(6) Include in the Master Blasting Plan the means and methods by which blast holes will be kept from intersecting when drilling near or adjacent to a loaded hole.

(a) Drill only vertical holes.

(b) If a casing, auger, or drill mast is used, it must be vertically plumbed at set up, when drill steel is added or every 5 feet (1.5 m) whichever is shorter, and upon completion. The casing, auger, or drill mast must extend from the barge and be firmly seated.

(c) Verify hole plumbness prior to loading.

(d) Abandon any hole that is out of plumb by more than three degrees from vertical and adjust adjacent hole spacing to prevent intersecting other holes.

(e) Halt drilling to check alignment with an inclinometer or approved device every 5 feet (1.5 m) of hole depth.

29-9. Figures and Tables.
Not Applicable.

29-10. Checklists and Forms.
Not Applicable.

Chapter 30
Diving Operations

30-1. References.

a. American Academy of Underwater Scientists (AAUS), Standards for Scientific Diving Manual (https://www.aaus.org/diving_standards) (30-1.a)

b. ANSI/Association of Commercial Diving Educators (ACDE)-01, Minimum Standard for Commercial Diver Training (https://www.acde.us/standard.htm) (30-1.b)

c. ACDE (https://www.acde.us) (30-1.c)

d. Association of Diving Contractors International (ADCI), Inc., International Consensus Standards for Commercial Diving and Underwater Operations (https://www.adc-int.org/content.asp?contentid=173) (30-1.d)

e. DoD Military Performance Specification (MIL-PRF)-27210 Oxygen, Aviator's Breathing, Liquid and Gas (https://quicksearch.dla.mil/qsDocDetails.aspx?ident_number=18723) (30-1.e)

f. ER 385-1-86, U.S. Army Corps of Engineers Dive Safety Program (https://www.publications.usace.army.mil/USACE-Publications/Engineer-Regulations) (30-1.f)

g. FAR Clause 52.236-13, Accident Prevention (https://www.govinfo.gov/content/pkg/CFR-2020-title48-vol2/pdf/CFR-2020-title48-vol2-chap1-subchapH.pdf) (30-1.g)

h. NOAA Nitrox Dive Tables (https://www.omao.noaa.gov) (30-1.h)

i. U.S. Navy Diving Manual, SS512-AG-PRO-010 (https://www.navsea.navy.mil/Resources/Instructions) (30-1.i)

j. U.S. Navy Guidance For Diving In Contaminated Waters, SS521-AJ-PRO-010 (https://www.navsea.navy.mil/Resources/Instructions) (30-1.j)

k. U.S. Navy Underwater Cutting and Welding Manual, S0300-BB-MAN-010 (https://www.navsea.navy.mil/Resources/Instructions) (30-1.k)

l. 29 CFR 1910 Subpart T, Commercial Diving Operations (https://www.govinfo.gov/content/pkg/CFR-2020-title29-vol5/pdf/CFR-2020-title29-vol5-part1910-subpartT.pdf) (30-1.l)

30-2. Definitions.

a. Actual Cubic Feet Per Minute (acfm). The actual volume of gas supplied to a diver, bell, etc., at ambient pressure. (30-2.a)

b. Bottom Time. The total elapsed time, measured in minutes, from the time when the diver leaves the surface in descent to the time the diver begins ascent. (30-2.b)

c. Contaminated Water. As related to underwater diving; water which contains any chemical, biological, or radioactive substance which poses a chronic or acute health risk to exposed personnel. Supervisory personnel are encouraged to contact local agencies to obtain information on local water contaminants and hazards. (30-2.c)

d. Designated Dive Coordinator (DDC). A USACE employee responsible for the appropriate oversight of a District, Fleet, Laboratory, Field Operating Activity (FOA), or Center Dive Safety Program. (30-2.d)

Note. For non-USACE contracting actions conducted under the FAR Clause 52.236-13 Accident Prevention, the DDC is the employee designated by the contracting authority to provide oversight for contractor diving plans and operations.

e. Dive Safety Inspector (DSI). An onsite government representative for contractor or USACE in-house diving operations. The DSI will assure dive team safety through coordination with the USACE supervisor/KO or COR and provide recommendations to correct deficiencies in the dive plan, AHA, or observed diving procedures. (30-2.e)

f. Diving, Direct Source Breathing Air Compressor. A machine that raises air or other gasses to a pressure above 1 atmosphere and supplies breathing air to a diver. (30-2.f)

g. Diving, Heavy Gear. Surface-supplied deep-sea diving gear including helmet (with or without breastplate), dry suit, and weighted shoes. The helmet is directly connected to the dry suit, forming a self-contained pressure envelope for the diver. (30-2.g)

h. Dive Safety Representative (DSR). A USACE / government employee assigned by the DDC and is normally the District SOHO representative who is assigned the responsibility of dive safety, provides dive safety advice, actively participates in the review and comment process for diving plans and hazard analyses, and onsite monitoring of diving operations. (30-2.h)

i. Diving Supervisor (DS). The person with the primary authority for any dive team's operation. Each dive team must have a designated DS to manage all aspects that affect the safety and health of dive team members. (30-2.i)

j. Helium-Oxygen (HeO_2). Breathing gas mixtures composed of helium and oxygen. (30-2.j)

k. Live Boating. A diving technique where a single surface-supplied diver performs work underwater while his hose is being tended from the bow of a vessel and while the vessel is being manually operated by the vessel master and is underway using its main propulsion system. (30-2.k)

l. Mixed-Gas Diving. A diving mode in which the diver breathes mixture other than air, (for example, HeO_2, Oxygen Enriched Air (OEA), nitrogen-oxygen (Nitrox). (30-2.l)

m. Nitrogen-Oxygen (Nitrox). Breathing gas mixtures ranging from 75 percent nitrogen/25 percent oxygen to 60 percent nitrogen/40 percent oxygen. (30-2.m)

n. Oxygen Enriched Air (OEA). A term often used to describe oxygen-rich mixtures. (30-2.n)

o. Penetration Dive. A dive that requires a diver to access an area that is both a physically confining space and one in which there is no direct access to the surface or bell for recovery of the diver from the water by the tender. (30-2.o)

p. Recompression Chamber. A pressure vessel for human occupancy such as a surface decompression chamber, closed bell, or deep diving system especially equipped to recompress, decompress, and treat divers. (30-2.p)

q. Scientific Diving. 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. (30-2.q)

r. Self-Contained Underwater Breathing Apparatus (SCUBA) Diving. A diving mode independent of surface supply in which the diver uses open-circuit self-contained underwater breathing apparatus. (30-2.r)

s. Surface Supplied Air (SSA). A diving mode in which the diver in the water is supplied from the dive location with compressed air for breathing. (30-2.s)

30-3. Personnel Required Qualification/Training.

a. Maintain training documentation according to 29 CFR 1910.410 (29 CFR 1910 Subpart T). Documentation must show dive team members, including dive tenders, have successfully completed training to the appropriate level (for example, SSA diver's certificate, surface supplied mixed-gas diver certificate). Copies of all dive-related training certificates are required. Such training must be provided by one of the following: (30-2.a)

(1) A commercial diving school, military school, federal government school, or an ACDE accredited school.

(2) An in-house training program that meets the requirements contained in ANSI/ACDE-01, or in the ADCI Consensus Standards.

(3) Training for Contractor Scientific Divers using compressed air SCUBA or SSA must be performed according to 29 CFR 1910.410 and must meet the above requirements or the training guidelines in the AAUS Standards for Scientific Diving. Training for USACE Scientific Divers must be performed according to ER 385-1-86.

(4) DSIs must hold current USACE training certification according to ER 385-1-86. All personnel used as DSIs must be approved by the DDC prior to performing inspector duties.

b. Proof of certification (that is, a diploma and/or official transcript) as a commercial working diver from an accredited commercial dive school or other dive-related training certificates (for example, chamber operator, saturation diver) is required for each dive team member. An ADCI card or similar certification from an internationally

recognized commercial diving organization may be substituted as proof of training for divers demonstrating more than five years of diving experience. (30-2.b)

c. Contractors must provide dive log evidence that each dive team member has training and experience consistent with the performance requirements of the scope of work. (30-2.c)

(1) As a minimum, each diver, back-up diver, and dive team supervisor must have at least one year of commercial experience in the applicable position.

(2) Divers must have completed at least four working dives with similar decompression techniques as in the dive plan, using the particular diving techniques and equipment. Divers must demonstrate that at least one of the four qualification dives were performed in the last nine months prior to the start of dive operations.

(3) Non-divers serving as dive tenders must have previous experience and training as a dive tender.

d. Each dive team member must have current certification in first aid and CPR (see chapter 3). (30-2.d)

(1) Additionally, each dive team member must have current certification in the use of emergency oxygen systems, and, if provided on the dive site, the use of an AED. See chapter 3 for AED requirements.

(2) All classes must contain a hands-on component and may not be taken online only. Evidence of this will be a photocopy of the certificates. The certificate(s) must state the date of issue and length of validity.

Note. Training in the use of emergency oxygen systems must meet the requirements of a nationally recognized training organization such as Divers Alert Network (DAN), Professional Association of Diving Instructors (PADI), National Association of Underwater Instructors (NAUI), the YMCA or other recognized sources.

e. Divers must receive an annual diving physical according to ADCI or similar standards by a hyperbaric physician (Doctor of Medicine (MD) or Doctor of Osteopathic Medicine (DO)) or other licensed physician knowledgeable in the physiology of diving. (30-2.e)

(1) A “Fit to Dive” statement that each diver has been medically examined within the previous 12 months and has been determined fit and approved to dive must be signed by the examining physician.

(2) The DDC must maintain a current file of physician “Fit to Dive” statement for all USACE qualified divers and divers-in-training.

(3) Contractors must submit physician's "Fit to Dive" statement to the DDC according to paragraph 30-7.a.

(4) After any serious diving-related injury or illness such as an over-pressurization injury and/or decompression illness, divers must be re-examined by a hyperbaric physician and be re-certified as "Fit to Dive".

f. Snorkelers. (30-2.f)

(1) All snorkelers and team members must be certified as skin divers (snorkelers) or open water divers by a nationally recognized organization.

(2) A licensed physician (DO or MD) must annually determine employees' medical fitness prior to snorkeling. This certification must be signed by a physician familiar with sports medicine and must state each snorkeler is physically and medically fit to perform snorkeling activities according to commonly accepted sports medicine guidelines. The contractor must submit such certification to the USACE supervisor for approval or to the KO or COR for acceptance.

(3) All snorkeling team members must be certified in first aid, CPR, emergency oxygen (O_2), and if provided onsite, the use of AEDs.

g. Equipment modifications, repairs, tests, calibrations, or maintenance must be performed by a certified technician according to the manufacturer's recommendations. The certified technician must show proof of training. (30-2.g)

30-4. Roles and Responsibilities.

a. Contract dive operations will follow the roles and responsibilities outlined in ADCI International Consensus Standards for Commercial Diving and Underwater Operations and this chapter. (30-4.a)

b. USACE dive operations will follow the roles and responsibilities outlined in ER 385-1-86 and this chapter. (30-4.b)

c. Dive Supervisor (DS). (30-4.c)

(1) Coordinate with the controlling authorities to minimize the hazards associated with water traffic, land-based traffic, industrial operations, heavy equipment operation, or other operations that present a hazard to the diver or dive team (see para 30-8.a(7)).

(2) Coordinate with the USCG to determine if there is a requirement to establish a safety zone.

(3) Develop site specific plans and procedures according to paragraph 30-7.

(4) Assure pre-dive checks are performed according to paragraph 30-5.

(5) Develop HEC procedures to protect dive teams from hazardous energy including but not limited to mechanical (for example, power transmission apparatus, counterbalances, springs, pressure, gravity), pneumatic, hydraulic, electrical, chemical, nuclear, and thermal energies (for example, high or low temperature). See chapter 12 and for pressure differentials see paragraph 30-7.

(a) When diving at a facility with an existing HEC procedure, the DS must review the facility's procedures and establish positive control procedures with the facility operator.

(b) If HEC procedures are required for the diving operation, the DS must visually check all LOTO and other control procedures and devices to ensure they are in place according to accepted procedure.

(6) For work involving LHE, review LHE signals and confirm radio communication with the LHE operator is functioning properly (see para 30-8.a(23)).

(7) When LHE manbaskets are used for diver access, ensure Critical Lift Plan are submitted according to chapter 16.

(8) Review welding or cutting procedures, select the proper welder polarity, and take precautions to ensure that electrocution will not occur (see para 30-8.a(24)).

(9) Review blasting procedures and take precautions to ensure unplanned or unscheduled blasts will not occur. See chapter 29 for additional blasting requirements.

(10) Conduct a pre-dive and post-dive briefing according to paragraph 30-8.a.

30-5. Inspection Requirements.

a. Contract diving operations must be monitored and/or inspected by personnel meeting the qualifications of DSI. DSIs must conduct onsite monitoring/inspections of contractor dive sites during pre-dive conferences, equipment inspections, and initial dives. Monitoring must be continuous for the duration of the contract dive activity, but may be intermittent as determined by the DDC based on an evaluation of the job complexity and degree of hazards. (30-5.a)

b. Individual USACE Dive Teams must be inspected during operations at least once annually by the DDC, or when designated, the Alternate Dive Coordinator (ADC), DSI, and/or DSR. (30-5.b)

Note. Use of trained monitors/inspectors with other credentials will be considered on a case-by-case basis and may be approved in writing by the DDC and USACE National Dive Safety Program Manager.

c. Prior to the dive, the DS must assure, as a minimum, the following pre-dive checks are performed: (30-5.c)

(1) Breathing air tanks contain sufficient air supply to perform the required work (that is, standby air tanks are onsite and full to the necessary capacity).

(2) All diving equipment functions properly prior to diver entry.

(3) All necessary safety equipment specified herein is onsite and functioning properly.

(4) LOTO procedures are followed.

d. Visually inspect SCUBA tanks internally at least annually and hydrostatically test them at least once every five years according to DOT and the CGA regulations. Stamp the hydrostatic test dates into the shoulder of each tank. (30-5.d)

30-6. Activity Hazard Analysis (AHA) Requirements.
Develop AHAs according to paragraphs 1-6 or 2-6, as applicable. When diving operations require the control of hazardous energy see paragraph 12-6.

30-7. Minimum Plan Requirements.

a. General Plan Requirements. (30-7.a)

(1) The following plans/documents are required for all diving operations (additional documentation may be required depending on the scope of the diving operation). Submit all documents to the USACE supervisor for approval by the DDC, or to the KO or COR for acceptance by the DDC, prior to commencement of diving operations. Always maintain a copy of these documents at the diving locations.

(a) Safe Practices Manual (see para 30-7.b).

(b) Dive Operations Plan(s) (see para 30-7.c).

(c) AHA to cover all aspects of the job (see para 30-6).

(d) Emergency Management Plan (see para 30-7.d).

(e) Dive Personnel Qualifications (see para 30-3).

(f) HEC Procedures when applicable (see para chapter 12).

Note. Two USACE Qualified Personnel independently must evaluate the documents prior to acceptance. The intent is for the DDC or ADC and DSR to accept all

documentation on a regular basis. However, due to potential personnel unavailability, a DSR is not required and can be substituted by a second DDC or ADC.

Note. Reviewers should be knowledgeable in the methodologies of the plan being reviewed or must consult with a SME to ensure the Dive Operations Plan and associated AHAs address the unique hazards associated with the dive.

(2) If for any reason the dive mission is altered:

(a) The DDC or ADC must review and accept minor to moderate revisions to the accepted dive plan prior to continuing the operation. These revisions may include differences in time, date, dive team members, work methods, tools used, and other changes that do not affect overall risk. This review may be conducted electronically or verbally and confirmed in writing after completion of the dive operation.

(b) A two-person review, as outlined in paragraph 30-7.a, is required for major changes or those which modify high-risk activities prior to continuing the operation or implementing new procedures. Major changes include modifying pressure differential and HECs adding penetration diving, changing dive equipment modes (that is, from SCUBA to SSA), discovering unexpected, contaminated diving conditions, etc. require a two-person review.

(3) Potential high-hazard conditions, such as penetration diving, contaminated environment diving, dives outside the no decompression limits, and in areas where differential pressure entrapment hazards exist, must be specifically addressed in the Dive Operations Plan and AHA when they are anticipated as part of the diving operation.

b. Safe Practices Manual. Contractors and USACE Districts/Fleets/Labs/ FOAs/Centers with in-house dive teams must develop and maintain a Safe Practices Manual that encompasses their entire diving program. The Safe Practices Manual must be available at all times to the Government representative and all dive team members at each diving location. The Safe Practices Manual must include, as a minimum, the following: (30-7.b)

(1) Dive safety procedures and checklists.

(2) Assignments and responsibilities of dive team members.

(3) Equipment certifications, procedures, and inspection checklists.

(4) Emergency procedures for fire, equipment failure, adverse weather conditions, and medical illness or injury and specific procedures for:

(a) Procedures to deal with entrapped or fouled diver, including fouled umbilical (suction and entanglement/debris).

(b) Actions upon loss of vital support equipment.

(c) Actions upon loss of gas supply.

(d) Actions upon loss of communication.

(e) Lost diver plan (SCUBA Operations only).

(f) Injured diver plan.

(g) Actions upon discovery of fire.

(h) Diver blow up or rapid ascent.

(i) Diver loss of consciousness.

(j) Injury or illness of member of surface crew with diver in the water.

(5) Procedures for internal safety inspections (for example, frequency, checklists).

(6) A complete copy of 29 CFR 1910, Subpart T, and a statement of the employer's policy for ensuring compliance with the standard.

(7) The appropriate U.S. Navy Diving Manual, SS512-AG-PRO-010 table(s), including as a minimum:

(a) No-Decompression Limits and Repetitive Group Designation for No-Decompression Air Dives tables.

(b) Residual Nitrogen Timetables for Repetitive Air Dives.

(c) Standard Air Decompression table.

(8) A sample of the diving log sheets to be used.

(9) A sample of the repetitive dive worksheets or equivalent (dive profile method) to be used.

(10) An outline of the fitness for duty (including medical) requirements for dive team members.

(11) An outline of administrative and record-keeping procedures.

c. Dive Operations Plan. This plan is a site-specific overview of all tasks to be performed, dive modes and equipment, site access, etc. Complex projects involving more than one work task, location, and/or dive team require task-specific dive plans as

part of the overall Dive Operations Plan. As a minimum, the Dive Operations Plan must contain the following: (30-7.c)

(1) Date of dive plan submission.

(2) Name and contact information for DS preparing the dive plan.

(3) Names and duties of onsite dive team members, including DS.

(4) List of diving equipment to be used.

(5) Type of diving platform to be used.

(6) Detailed description of the mission: Identify if and how work will be divided into separate tasks or phases of work.

(7) Date(s), time(s), duration, and location of operation.

(8) Diving mode used (that is, SCUBA and/or SSA) including a description of the back-up air supply, as required.

(9) Diving methodology (for example, mixed-gas, Surface Decompression Using Oxygen (SUR D O_2)).

(10) Nature of work to be performed by the divers, including tools used and materials to be handled or installed.

(11) Anticipated surface and underwater conditions, to include visibility, temperature, currents, etc., and as appropriate, thermal protection.

(12) Maximum single dive bottom time for the planned depth of dive for each diver. Calculate altitude adjustments to dive tables for dives made at altitudes of 1000 feet (304.8 m) or more above sea level.

(13) Identification of topside assistance or support to the dive team (for example, crane operator, lock operator).

(14) Means of direct communication between the dive site and the DDC, project office, the lockmaster or USACE PM, and the COR (if applicable).

(15) Description of the anticipated hazards or concerns and the control measures that will be implemented to control to an acceptable level to include but not limited to the following:

(a) For diving operations conducted in areas where pressure differentials may exist, the plan must be developed in coordination with the facility operator and address the following:

(a-1) Identification of all potential exposure points (for example, gate sills, valve openings, holes).

(a-2) Means for identifying whether control structures and mechanisms are fully in place (for example, measurements of stop gates and openings, valve indicators).

(a-3) Methods for checking pressure differential openings (for example, observing current/water flow, remote testing of opening area with objects such as rope, sandbags, cinders).

(a-4) Route the diver will take from staging area to work area. Include specific mitigations designed to prevent diver and umbilical from running into uncontrolled pressure differential openings.

(a-5) Procedures for immediate emergency pressure equalization or reduction, if possible.

(a-6) Procedures for emergency diver extraction or rescue due to pressure differential exposure, including standby diver deployment precautions.

Note. Potential or actual pressure differentials may occur in, but not limited to, locks, dams, spillways, powerhouses, hollow structures, and plant intakes.

(b) For diving operations conducted in contaminated water, the plan must specifically address the areas below according to SS521-AJ-PRO-010:

(b-1) Types of contaminants and contaminated water categories (CAT 1, 2, 3, 4).

(b-2) Levels of protection and protective equipment required.

(b-3) Contaminated water diver and topside personnel training and qualifications.

(b-4) Sources of information used to determine water quality.

(b-5) Dive Station Decontamination Procedures for Divers and Topside Personnel.

(b-6) Medical evaluation support and post dive monitoring.

(b-7) Hazardous waste minimization and disposal.

Note. Hazard scenarios and control measures must be considered for surface, mud-line and sediment, rainfall, points of discharge, and vertical and bottom water contamination (that is, a diver walking, crawling, or working, to include swim fin action that stirs up bottom sediments) as applicable to the operation.

(c) For diving operations involving surface decompressions with oxygen (SUR D O_2) and/or 100% oxygen, the plan must include oxygen-specific decompressions procedures and schedule.

(16) Plans submitted for Contractor operations must also include the name of contractor (and diving subcontractor if applicable), contract number, and names and contact information for key personnel.

Note. Include the following statement in the Dive Operations Plan: "If for any reason the dive plan is altered in mission, depth, personnel, or equipment, the DDC must be contacted in order to review and accept the alteration prior to actual operation."

d. Emergency Management Plan. Prepare an Emergency Management Plan for each dive operation. The plan must include, as a minimum, the following: (30-7.d)

(1) Location and phone number of nearest operational recompression chamber, if not located at the dive site, and the DAN emergency hotline number (919-684-9111).

(2) Location, directions to, and phone number(s) of nearest hospital(s) or available physicians capable of treating dive injuries.

(3) Location and phone number of nearest USCG Rescue Coordination Center, where appropriate.

(4) Emergency victim transport procedures including phone numbers of appropriate emergency transport services.

(5) Procedures and phone numbers or other means of communications to activate emergency services at the facility where the work is being performed.

(6) Diver rescue procedures conducted by the dive team, including responsibilities of team members, best location(s) where injured divers may be removed from the water, and best location(s) for performing first aid and stabilization prior to emergency medical support arrival.

e. Snorkeling Plan. Develop a Snorkeling Plan based on the requirements of paragraphs 30-7.b(1) through 30-7.b(5). It must contain, as a minimum, the following: (30-7.e)

(1) An AHA for each specific snorkeling mission. Give particular attention to currents and other environmental considerations. (See para 28-6)

(2) Records for snorkeling activities, to include:

(a) Snorkeler's annual physician certifications.

(b) Emergency Management Plan.

30-8. General Requirements.

a. Diving Operations. (30-8.a)

(1) Perform all diving operations according to this manual. Failure to meet these requirements will be cause for rejection of plans or cessation of operations.

(2) Coordinate requests for waivers or variances with the local DDC or ADC and according to the requirements of this manual.

(3) Do not use diving as a work method if the work objective can be more safely and efficiently accomplished by another means, including but not limited to, using Remotely Operated Vehicles (ROVs), and/or camera systems, or by dewatering the work area so work may be accomplished in the dry.

(4) Use SSA whenever possible according to the practical constraints of the diving operations.

(5) Do not use live boating without prior specific acceptance by the DDC.

(6) When diving at altitudes between 1,000 and 10,000 feet (304.8 to 3048 m), use the U.S. Navy Dive Manual SS512-AG-PRO-010 table to obtain decompression obligation.

(7) All dive operations must be conducted with full knowledge and close coordination with the USACE supervisor/KO or COR and onsite authorities such as the DSI, lockmaster, PM, etc. to ensure external operations and processes do not impact the safety of the dive.

(8) Key personnel designated by the DDC must attend a Pre-Dive Conference prior to the initial work on each dive operation. The conference agenda must include a discussion of the Dive Operations Plan, AHA, Emergency Management Plan, and any necessary plan modifications. For contractor operations, the DSI or DDC and a

representative of the contractor, with sufficient authority to implement any changes by the DSI or DDC, must attend.

(9) The DS must conduct a Pre-Dive Brief. The entire dive team must be briefed in detail on the following (as a minimum) prior to each dive:

(a) Description of mission and location, including drawings and/or photographs pertinent to the mission and equipment and materials that are to be installed as part of the mission.

(b) Description of diving apparatus/equipment and craft to be used.

(c) Maximum working depth with estimated bottom times and water temperatures.

(d) Names and duties of personnel on the team. When possible, incorporate at least one person on the dive that has previously performed the same or similar mission.

(e) Discussion of AHA.

(f) Emergency procedures.

(10) The DS must conduct a Post-Dive Brief. The entire dive team must be briefed upon completion of each diving operation or at the conclusion of each day on (as a minimum) the following information and requirements:

(a) Advise divers of the location of the nearest recompression chamber (if not located onsite), and the emergency hotline number for DAN or the local dive medical facility. Additionally, caution them on the limitations of their post dive activities including repetitive dives, traveling to higher altitude, and flying.

(b) Divers must wait at least 12 hours before flying after any dive. Divers must wait at least 24 hours before flying after multiple days of repetitive dives.

(11) Staff all dive teams according to the tables 30-2 through 30-6.

(a) The DDC may increase the levels after considering the diving and snorkeling support systems, the task at hand, weather conditions, dive/snorkeling platform type and location, and other factors.

(b) Team members may rotate through the dive or snorkeling team positions as long as the minimum staffing levels are maintained, and team members are qualified and accepted for the position.

(12) Submit copies of the dive logs to the DDC and COR after completion of the dive operation. For USACE dive teams, maintain these records on file for the time

period the employee is in the dive program and an additional two years after the employee has left the dive program.

(13) For each diver and dive, the following dive log information, as a minimum, must be recorded and maintained at the dive location:

(a) Full name.

(b) Date, time, and location of dive.

(c) Maximum depth and bottom time.

(d) Surface interval between dives.

(e) Breathing medium and type of equipment used.

(f) Group classification at the beginning and end of each interval and repetitive dive worksheet.

(g) Underwater and surface conditions.

(h) Depth and duration of each decompression stops.

(i) Date and time of last previous dive if it occurred within the last 24 hours.

(j) Name of DS(s) during dive.

(k) General description of work performed.

(l) For dives outside the no-decompression limits, deeper than 100 feet salt water (fsw) (30.5 m), or using mixed-gas, include depth-time and breathing-gas profiles and decompression tables (including any modifications).

(m) For each dive in which decompression sickness and/or pulmonary barotraumas is suspected, or symptoms are evident, the following information must be recorded and maintained:

(m-1) Descriptions of signs and symptoms (including depth and time of onset).

(m-2) Description and results of treatment.

(m-3) Name, address, and phone number of attending physician.

(14) Provide the following emergency and first aid equipment at all dive sites:

(a) A first aid kit meeting the requirements of chapter 3.

(b) An oxygen resuscitation system for each diver, to include standby diver(s), that delivers oxygen (O_2) for a minimum of 30 minutes at a rate of 15 liters per minute (lpm) or until emergency medical assistance can be administered. The system must contain a pocket mask with O_2 inlet, non-rebreather mask, and demand inhalator and/or demand resuscitator.

(c) A stokes litter or backboard, equipped with at least four body straps, snap buckles, and a head block, and have flotation capability.

(15) When diving from vessels, display International Code flag “A” and recreational dive flags with a minimum dimension of 23 inches (58.4 cm) a minimum of 3 feet (0.9 m) above the working surface at the dive location during diving operations. When diving from surfaces other than vessels in areas capable of supporting marine traffic, display a rigid replica of the International Code flag "A" at least 3 feet (0.9 m) in height at the dive location in a manner which allows all-round visibility, and illuminate it during night diving operations.

(16) When diving SSA from anchored vessels, the vessel must use no less than a two-point anchorage system.

(17) Select and configure staging areas, where the fully suited and equipped diver enters the water, based on a hazard analysis that includes an examination of the following:

(a) Ease of diver access to the water.

(b) Hazards to diver (for example, currents, equipment) in route from surface to work area.

(c) Ability of standby diver to access the water immediately and to reach the diver quickly.

Note. If diver entry to water is remote from the staging area, locate the standby diver at the water entry or at a spot immediately accessible to it.

(d) Ability to protect members and the standby diver from weather, operational, and other hazards located at the topside dive team station.

(e) Whether topside equipment can be stowed safely and function properly.

(18) Provide a standby diver whenever there is a diver(s) in the water, to serve as immediate emergency assistance to the primary diver(s).

(a) Untethered SCUBA divers, working in “buddy” pairs, must have one tethered standby diver at the surface for each pair.

(b) A standby diver will deploy only after the DS assesses the situation and gives direction.

(c) Fully equip the standby diver for immediate deployment the entire time the primary diver is in the water.

(c-1) The standby diver must don all specific gear (suits, harnesses, and equipment) they must wear or use and test all of it for proper operation before the primary diver leaves the surface.

(c-2) The standby diver must not assume other work responsibilities other than communications with the primary diver unless all the conditions in table 30-4 are met.

(c-3) Maintain all gear operational and ready for immediate use for the duration of the dive. The standby diver must don and test gear that is exchanged or replaced during the dive.

(d) The standby diver must be dressed appropriately for the water and air temperature and remain fully suited up with helmet or mask ready for immediate donning from the time the primary diver leaves the surface until reaching the work area or working depth. The standby diver may remove the portions of their gear needed to prevent heat or cold stress and fatigue. If the AHA identifies a need for the standby diver to remain fully dressed to deploy, it must address measures that will be taken to control these hazards (for example, standby in water at surface). Any gear that has been removed must be maintained ready for immediate donning and use, and accessible to the standby at the entry to the water.

(e) If configuration of the surface staging area prevents safe, immediate entry of the standby diver into the water, position the standby diver in the water fully dressed. The standby diver must remain at the surface ready for deployment prior to the primary diver leaving the surface.

(19) Dives that require surface decompression as an integral part of the dive operation must have a trained chamber operator, whose sole purpose is to attend to the chamber operation. When recompression capability is required on station, the recompression chamber must be in compliance with the requirements of 29 CFR 1910.423 (29 CFR 1910 Subpart T).

(a) In dive operations where use of the chamber is required for emergency, first aid, or other unexpected recompression events, all diving must be suspended during the chamber operations.

(b) Whenever a chamber is onsite, the chamber operator must be capable of communicating with a diving physician.

(c) Divers completing a decompression dive must remain within 60 minutes travel of a fully operable and staffed recompression chamber for a minimum of two hours after completing the decompression dive.

(20) Power Tools. Test and certify hand-held power tools are safe for underwater use. These tools must be de-energized at the surface before being placed into or retrieved from the water and must not be supplied with power until requested by the diver.

(21) Underwater Excavations. Perform underwater excavation operations according to ADCI International Consensus Standards for Commercial Diving and Underwater Operations.

(22) Contaminated Water.

(a) Diving in contaminated water is prohibited for all personnel unless supporting documentation is provided that demonstrates divers and topside personnel are not exposed to, or will be protected from, known or potential contamination hazards that would pose a chronic or acute health risk (see para 30-7.c).

(b) All divers and topside personnel must provide evidence of training and experience with contaminated water operations prior to actual diving operations (see paras 30-3.b and c).

(23) Crane operations conducted to support diving operations must be performed according to chapter 16 of this manual.

(a) Perform all working dives requiring communications between the divers and topside to direct crane load movements, etc., in SSA mode.

(b) The crane operator must take instruction from the tender or supervisor who is in direct communication with the diver.

(c) Crane operations where the load is placed or removed while a diver is underwater are considered Critical Lifts. The diver or load director must participate in the Critical Lift Plan development according to chapter 16.

(d) Divers performing rigging duties must be qualified riggers and meet the personnel qualifications according to chapter 15.

(24) Underwater Welding and Burning Operations. See chapter 10 for additional requirements.

(a) Underwater welding and burning operations are limited to SSA mode only.

(b) Equipment configuration and procedures must be according to the U.S. Navy Underwater Cutting and Welding Manual, S0300-BB-MAN-010.

(c) Divers performing underwater welding and burning operations must be equipped with the following as a minimum:

(c-1) A rubber or neoprene dive suit in good condition that provides electrical insulation to the diver.

(c-2) Insulating gloves with a cuff that, as a minimum, reaches and fully covers the wrist.

(c-3) A welding or burning eye shield attached to the dive helmet with appropriate shade for the conditions at the working area. See chapter 5 for helmet requirements.

b. SCUBA Operations. (30-8.b)

(1) SCUBA diving operations are not permitted in any of the following scenarios:

(a) At depths greater than 100 feet (30.5 m).

(b) On dives outside the no-decompression limits unless a dual lock, multi-place, recompression chamber in compliance with the requirements of 29 CFR 1910.423 (29 CFR 1910 Subpart T) is available at the dive location and is immediately available for use, a trained competent operator is onsite, and the chamber is of sufficient size to accommodate the diver as well as an inside tender.

(c) Against currents exceeding one knot.

(d) In enclosed or physically confining spaces. See chapter 34 for confined space requirements.

(e) Using closed circuit or semi-closed-circuit SCUBA.

(f) In visibility less than 3 feet (0.9 m) unless line tended with diver to surface two-way voice communications.

(g) In areas where pressure differentials exist and it cannot be positively verified that all potential leaks have been eliminated.

(h) When the diver does not have direct access to the surface.

(2) Specific operational requirements for SCUBA operations are as follows:

(a) The minimum sized SCUBA tank allowed as primary air is a standard 80 ft^3 aluminum tank pressurized to at least 2,700 psi at the beginning of dive operations.

Note. Divers must terminate their dive so they reach the surface with a minimum tank pressure of 500 psi.

(b) Equip each diver with a minimum 30 ft^3 bailout bottle for emergency use pressurized to at least 90 percent of its working psi rating and equipped with a separate 1st and 2nd stage regulator. An “octopus” is not considered to be an alternate air source.

(c) SCUBA air cylinders must be inspected according to paragraph 30-5 and comply with the following requirements:

(c-1) Air cylinders of seamless steel or aluminum must meet DOT 3AA and DOT 3AL specifications.

(c-2) Each cylinder must be stamped identification symbols into the shoulder of the tank.

(d) Equip each diver with a buoyancy compensation device having a manually activated inflation source, an oral inflation device, and an exhaust valve.

(e) Equip each SCUBA diver with a submersible cylinder pressure gauge capable of being monitored by the diver during the dive.

(f) Equip each SCUBA diver with a weight belt or assembly capable of quick release.

(g) Equip each SCUBA diver with a depth gauge and knife.

(h) Use a timekeeping device for recording diving times for all SCUBA diving operations. The DS and diver must each have a timekeeping device.

(i) Each tethered SCUBA diver must wear a safety harness with a positive buckling device, attachment point for the safety line, and a lifting point. The safety harness must distribute the pull force of the line over the diver’s body while maintaining the body in a heads-up vertical position when unconscious or inert. Tethered SCUBA diver must be line-tendered from the surface.

(j) Each untethered SCUBA diver must be accompanied by another diver in the water in continuous visual contact.

c. Surface Supplied Air (SSA) Operations. (30-8.c)

(1) SSA operations must not be conducted at depths greater than 190 feet (57.9 m), except dives with bottom times of 30 minutes or less may be conducted to depth of 220 feet (67 m). Do not conduct exceptional exposure dives, as defined by the U.S. Navy Diving Manual, except in emergency lifesaving situations. USACE in-house SSA operations must not exceed a planned depth of 110 feet (33.5 m) unless a waiver is requested by the DDC and approved by the USACE National Dive Safety Program Manager.

(2) SSA equipment components must be a type specifically designed to be used in diving support systems.

(3) A recompression chamber must be available for all SSA operations when diving outside the decompression limits, utilizing mixed-gas, and/or when diving at or deeper than 100 feet (30.5 m) is planned.

(a) Under these conditions, a dual lock, multi-place, recompression chamber in compliance with the requirements of 29 CFR 1910.423 must be available at the dive location immediately available for use.

(b) The chamber must be of sufficient size to accommodate the diver as well as an inside tender, and a trained chamber operator must be immediately available.

(c) Sufficient oxygen must be available to complete chamber operations. Oxygen used for diver's breathing at 100% concentrations and for mixing of diver's breathing gases must meet MIL-PRF-27210. Oxygen quality standards are as follows:

Note. Gaseous and liquid oxygen must contain not less than 99.5% by volume. The remainder, except for moisture and minor constituents specified below, must be argon and nitrogen.

(c-1) Oxygen (percent by volume) must not be less than 99.5%.

(c-2) Oxygen must not contain a level of CO_2 (by volume) greater than 10 ppm.

(c-3) Oxygen must not contain a level of methane (CH_4 by volume) greater than 50 ppm.

(c-4) Oxygen must not contain a level of acetylene (C_2H_2) greater than 0.1 ppm.

(c-5) Oxygen must not contain a level of ethylene (C_2H_4) great than 0.4 ppm.

(c-6) Oxygen must not contain a level of ethane (C_2H_6 and other hydrocarbons) greater than 6.0 ppm.

(c-7) Oxygen must not contain a level of nitrous oxide (N_2O by volume) greater than 4.0 ppm.

(c-8) Oxygen must not contain a level of halogenated compounds (by volume) as refrigerants greater than 2.0 ppm.

(c-9) Oxygen must not contain a level of halogenated compounds (by volume) as solvents greater than 0.2 ppm.

(4) Use a bell for dives with an in-water decompression time greater than 120 minutes, unless heavy gear is worn, or diving is conducted in physically confining spaces.

(5) Minimum specific operational requirements for SSA diving operations are as follows:

(a) Continuously tend each diver while in the water, with one diver per tender, regardless of depth. The tender must not perform any other duties outside of tending the diver, except as allowed by tables 30-2 through 30-8.

(b) Station an underwater tender/diver at the immediate underwater point of entry when any overhead obstruction limiting direct access to the surface is present and/or penetration diving is conducted or when in an enclosed or physically confining spaces.

(c) Provide a primary breathing air supply for each diving operation sufficient to support divers for the duration of the planned dive, including decompression.

(d) Each diver must have a reserve breathing supply available that can be turned on immediately by the diver in the event of loss of air. The reserve breathing air supply must have its own underwater submergible pressure gage with a 36 inch (91.5 cm) hose. The air supply must be of sufficient capacity to recover the diver and complete emergency recompression, if required, in the event of loss of primary air. The supply tank must contain no less than 30 ft^3 (0.85 m^3) of air pressurized to at least 90% of the tank's working psi at the beginning of the dive.

(e) Each dive location must have a reserve breathing air supply integral or in-line with the primary air source sufficient to safely terminate the dive and recover the diver(s) in the event of loss of the primary air supply.

(f) Provide the standby diver with a spare air supply hose on dives deeper than 100 feet (30.5 m) or outside the no decompression limits and using heavy gear. The spare hose is a replacement for the primary diver's air hose should it become damaged. Provide an in-water support stage to divers when using heavy gear, regardless of depth.

(g) Incorporate electronic communication systems with an external speaker so the entire dive team can monitor communications.

(g-1) Test communications devices prior to each dive, maintain them in an operable condition, and protect them from damage during use and storage according to the manufacturer's instructions.

(g-2) If voice communications are lost, terminate dive operations in a safe, orderly fashion using line-pull signals.

(g-3) Do not allow defective electronic communication equipment to prevent a standby diver from deploying in an emergency. However, deploy only after the DS determines it is safe to dive and use line-pull signals as appropriate.

d. Mixed-Gas Diving Operations. (30-8.d)

(1) For mixed-gas dives, provide a fully functioning dual lock, multi-place, recompression chamber with a trained, competent operator. Provide sufficient oxygen to complete chamber operations. The recompression chamber must be capable to conduct decompression following the mixed-gas decompression tables in the U.S. Navy Diving Manual. Do not perform extreme depth, mixed-gas diving.

(2) Equip each diving operation with a primary breathing gas supply sufficient to support divers for the duration of the planned dive, including decompression.

(3) Equip each diving operation with a reserve breathing gas supply integral or in-line with the primary air source sufficient to safely recover the diver(s) in the event of failure of the primary breathing gas supply.

(4) The primary and reserve breathing gas supply must be capable of delivering the mixed-gas requirements. For example, when performing mixed-gas helium-oxygen according to the U.S. Navy Surface-Supplied Helium-Oxygen Decompression Tables, the diving system must be capable of suppling the diver's umbilical with four different breathing gasses: Bottom Mixture; 50% Helium 50% Oxygen; 100% Oxygen; and Air.

(5) SUR D O_2 and/or 100% oxygen in-water decompression by trained and certified dive teams, may only be authorized as a decompression methodology upon submittal of an oxygen-specific decompression plan and schedule as part of the dive operations plan, and only with the expressed written approval of the DDC or ADC (see para 30-7.c).

(6) When heavy gear is worn provide the following:

(a) Provide each standby diver with an extra hose capable of supplying breathing gas to the diver in the water.

(b) Provide each diver with an in-water stage.

(7) For divers without access to a bell for dives deeper than 100 feet (30.5 m) or outside the no-decompression limits, provide an in-water stage.

(8) When a closed bell is used, one dive team member in the bell must be available to tend the diver in the water.

e. Oxygen Enriched Air (OEA). (30-8.e)

(1) USACE National Dive Safety Program Manager must approve any use of OEA such as Nitrox (EANx) breathing mixtures, and the associated equipment, by USACE in-house dive teams. Provide a written program that identifies training, certification, and procedures for OEA use with the request for approval. The DDC must approve use of OEA by contractors.

(2) Properly mark bottles used for OEA breathing mixtures.

(3) Follow, without exception, the U.S. Navy or NOAA Nitrox Dive Tables for the OEA mixture being used. Other more conservative decompression tables may be used after acceptance by the DDC.

(4) The use of OEA/EANx is considered mixed-gas diving and requires a decompression chamber onsite and ready for use.

(5) All divers must provide evidence of training and experience with OEA breathing mixtures prior to actual diving operations (see para 30-3).

(6) Test OEA breathing mixtures to assure proper mix prior to each use. No more than 40% OEA is allowed for normal diving operations. Higher OEA concentrations are allowable for in-water decompression at shallow safety stops.

f. Equipment Requirements. (30-8.f)

(1) Equipment modifications, repairs, tests, calibrations, or maintenance must be recorded by means of a tagging or logging system, and include the date and nature of work performed and the name of the individual performing the work. All work must meet manufacturer recommendations and be performed by a certified technician.
(See para 30-3.g)

(2) Breathing Air Compressors.

(a) Direct source breathing air compressor systems must be designed for their intended use and be equipped with a volume tank with check valve on the inlet side, a pressure gauge, a relief valve, drain valve and a low-pressure alarm.

(b) Direct Source breathing air compressors must overcome any line loss or other losses and deliver a minimum 4.5 acfm (2.1 l/s), or an amount acfm specified by the helmet manufacturer, to each diver at the maximum diving depth.

(c) Equip all direct source breathing air compressors with a CO monitor with alarm when powered by or used in close proximity to internal combustion engines (for example, boat motors, generators, cranes).

(d) Design all monitor/alarm systems with a visual and/or audio alarm and locate so the DS will be made aware of the hazardous conditions.

(e) Locate all breathing air compressor intakes away from and upwind of areas containing exhaust or other contaminants.

(f) Do not use oil-lubricated breathing air compressors containing a petroleum or potentially CO producing piston lubricant.

(g) Do not fuel an operating breathing air compressor.

(h) Equip breathing air compressors with appropriate in-line air purifying absorbent beds and/or filters inserted into the supply line to assure breathing air quality.

(i) Test each breathing air compressor by sampling at the connection to the distribution system.

(i-1) Have an accredited testing laboratory test all breathing air compressors with a working pressure greater than 500 psi every six months. Lab accreditation must be from a National Institute of Standards and Technology/National Voluntary Laboratory Accreditation Program, American Association of Laboratory Accreditation (for environmental or calibration), or similarly accredited organization.

(i-2) Have an accredited testing laboratory test all breathing air compressors with a working pressure less than 500 psi every two years. Perform in-house testing every six months.

(j) Provide the USACE supervisor/KO or COR with a copy of air quality certifications for all onsite direct source breathing air compressors and offsite suppliers showing the air meets the following purity standards:

(j-1) Air must not contain a level of CO greater than 10 ppm.

(j-2) Air must not contain a level of CO_2 greater than 1,000 ppm.

(j-3) Air must not contain a level of oil mist greater than 5 mg/m3.

(j-4) Air must not contain a level of hydrocarbons other than methane greater than 25 ppm.

(j-5) Air must not contain a noxious or pronounced odor.

(3) Breathing Air Supply Hoses and Umbilicals.

(a) Breathing air supply hoses must be suitable for breathing gas service or must be specifically manufactured for SSA use. Hoses must have a maximum allowable working pressure equal to or greater than supply pressure plus 150 psi.

(b) Breathing air supply hoses must have connectors made of corrosion resistant materials with a working pressure at least equal to the working pressure of the hose to which they are attached: connectors must not be able to become accidentally disengaged. All system hoses must have a lanyard strain-relief attaching the hose to equipment to prevent the hose from whipping should the hose burst.

(c) Umbilicals must be marked, beginning at the diver's end, in 10 feet (3 m) increments to 100 feet (30.5 m) and in 50 feet (15.2 m) increments thereafter (see table 30-1).

(d) Umbilicals must have a nominal breaking strength of 1000 lbs. (453.6 kg) and must be made of kink resistant materials.

(e) The umbilical assembly used for the standby diver must be at least long enough to reach the primary diver at the furthest distance the primary diver can be from the dive station.

(f) Carefully tend the umbilicals to maintain them and the diver clear of hazards (such as propellers, including those of ROVs, or intakes) present in the diving zone.

(g) Test hoses to 1.5 times the working pressure prior to placing into initial service and after any repair, modification, or alteration, and at least every 12 months. Maintain and test umbilical assemblies according to the manufacturer's instructions.

(h) Close and cap the open ends of the breathing gas hoses and umbilicals when not in use.

(4) SSA And Mixed-Gas Helmets and Masks.

(a) Helmets and masks must have an exhaust valve and non-return valve that readily close at the attachment between the helmet or mask and the hose.

(b) Helmets and masks must have a minimum ventilation rate capacity of 4.5 acfm (2.1 l/s) at the depth at which they are operated.

(c) Helmets and masks must support a reverse breathing supply which can be immediately turned on by the diver in event of loss air.

(d) Helmets and masks must support a two-way or four-way diver surface communication system.

(e) The use of Kirby Morgan Super Lite 17 A/B helmets are prohibited for use by USACE in-house dive programs. This helmet can be used by commercial dive contractors on USACE projects provided the helmet has been inspected and is equipped with the required and recommended safety equipment.

(5) Dive Harnesses. Unless heavy gear is worn, each tethered diver must wear a diver's safety harness meeting ADCI standards with a positive buckling device, two leg straps, attachment point for the safety line, and a lifting point to distribute the pull force of the line over the diver's body while maintaining the body in a heads-up vertical position when unconscious or inert.

g. Scientific Snorkeling. (30-8.g)

(1) Plan all scientific snorkeling according to paragraph 30-7.e and paragraph 30-8.g.

(2) Beach surveys must follow applicable scientific snorkeling safety procedures and must be conducted only with prior acceptance of the DDC.

(3) Scientific snorkeling is only for environmental assessments, such as fish surveys, stream surveys, and the like. Structural inspections or other work is not allowed.

(4) All snorkelers and team members must meet the qualifications of paragraph 30-3.f.

(5) Staff all snorkeling teams according to the tables 30-7 or 30-8.

(6) DSIs will provide safety oversight for snorkeling operations.

(7) Perform scientific snorkeling only at the surface of the water. No diving of any kind is permitted.

(8) Untethered single person scientific snorkeling is not allowed.

(9) A team member must accompany each untethered snorkeler either along the shore or in a boat and be within 50 feet (15.2 m) of the snorkeler at all times.

(a) Two untethered snorkelers in the same body of water may act as observer/assistant for each other.

(b) Team members must utilize wearable and throwable PFDs according to chapters 5 and 19 and must be capable of performing a rescue on the specific snorkeler(s) in an emergency.

(10) Untethered scientific snorkeling is not allowed in waters deeper than 5 feet (1.5 m), in bodies of water that a snorkeler cannot wade across, in currents exceeding one knot, in visibility less than 3 feet (0.9 m), or anywhere a pressure differential may exist.

(11) The local DDC may allow scientific snorkeling in open waters greater than 5 feet (1.5 m) deep upon approval of an acceptable AHA and compliance with all the following:

(a) The snorkeler must be tethered with a harness and a maximum of 40 feet (12.2 m) of floating line.

(b) Constantly tend the tether from the shore or boat.

(c) The snorkeler must wear a device providing a minimum of 15.5 lbs. (7 kg) of positive buoyancy (for example, Type III PFD, fully inflated snorkeling vest). The device must include a divers safety harness with a positive buckling device, two leg straps, attachment point for the safety line, and a lifting point to distribute the pull force of the line over the snorkeler's body while maintaining the body in a heads-up vertical position when unconscious or inert. The snorkeler must use professional grade equipment that includes a snorkel, mask, gloves, fins, appropriate footwear, thermal protection, as needed, and a knife.

(d) There are no potential tether entanglement hazards in the snorkeling area (for example, overhanging branches, surface stumps, rocks).

(12) When snorkeling from anchored vessels, the vessel must use no less than a two-point anchorage system.

(13) When snorkeling from vessels, display International Code flag "A" and recreational dive flags with a minimum dimension of 23 inches (58.4 cm) a minimum of 3 feet (0.9 m) above the working surface at the snorkeling location during snorkeling operations. When snorkeling from surfaces other than vessels in areas capable of supporting marine traffic, display a rigid replica of the International Code flag "A" at least 3 feet (0.9 m) in height at the snorkeling location in a manner which allows all-round visibility, and illuminate it during night diving operations.

(14) The following emergency and first aid equipment must be located at all snorkeling sites:

(a) A first aid kit meeting the requirements of chapter 3.

(b) An oxygen resuscitation system for each snorkeler that delivers O_2 for a minimum of 30 minutes at a rate of 15 lpm or until emergency medical assistance can be administered. The system must contain a pocket mask with O_2 inlet, non-rebreather mask, and demand inhalator and/or demand resuscitator.

(c) A stokes litter or backboard, equipped with at least four body straps, snap buckles, and a head block, and have flotation capability.

(15) Provide a direct means of communicating with emergency services while snorkeling.

30-9. Figures and Tables.

Table 30-1
Umbilical Markings

Distance (from diver's end)	Marking
10 feet (3m)	1 white band
20 feet (6.1m)	2 white bands
30 feet (9.2m)	3 white bands
40 feet (12.2m)	4 white bands
50 feet (15.2m)	1 yellow band
60 feet (18.3m)	1 yellow band / 1 white band
70 feet (21.3m)	1 yellow band / 2 white bands
80 feet (24.4m)	1 yellow band / 3 white bands
90 feet (27.4m)	1 yellow band / 4 white bands
100 feet (30.5m)	1 red band
150 feet (45.7m)	1 red band / 1 yellow band
200 feet (61m)	2 red bands
250 feet (76.2m)	2 red bands / 1 yellow band
300 feet (91.5m)	3 red bands

Note:
For each 50 feet (15.2 m) increment thereafter the sequence continues by increasing the number of red bands at each even increment of 100 feet (30.5 m). In cases where the umbilical color matches an above band color, a reasonable substitute may be used (contrasting outline on same-color tape, contrasting diagonal pattern, replacement with a color not already used).

Table 30-2
Staffing Levels for SCUBA: Untethered, 0 to 100 feet (0 to 30.5 m)

Personnel	Number
Diving Supervisor	1
Divers (in visual contact)	2
Standby Diver[1]	1
TOTAL MINIMUM TEAM	4

Note:
For applicable staffing level notes, see table 30-8.

Table 30-3
Staffing Levels for SCUBA: Tethered with Communications, 0 to 100 feet (0 to 30.5 m)

Personnel	Number
Diving Supervisor[3]	1
Diver in water	1
Standby Diver[1] (tethered with communications)	1
Tender	1
TOTAL MINIMUM TEAM	4

Note:
For applicable staffing level notes, see table 30-8.

Table 30-4
Staffing Levels for SSA: 0 to 100 feet (0 to 30.5 m) within No Decompression Limits

Personnel	Number	Penetration Dive
Diving Supervisor[3]	1	1
Diver	1	2
Standby Diver[1]	1	1
Tender	1	2
TOTAL MINIMUM TEAM	4	6

Note:
[1] For applicable staffing level notes, see table 30-8.

[2] The standby diver may be deployed as a working diver provided all of the following conditions are met: surface-supplied no-decompression dive of 60 fsw or less; divers are in close proximity, (based onsite specific requirements), with unimpeded access to each other; divers have communications with each other at all times; No entanglement hazards exist; prior to deploying the standby diver, the first diver on the jobsite determines the work area to be free of hazards (for example, suctions, discharges); the dive is not a penetration or confined space dive; and each diver has a full-time tender (which brings the minimum number of team members to five).

Table 30-5
Staffing Levels for SSA: 0 to 100 feet (0 to 30.5 m) Requiring Decompression and All SSA: 101 to 190 feet (30.8 to 57.9 m)

Personnel	Dives within No Decompression Limits	Dives Requiring Decompression	Penetration Dives
Diving Supervisor	1	1	1
Chamber Operator[2]	1[2]	1[4]	1
Diver	1	1	2
Standby Diver[1]	1	1	1
Tender	1	1	2
Standby Diver Tender	1	1	1
TOTAL MINIMUM TEAM	5 or 6	5 or 6	8

Note:
For applicable staffing level notes, see table 30-8.

Table 30-6
Staffing Levels for Surface Supplied Mixed-Gas Diving

Personnel	Dives within No Decompression Limits	Dives Requiring Decompression	Penetration Dives
Diving Supervisor	1	1	1
Chamber Operator[2]	1[2]	1[4]	1
Diver	1	1	2
Standby Diver[1]	1	1	1
Tender	1	1	2
Standby Diver Tender	1	1	1
TOTAL MINIMUM TEAM	5 or 6	5 or 6	8

Note:
For applicable staffing level notes, see table 30-8.

Table 30-7
Staffing Levels for Scientific Snorkeling: Untethered, 0 to 5 feet (0 to 1.5 m)

Personnel	Number
Team Supervisor[5]	1
Snorkelers (in visual contact)	2
TOTAL MINIMUM TEAM	3

Note:
For applicable staffing level notes, see table 30-8.

Table 30-8
Staffing Levels for Scientific Snorkeling: Tethered, Greater than 5 feet (1.5 m)

Personnel	Number
Team Supervisor[5]	1
Snorkeler in water	1
Team Member[5]	1
TOTAL MINIMUM TEAM	3

Staffing level notes (Tables 30-2 through 30-8):

[1] The standby diver must be rested and capable of performing emergency rescue assistance. When work is limited to no decompression limits, the standby diver must be sufficiently free of residual nitrogen to allow for 25 minutes of bottom time at the working depth without exceeding "No Decompression Limits."

[2] The trained chamber operator may be any non-diving member of the dive team when the chamber is only for emergency use when diving within the no-decompression limits. Saturation diving requires that a life support technician must serve as the chamber operator.

[3] The supervisor may be the standby tender for dives under 100 feet (30.5 m).

[4] The trained chamber operator may be any non-diving member of the dive team if all diving ceases during chamber decompression.

[5] The team supervisor and team member must be capable of performing emergency rescue assistance.

30-10. Checklists and Forms.

Not Applicable.