visibility, and shall be illuminated during night diving operations. | |

| | **1910.422 *PROCEDURES DURING DIVE.*** | **Comments/Remarks/Notes** |
|---|---|---|
| | **(a) *General.*** The employer shall comply with the following requirements which are applicable to each diving operation unless otherwise specified. | |
| | **(b) *Water entry and exit.*** | |
| | (1) A means capable of supporting the diver shall be provided for entering and exiting the water. | |
| | (2) The means provided for exiting the water shall extend below the water surface. | |
| | (3) A means shall be provided to assist an injured diver from the water or into a bell. | |
| | **(c) *Communications.***<br>(1) An operational two-way voice communication system shall be used between:<br>(i) Each surface-supplied air or mixed-gas diver and a dive-team member at the dive location or bell (when provided or required); and<br>(ii) The bell and the dive location. | |
| | (2) An operational, two-way communication system shall be available at the dive location to obtain emergency assistance. | |
| | **(d) *Decompression tables.*** Decompression, repetitive, and no-decompression tables (as appropriate) shall be at the dive location. | |
| | **(e) *Dive profiles.*** A depth-time profile, including when appropriate any breathing-gas changes, shall be maintained for each diver during the dive including decompression. | |
| | **(f) *Hand-held power tools and equipment.*** | |
| | (1) Hand-held electrical tools and equipment shall be de-energized before being placed into or retrieved from the water. | |
| | (2) Hand-held power tools shall not be supplied with power from the dive location until requested by the diver. | |
| | **(g) *Welding and burning.*** | |
| | (1) A current supply switch to interrupt the current flow to the welding or burning electrode shall be:<br>(i) Tended by a dive-team member in voice communication with the diver performing the welding or burning.<br>(ii) Kept in the open position except when the diver is welding or burning. | |
| | (2) The welding machine frame shall be grounded. | |
| | (3) 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. | |
| | (4) Insulated gloves shall be provided to divers performing welding and | |

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| | burning operations. | |
| | (5) 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. | |
| | **(h) *Explosives.*** | |
| | (1) Employers shall transport, store, and use explosives in accordance with this section and the applicable provisions of 29 CFR 1910.109 and 29 CFR 1926.912. | |
| | (2) Electrical continuity of explosive circuits shall not be tested until the diver is out of the water. | |
| | (3) Explosives shall not be detonated while the diver is in the water. | |
| | **(i) *Termination of dive.*** The working interval of a dive shall be terminated when: | |
| | (1) A diver requests termination; | |
| | (2) A diver fails to respond correctly to communications or signals from a dive-team member; | |
| | (3) Communications are lost and cannot be quickly re-established between the diver and a dive-team member at the dive location, and between the designated person-in-charge and the person controlling the vessel in liveboating operations; or | |
| | (4) A diver begins to use diver-carried reserve breathing gas or the dive-location reserve breathing gas. | |

| | **1910.423 *POST-DIVE PROCEDURES.*** | **Comments/Remarks/Notes** |
|---|---|---|
| | **(a) *General.*** The employer shall comply with the following requirements which are applicable after each diving operation, unless otherwise specified. | |
| | **(b) *Precautions.*** | |
| | (1) After the completion of any dive, the employer shall:<br>(i) Check the physical condition of the diver;<br>(ii) Instruct the diver to report any physical problems or adverse physiological effects including symptoms of decompression sickness;<br>(iii) Advise the diver of the location of a decompression chamber which is ready for use; and<br>(iv) Alert the diver to the potential hazards of flying after diving. | |
| | (2) For any dive outside the no-decompression limits, deeper than 100 fsw or using mixed-gas as a breathing mixture, the employer shall instruct the diver to remain awake and in the vicinity of the decompression chamber which is at the dive location for at least one hour after the dive (including decompression or treatment as appropriate). | |
| | **(c) *Recompression capability.*** | |
| | (1) A decompression chamber capable of recompressing the diver at the surface to a minimum of 165 fsw (6 ATA) shall be available at the dive location for:<br>(i) Surface-supplied air diving to depths deeper than 100 fsw and shallower than 220 fsw;<br>(ii) Mixed-gas diving shallower than 300 fsw; or<br>(iii) Diving outside the no-decompression limits shallower than 300 fsw. | |
| | (2) A decompression chamber capable of recompressing the diver at the surface to the maximum depth of the dive shall be available at the dive location for dives deeper than 300 fsw. | |
| | (3) The decompression chamber shall be: | |

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| | (i) Dual-lock;<br>(ii) Multi-place; and<br>(iii) Located within 5 minutes of the dive location. | |
| | (4) The decompression chamber shall be equipped with:<br>(i) A pressure gauge for each pressurized compartment designed for human occupancy;<br>(ii) A built-in-breathing-system with a minimum of one mask per occupant;<br>(iii) A two-way voice communication system between occupants and a dive-team member at the dive location;<br>(iv) A viewport; and<br>(v) Illumination capability to light the interior. | |
| | (5) Treatment tables, treatment gas appropriate to the diving mode, and sufficient gas to conduct treatment shall be available at the dive location. | |
| | (6) A dive-team member shall be available at the dive location during and for at least one hour after the dive to operate the decompression chamber (when required or provided). | |
| | **(d) *Record of dive.*** | |
| | (1) The following information shall be recorded and maintained for each diving operation:<br>(i) Names of dive-team members including the designated person-in-charge;<br>(ii) Date, time, and location;<br>(iii) Diving modes used;<br>(iv) General nature of work performed;<br>(v) Approximate underwater and surface conditions (visibility, water temperature and current); and<br>(vi) Maximum depth and bottom time for each diver. | |
| | (2) For each dive outside the no-decompression limits, deeper than 100 fsw or using mixed-gas, the following additional information shall be recorded and maintained:<br>(i) Depth-time and breathing-gas profiles;<br>(ii) Decompression table designation (including modification); and<br>(iii) Elapsed time since last pressure exposure if less than 24 hours or repetitive dive designation for each diver. | |
| | (3) For each dive in which decompression sickness is suspected or symptoms are evident, the following additional information shall be recorded and maintained:<br>(i) Description of decompression sickness symptoms (including depth and time of onset); and<br>(ii) Description and results of treatment. | |
| | **(e) *Decompression procedure assessment.*** The employer shall: | |
| | (1) Investigate and evaluate each incident of decompression sickness based on the recorded information, consideration of the past performance of the decompression table used, and individual susceptibility; | |
| | (2) Take appropriate corrective action to reduce the probability of recurrence of decompression sickness; and | |
| | (3) Prepare a written evaluation of the decompression procedure assessment, including any corrective action taken, within 45 days of the incident of decompression sickness. | |

| | **1910.424 *SCUBA DIVING.*** | **Comments/Remarks/Notes** |
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| | **(a) *General.*** Employers engaged in SCUBA diving shall comply with the following requirements, unless otherwise specified. | |

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| | **(b) *Limits.*** SCUBA diving shall not be conducted: | |
| | (1) At depths deeper than 130 fsw; | |
| | (2) At depths deeper than 100 fsw or outside the no-decompression limits unless a decompression chamber is ready for use; | |
| | (3) Against currents exceeding one (1) knot unless line-tended; or | |
| | (4) In enclosed or physically confining spaces unless line-tended. | |
| | **(c) *Procedures.*** | |
| | (1) A standby diver shall be available while a diver is in the water. | |
| | (2) A diver shall be line-tended from the surface, or accompanied by another diver in the water in continuous visual contact during the diving operation. | |
| | (3) A diver shall be stationed at the underwater point of entry when diving is conducted in enclosed or physically confining spaces. | |
| | (4) A diver-carried reserve breathing-gas supply shall be provided for each diver consisting of:<br>(i) A manual reserve (J-valve); or<br>(ii) An independent reserve cylinder with a separate regulator or connected to the underwater breathing apparatus. | |
| | (5) The valve of the reserve breathing-gas supply shall be in the closed position prior to the dive. [For a J-valve, this is the up position.] | |

| | **1910.425 *SURFACE-SUPPLIED AIR DIVING.*** | **Comments/Remarks/Notes** |
|---|---|---|
| | **(a) *General.*** Employers engaged in surface-supplied air diving shall comply with the following requirements, unless otherwise specified. | |
| | **(b) *Limits.*** | |
| | (1) Surface-supplied air diving shall not be conducted at depths deeper than 190 fsw, except that dives with bottom times of 30 minutes or less may be conducted to depths of 220 fsw. | |
| | (2) A decompression chamber shall be ready for use at the dive location for any dive outside the no-decompression limits or deeper than 100 fsw. | |
| | (3) A bell shall be used for dives with an inwater decompression time greater than 120 minutes, except when heavy gear is worn or diving is conducted in physically confining spaces. | |
| | **(c) *Procedures.*** | |
| | (1) Each diver shall be continuously tended while in the water. | |
| | (2) A diver shall be stationed at the underwater point of entry when diving is conducted in enclosed or physically confining spaces. | |
| | (3) Each diving operation shall have a primary breathing-gas supply sufficient to support divers for the duration of the planned dive including decompression. | |
| | (4) For dives deeper than 100 fsw or outside the no-decompression limits:<br>(i) A separate dive-team member shall tend each diver in the water;<br>(ii) A standby diver shall be available while a diver is in the water;<br>(iii) A diver-carried reserve breathing-gas supply shall be provided for each diver except when heavy gear is worn; and<br>(iv) A dive-location reserve breathing-gas supply shall be provided. | |
| | (5) For heavy gear diving deeper than 100 fsw or outside the no-decompression limits:<br>(i) An extra breathing-gas hose capable of supplying breathing gas to the diver in the water shall be available to the standby diver.<br>(ii) An inwater stage shall be provided to divers in the water. | |
| | (6) Except when heavy gear is worn or where physical space does not permit, a diver-carried reserve breathing-gas supply shall be provided | |

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| | whenever the diver is prevented by the configuration of the dive area from ascending directly to the surface. | |

| | **1910.426 *MIXED-GAS DIVING.*** | **Comments/Remarks/Notes** |
|---|---|---|
| | **(a) *General.*** Employers engaged in mixed-gas diving shall comply with the following requirements, unless otherwise specified. | |
| | **(b) *Limits.*** Mixed-gas diving shall be conducted only when: | |
| | (1) A decompression chamber is ready for use at the dive location; and | |
| | (i) A bell is used at depths greater than 220 fsw or when the dive involves inwater decompression time of greater than 120 minutes, except when heavy gear is worn or when diving in physically confining spaces; or<br>(ii) A closed bell is used at depths greater than 300 fsw, except when diving is conducted in physically confining spaces. | |
| | **(c) *Procedures.*** | |
| | (1) A separate dive-team member shall tend each diver in the water. | |
| | (2) A standby diver shall be available while a diver is in the water. | |
| | (3) A diver shall be stationed at the underwater point of entry when diving is conducted in enclosed or physically confining spaces. | |
| | (4) Each diving operation shall have a primary breathing-gas supply sufficient to support divers for the duration of the planned dive including decompression. | |
| | (5) Each diving operation shall have a dive-location reserve breathing-gas supply. | |
| | (6) When heavy gear is worn:<br>(i) An extra breathing-gas hose capable of supplying breathing gas to the diver in the water shall be available to the standby diver; and<br>(ii) An inwater stage shall be provided to divers in the water. | |
| | (7) An inwater stage shall be provided for divers without access to a bell for dives deeper than 100 fsw or outside the no-decompression limits. | |
| | (8) When a closed bell is used, one dive-team member in the bell shall be available and tend the diver in the water. | |
| | (9) Except when heavy gear is worn or where physical space does not permit, a diver-carried reserve breathing-gas supply shall be provided for each diver:<br>(i) Diving deeper than 100 fsw or outside the no-decompression limits; or<br>(ii) Prevented by the configuration of the dive area from directly ascending to the surface. | |

| | **1910.427 *LIVEBOATING.*** | **Comments/Remarks/Notes** |
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| | **(a) *General.*** Employers engaged in diving operations involving liveboating shall comply with the following requirements. | |
| | **(b) *Limits.*** Diving operations involving liveboating shall not be conducted: | |
| | (1) With an inwater decompression time of greater than 120 minutes; | |
| | (2) Using surface-supplied air at depths deeper than 190 fsw, except that dives with bottom times of 30 minutes or less may be conducted to depths of 220 fsw; | |
| | (3) Using mixed-gas at depths greater than 220 fsw; | |
| | (4) In rough seas which significantly impede diver mobility or work function; or | |
| | (5) In other than daylight hours. | |
| | **(c) *Procedures.*** | |
| | (1) The propeller of the vessel shall be stopped before the diver enters or | |

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| | exits the water. | |
| | (2) A device shall be used which minimizes the possibility of entanglement of the diver's hose in the propeller of the vessel. | |
| | (3) Two-way voice communication between the designated person-in-charge and the person controlling the vessel shall be available while the diver is in the water. | |
| | (4) A standby diver shall be available while a diver is in the water. | |
| | (5) A diver-carried reserve breathing-gas supply shall be carried by each diver engaged in liveboating operations. | |

| | **1910.430 *EQUIPMENT.*** | **Comments/Remarks/Notes** |
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| | **(a) *General.*** | |
| | (1) All employers shall comply with the following requirements, unless otherwise specified. | |
| | (2) Each equipment modification, repair, test, calibration or maintenance service shall be recorded by means of a tagging or logging system, and include the date and nature of work performed, and the name or initials of the person performing the work. | |
| | **(b) *Air compressor system.*** | |
| | (1) Compressors used to supply air to the diver shall be equipped with a volume tank with a check valve on the inlet side, a pressure gauge, a relief valve, and a drain valve. | |
| | (2) Air compressor intakes shall be located away from areas containing exhaust or other contaminants. | |
| | (3) Respirable air supplied to a diver shall not contain:<br>(i) A level of carbon monoxide (CO) greater than 20 ppm;<br>(ii) A level of carbon dioxide ($CO_2$) greater than 1,000 ppm;<br>(iii) A level of oil mist greater than 5 milligrams per cubic meter; or<br>(iv) A noxious or pronounced odor. | |
| | (4) The output of air compressor systems shall be tested for air purity every 6 months by means of samples taken at the connection to the distribution system, except that non-oil lubricated compressors need not be tested for oil mist. | |
| | **(c) *Breathing-gas supply hoses.*** | |
| | (1) Breathing-gas supply hoses shall:<br>(i) Have a working pressure at least equal to the working pressure of the total breathing-gas system;<br>(ii) Have a rated bursting pressure at least equal to 4 times the working pressure;<br>(iii) Be tested at least annually to 1.5 times their working pressure; and<br>(iv) Have their open ends taped, capped or plugged when not in use. | |
| | (2) Breathing-gas supply hose connectors shall:<br>(i) Be made of corrosion-resistant materials;<br>(ii) Have a working pressure at least equal to the working pressure of the hose to which they are attached; and<br>(iii) Be resistant to accidental disengagement. | |
| | (3) Umbilicals shall:<br>(i) Be marked in 10-foot increments to 100 feet beginning at the diver's end, and in 50-foot increments thereafter;<br>(ii) Be made of kink-resistant materials; and<br>(iii) Have a working pressure greater than the pressure equivalent to the maximum depth of the dive (relative to the supply source) plus 100 psi. | |
| | **(d) *Buoyancy control.*** | |
| | (1) Helmets or masks connected directly to the dry suit or other | |

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| | buoyancy-changing equipment shall be equipped with an exhaust valve. | |
| | (2) A dry suit or other buoyancy-changing equipment not directly connected to the helmet or mask shall be equipped with an exhaust valve. | |
| | (3) When used for SCUBA diving, a buoyancy compensator shall have an inflation source separate from the breathing-gas supply. | |
| | (4) An inflatable flotation device capable of maintaining the diver at the surface in a face-up position, having a manually activated inflation source independent of the breathing supply, an oral inflation device, and an exhaust valve shall be used for SCUBA diving. | |
| | **(e) *Compressed gas cylinders.*** Compressed gas cylinders shall: | |
| | (1) Be designed, constructed and maintained in accordance with the applicable provisions of 29 CFR 1910.101 and 1910.169 through 1910.171; | |
| | (2) Be stored in a ventilated area and protected from excessive heat; | |
| | (3) Be secured from falling; and | |
| | (4) Have shut-off valves recessed into the cylinder or protected by a cap, except when in use or manifolded, or when used for SCUBA diving. | |
| | **(f) *Decompression chambers.*** | |
| | (1) Each decompression chamber manufactured after the effective date of this standard, shall be built and maintained in accordance with the ASME Code or equivalent. | |
| | (2) Each decompression chamber manufactured prior to the effective date of this standard shall be maintained in conformity with the code requirements to which it was built, or equivalent. | |
| | (3) Each decompression chamber shall be equipped with:<br>(i) Means to maintain the atmosphere below a level of 25 percent oxygen by volume;<br>(ii) Mufflers on intake and exhaust lines, which shall be regularly inspected and maintained;<br>(iii) Suction guards on exhaust line openings; and<br>(iv) A means for extinguishing fire, and shall be maintained to minimize sources of ignition and combustible material. | |
| | **(g) *Gauges and timekeeping devices.*** | |
| | (1) Gauges indicating diver depth which can be read at the dive location shall be used for all dives except SCUBA. | |
| | (2) Each depth gauge shall be dead-weight tested or calibrated against a master reference gauge every 6 months, and when there is a discrepancy greater than two percent (2 percent) of full scale between any two equivalent gauges. | |
| | (3) A cylinder pressure gauge capable of being monitored by the diver during the dive shall be worn by each SCUBA diver. | |
| | (4) A timekeeping device shall be available at each dive location. | |
| | **(h) *Masks and helmets.*** | |
| | (1) Surface-supplied air and mixed-gas masks and helmets shall have: | |
| | (i) A non-return valve at the attachment point between helmet or mask and hose which shall close readily and positively; and<br>(ii) An exhaust valve. | |
| | (2) Surface-supplied air masks and helmets shall have a minimum ventilation rate capability of 4.5 acfm at any depth at which they are operated or the capability of maintaining the diver's inspired carbon dioxide partial pressure below 0.02 ATA when the diver is producing carbon dioxide at the rate of 1.6 standard liters per minute. | |
| | **(i) *Oxygen safety.*** | |

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| | (1) Equipment used with oxygen or mixtures containing over forty percent (40%) by volume oxygen shall be designed for oxygen service. | |
| | (2) Components (except umbilicals) exposed to oxygen or mixtures containing over forty percent (40%) by volume oxygen shall be cleaned of flammable materials before use. | |
| | (3) Oxygen systems over 125 psig and compressed air systems over 500 psig shall have slow-opening shut-off valves. | |
| | **(j) *Weights and harnesses.*** | |
| | (1) Except when heavy gear is worn, divers shall be equipped with a weight belt or assembly capable of quick release. | |
| | (2) Except when heavy gear is worn or in SCUBA diving, each diver shall wear a safety harness with:<br>(i) A positive buckling device;<br>(ii) An attachment point for the umbilical to prevent strain on the mask or helmet; and<br>(iii) A lifting point to distribute the pull force of the line over the diver's body. | |

| | **1910.440 *RECORDKEEPING REQUIREMENTS.*** | **Comments/Remarks/Notes** |
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| | **(a) *Recording diving-related injuries and illnesses.*** | |
| | (1) [Reserved] | |
| | (2) The employer shall record the occurrence of any diving-related injury or illness which requires any dive-team member to be hospitalized for 24 hours or more, specifying the circumstances of the incident and the extent of any injuries or illnesses. | |
| | **(b) *Availability of records.*** | |
| | (1) Upon the request of the Assistant Secretary of Labor [for OSHA], or the Director, National Institute for Occupational Safety and Health, 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. | |
| | (2) Records and documents required by this standard 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) (in 1996, 29 CFR 1910.20 was re-designated as 29 CFR 1910.1020). 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. Equipment inspections and testing records which pertain to employees (29 CFR 1910.430) shall also be provided upon request to employees and their designated representatives. | |
| | (3) Records and documents required by this standard shall be retained by the employer for the following period:<br>(i) Dive-team member medical records (physician's reports) (29 CFR 1910.411) – 5 years; [NOTE: No longer required since 29 CFR 1910.411 was deleted from the standard];<br>(ii) Safe practices manual (29 CFR 1910.420) – current document only;<br>(iii) Depth-time profile (29 CFR 1910.422) – until completion of the recording of the dive, or until completion of decompression procedure assessment where there has been an incident of decompression sickness;<br>(iv) Recording of dive (29 CFR 1910.423) – 1 year, except 5 years where there has been an incident of decompression sickness; | |

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| | (v) Decompression procedure assessment evaluations (29 CFR 1910.423) – 5 years;<br>(vi) Equipment inspections and testing records (29 CFR 1910.430) – current entry or tag, or until equipment is withdrawn from service;<br>(vii) Records of hospitalizations (29 CFR 1910.440) – 5 years. | |
| | (4) After the expiration of the retention period of any record required to be kept for five (5) years, the employer shall forward such records to the National Institute for Occupational Safety and Health, Department of Health and Human Services. The employer shall also comply with any additional requirements set forth at 29 CFR 1910.1020(h) (in 1996, 29 CFR 1910.20 was re-designated as 29 CFR 1910.1020). | |
| | (5) In the event the employer ceases to do business:<br>(i) The successor employer shall receive and retain all dive and employee medical records required by this standard; or<br>(ii) If there is no successor employer, dive and employee medical records shall be forwarded to the National Institute for Occupational Safety and Health, Department of Health and Human Services. | |