TETRA TECH

Diving Safe Practices Manual

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Safety Excellence

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TMR Manual

DSP-01 Diving Safe Practices Manual

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TABLE OF CONTENTS

ABBREVIATIONS AND ACRONYMS

ACFM	actual cubic feet per minute
ADCI	The Association of Diving Contractors International
AED	automated external defibrillator
AGE	arterial gas embolism
AHA	Activity Hazard Analysis
Army	U.S. Army
ATA	Atmosphere Absolute
CFR	*Code of Federal Regulations*
CRL	Corporate Reference Library
CNS	central nervous system
CPR	cardiopulmonary resuscitation
DCS	decompression sickness
DDC	District Diving Coordinator
DDESB	Department of Defense Explosives Safety Board
DOT	U.S. Department of Transportation
DRB	Diving Review Board
DSO	Diving Safety Officer
DSR	Diving Safety Representative
DSPM	Diving Safe Practices Manual
EM	Engineers Manual
ESSQ	Environment, Safety, Security and Quality
FSW	feet of seawater
HAZWOPER	Hazardous Waste Operations and Emergency Response
HASDP	Health and Safety Dive Plan
MEC	munitions and explosives of concern
NIOSH	National Institute for Occupational Safety and Health
NOAA	National Oceanographic and Atmospheric Administration
NOSSA	Naval Ordnance Safety and Security Activity
OSHA	Occupational Safety and Health Administration

ABBREVIATIONS AND ACRONYMS (Continued)

PFD	personal flotation device
PPM	parts per million
PSI	pounds per square inch (gauge)
SCUBA	self-contained underwater breathing apparatus
SDS	Senior Diving Supervisor
SHM	Safety and Health Manager
SOP	Standard Operating Procedures
SSHO	Site Safety and Health Officer
SUXOS	Senior UXO Supervisor
TP	Technical Paper
Tt	Tetra Tech
TMR	Tetra Tech Munitions Response
USACE	U.S. Army Corps of Engineers
USCG	U.S. Coast Guard
USN	U.S. Navy
U.S.	United States
UXO	unexploded ordnance

1.0 PURPOSE

This Tetra Tech Munitions Response (TMR) Diving Safe Practices Manual (DSPM) provides TMR employees and subcontractors with the requirements and guidance for conducting safe diving operations. Contractors working directly for the client will be required to have safe practices that meet or exceed the requirements of this manual while operating from TMR-owned or leased equipment or property.

This manual ensures TMR diving operations meet and/or exceed the requirements of federal and state agencies. The project management team, designated dive supervisor/lead divers, project quality managers (PQMs), and site safety and health officers (SSHOs) will ensure compliance with Occupational Safety and Health Administration (OSHA) regulations and standards by implementing these procedures during dive operations.

This manual was prepared in accordance with the OSHA regulations. Federal, state, and local regulations were also considered during the preparation of this manual. If a conflict arises between the current edition of this manual and applicable or updated federal or other legal directives or statutes, the latter shall always take precedence.

2.0 FEDERAL AND STATE STANDARDS REQUIREMENTS

This manual was developed using guidelines, procedures, rules, and regulations from the following government and civilian agencies:

- OSHA
- U.S. Army Corps of Engineers (USACE)
- The Association of Diving Contractors International (ADCI)
- U.S. Navy (USN)
- U.S. Coast Guard (USCG)
- U.S. Army (Army)
- National Oceanographic and Atmospheric Administration (NOAA)

This manual provides the **minimum regulatory standards** for team composition, diving procedures, equipment maintenance, and operations.

3.0 SCOPE

This document contains procedures applicable to all TMR projects involving underwater operations that use divers or snorkelers to perform work or scientific research. The procedures in this document shall meet the requirements in 29 *Code of Federal Regulations* (CFR) 1910.401, Subpart T. Requirements that are not specifically included in this DSPM will be included in the project specific Health and Safety Dive Plan (HASDP). When contracted to dive for clients who mandate following USACE standards, additional equipment, procedures, and review requirements will be addressed in the project specific HASDP. The specific requirements are identified in Section 30 of USACE Engineers

Manual (EM) 385-1-1, Safety and Health Requirements Manual. If there are any conflicts between this manual, OSHA, and/or federal and state/ local regulations, the most stringent regulations will take precedence, provided site safety is not compromised. All conflicts will be detailed, with procedures provided in the project specific HASDP.

4.0 REVISIONS

Revisions to this manual will be periodically completed based on new advances in diving practices, technological advances, and changes in regulations.

5.0 DIVING REVIEW BOARD

The diving program manager is designated the Chairman of the Diving Review Board (DRB) and is responsible for updating this manual. The designated diving safety officer (DSO) will maintain the qualification records of personnel approved for diving and will approve all other divers (including subcontracted divers) involved on TMR projects.

6.0 GENERAL RESPONSIBILITIES

This manual will be reviewed by the diving program manager, DSO, and the TMR senior diving supervisor (SDS) for technical content involving TMR diving. They will ensure diving operations are conducted in a safe and efficient manner throughout the company. Their responsibilities include:

- Review existing policies and procedures to ensure safe, effective diving operations.
- Develop recommendations to improve diving operations.
- Review and discuss diving accident report releases by various sources and ensure the distribution of copies to Dive Team members.
- Review any TMR near-miss or actual diving mishaps and develop procedures and policies to prevent future occurrences.
- Ensure that the TMR dive program conforms to all the guidelines in this DSPM, as well as all applicable federal, state, and local laws and regulations.
- Coordinate proper recordkeeping for diving personnel, diving operations, and dive equipment maintenance.
- Coordinate periodic diver training and safety programs as needed.
- Review, prior to approval, prospective TMR dive operations that use non-standard diving modes and procedures or carry above average risk.
- Review the qualifications and performance of all divers and potential Diving Supervisors/ Lead Divers.
- Stay updated on new safety procedures, as well as OSHA, USN, USCG, USACE, and ADCI requirements.
- The Quality Department will review this manual for compliance with appropriate laws and regulations.

- Approval authority rests with the TMR President, with review by the dive program manager.
- The Chairman of the DRB will be responsible for all required corporate recordkeeping in accordance with this manual, and maintenance of all identified references.
- For unexploded ordnance (UXO) diving operations, the dive program manager will review and approve all TMR employees and subcontractor personnel involved in UXO diving.

The DSPM will never substitute for prior planning, sound judgment, and a continuing concern for maximum safety. Safety is not a rulebook; it is a state of mind and must be continually maintained in our workplace culture. However, not all circumstances or situations can be explained and detailed in this DSPM. For this reason, TMR only recommends deviating from these guidelines when, in the opinion of the diving supervisor/lead diver, an emergency exists where the health and safety of personnel is a concern. The diving supervisor/lead diver will have final authority regarding safe conditions at the dive site. A written event report will be submitted to the Chairman of the DRB within 48 hours of the deviation from the DSPM to document possible changes to this manual and conformation to OSHA and other regulatory requirements.

6.1 Waiver of Requirements

The DRB may grant a waiver for specific requirements of training, examinations, and minimum activity to maintain certification.

6.2 Diving Program Manager/Chairman, DRB

The diving program manager is the Chairman of the TMR DRB. The DRB is composed of the diving program manager, the DSO, and the SDS from the TMR Operating Unit as assigned by the appropriate manager. The Chairman of the DRB is responsible for managing the TMR Diving Program in conjunction with the assigned board members; they will maintain the diving logs and references as required by OSHA in 29 CFR 1910.401, Subpart T. The DSO will maintain qualifications and physical records for all TMR divers. The Chairman will review and approve divers, including subcontractors who are assigned to individual projects.

6.3 DSO/DRB Member

The diving safety officer (DSO), as a permanent DRB member, is responsible for the safe conduct of UXO and construction diving operations. The DSO is responsible for the appropriate diver training and qualifications for UXO operations. The DSO will submit to the DRB the names of qualified UXO divers to be certified by TMR to work on company projects. The DSO will maintain a recent copy of the USN Diving Manual. OSHA, USACE, USCG, American National Standards Institute, applicable local regulations and the Association of Diving Contractors International Consensus and Technical Standards. The DSO will make these manuals available to the diving supervisors as required.

The DSO identifies diving supervisors/lead divers. Upon concurrence of the DRB, the DSO officially assigns them to the position in writing.

6.4 SDS/DRB Member

The senior diving supervisor (SDS) will be a senior TMR diver designated by the DSO and will be a member of the DRB. The SDS is responsible for the operational readiness of the TMR dive equipment and supporting assets. The SDS also provides supervision of the TMR divers, makes recommendations for dive staff assignments. The SDS is the SME for development of new diving procedures, technology, and capabilities.

6.5 Senior UXO Supervisor

A senior UXO supervisor (SUXOS) will be designated, in writing by the DSO, to projects that have both a UXO removal/investigation requirement and a diving requirement. The SUXOS will coordinate all ordnance response requirements and establish safe procedures for the investigation and removal of all UXO hazards.

On larger operations involving both diving and UXO operations, the Diving Supervisor/Lead Diver will normally supervise diving, and the SUXOS will oversee the UXO response. The same person can serve as SUXOS and diving supervisor/lead diver, if that person has both qualifications on smaller projects. The SUXOS shall be a qualified TMR environmental safety supervisor person in accordance with the guidelines outlined in Department of Defense Explosives Safety Board [DDESB] Technical Paper [TP] 18, Reference (e).

6.6 Diving Supervisor/ Lead Diver

The diving supervisor/lead diver will be designated in writing as the Designated Person in Charge for each diving operation. This designation is based on knowledge, experience, and level of training. The diving supervisor/lead diver is in charge of the overall diving operation and is responsible for the planning and execution of the dive, as well as the safety and health of the dive team. The diving supervisor/lead diver will be a qualified TMR qualified SUXOS. In carrying out these duties, their responsibilities will include, but will not be limited to:

- Ensuring that all dive team members who are exposed to, or control the exposure of others to, hyperbaric conditions will be trained in diving-related physics and physiology.
- Ensuring that each dive team member will be assigned tasks in accordance with the employee's experience or training. 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.
- Ensuring that a dive team member will not be required to be exposed to hyperbaric conditions against the employee's will, except when necessary to complete decompression or treatment procedures.
- Ensuring that a dive team member will not be permitted to dive or otherwise be exposed to hyperbaric conditions for the duration of any physical impairment or condition which is known and is likely to adversely affect the safety or health of a dive team member.

- Investigating and evaluating each incident of decompression sickness based on the recorded information, consideration of the past performance of decompression table used, and individual susceptibility.
- Taking appropriate corrective action to reduce the probability of or recurrence of decompression sickness.
- Preparing a written evaluation of the decompression procedure assessment, including any corrective action taken, within 10 days of the incident of decompression sickness.
- Being fully aware of all relevant governmental regulatory agency regulations that apply to the diving operation and the diving mode employed.
- Being in immediate control and available to implement emergency procedures during diving operations. The dive supervisor/lead diver is not permitted to dive unless another qualified person is present and has been formally appointed and designated to assume this responsibility.
- Ensuring, prior to diving, that all additional parties are informed that diving operations are about to be undertaken. These parties include, but are not limited to, craft masters, boat pilots, harbormasters, managers of pipelines, and managers for civil engineering sites and inland waterways.
- Ensuring that diving operations are conducted from a suitable and safe location on the surface.
- Establishing a project specific HASDP, and ensuring that sufficient air supply, supplies, and proper equipment are available for the safe and timely completion of the job task. This must be approved by the TMR DRB prior to conducting any diving evolution.
- Briefing the dive team as to the plan of attack, and soliciting suggestions outlined in Attachment 1, diving supervisor/lead diver Dive Plan Brief, native file format located in the Guidelines Templates and Tools folder in the Corporate Reference Library (CRL). During the briefing, they will make team assignments, designate required equipment, review diving signals, establish a positive diver recall method, and cover emergency procedures.
- Using the TMR Diving Supervisor Pre-Dive and Post-Dive Checklists (see Attachments 2, Diving Supervisor/Lead Diver Pre-Dive Checklist, and 3, Diving Supervisor/Lead Diver Post-Dive Checklist, which are also available in the native file format located in the Guidelines Templates and Tools folder in the CRL
- Ensuring all members of the diving team are familiar with the emergency procedures contained in the Emergency Procedures (see Attachment 4, which is available in the native file format located in the Guidelines Templates and Tools folder in the CRL).
- Being aware of the procedures to follow and the routes to take to obtain medical support in the event of an accident, either diving- or non-diving-related.
- Ensuring that a two-way communication system is available and tested.
- Ensuring that the Emergency Phone Numbers Checklist (see Attachment 5, which is available in the native file format located in the Guidelines Templates and Tools folder in the CRL) is completed and posted at the dive site.

- Determining the qualifications and proficiency of all personnel and ensuring that no dives are made by unqualified persons.
- Verifying that all equipment required is on scene and in working order.
- Ensuring that all relevant operating instructions, manuals, decompression schedules, treatment tables, and regulatory publications are available on the dive site.
- Maintaining a dive profile log for each diver, which includes depth, bottom time, and residual nitrogen time (see Attachments 6 and 7, which are also available in the CRL).
- Terminating diving operations at any time when, in their opinion, safe diving procedures are not being followed or conditions prevent safeguarding the divers. The diving supervisor/lead diver will not resume diving operations until the unsafe conditions have been removed or corrected.
- Ensuring that, after every dive, the Post-Dive Checklists in Attachment 3, which is available in the native file format located in the Guidelines Templates and Tools folder in the CRL, are used.
- Ensuring that, after any treatment or unplanned dive conducted outside the no-decompression limits, the diver is instructed to stay awake and remain in the vicinity of the chamber for at least 1 hour.
- Reporting all accidents or incidents involving personnel as required by TMR procedures and relevant governmental regulations.
- Ensuring all reports and paperwork are completed and submitted at the end of the diving day.
- Maintaining certification in cardiopulmonary resuscitation (CPR), first aid (American Red Cross or equivalent), automated external defibrillator (AED), and emergency oxygen administration.

6.7 Divers and Snorkelers

Divers must be at least 18 years of age, be medically certified as "fit to dive," and have a knowledge of diving theory, diving-related physics, and physiology. They will provide copies of their certifications to the DRB Chairman before being allowed to dive. On diving projects involving UXO operations, the minimum age of the diver must be 21 years, per the Bureau of Alcohol, Tobacco and Firearms regulations concerning the handling of explosives.

Divers must have a full understanding of the diving equipment in use, and of the tasks assigned. A diver is assigned by the diving supervisor/lead diver to perform specific tasks underwater and topside. The diver must be qualified for the diving technique, equipment selected, and the task assigned. Each diver will meet the following requirements:

- Know how to use the tools, equipment, and systems relevant to assigned tasks.
- Know the techniques of the assigned diving mode.
- Accomplish all tasks assigned by the diving supervisor/lead diver. In the event that the diver is assigned a task for which he/she does not consider himself/herself

to be qualified either by training or experience, the diver will immediately inform the diving supervisor/lead diver.

- Read, understand, and comply with all TMR policies and with applicable government regulations as they relate to their qualifications or performance while engaged in diving.
- Maintain a high level of physical fitness.
- Immediately obey all commands or instructions from the diving supervisor/lead diver to return to the surface, or first decompression stop, as appropriate.
- Keep topside personnel advised of conditions on the bottom.
- Be responsible for the diving gear worn and ensure that it is complete, in good repair, and ready for use at any time in accordance with regulations or instructions concerning its use, maintenance, repair, and testing.
- Report to the diving supervisor/lead diver any defect or malfunction of the diving equipment provided for the diving operation.
- Ensure the deepest depth of the dive has been established before ascent.
- Report to the diving supervisor/lead diver any recent medical treatment or illness so that the proper determination can be made concerning the diver's fitness to dive.
- Immediately report all symptoms or suspected symptoms of decompression sickness as early and accurately as possible.
- Always follow safe diving practices during the diving operation, whether topside or in the water. The diver will bring any questionable items to the attention of the diving supervisor/lead diver and will be alert for the safety of all.
- Remain awake and in the vicinity of the decompression chamber for at least one hour following recompression treatment or a hyperbaric exposure beyond no-decompression limits.
- Know and observe the rules for ascending to altitude, including flying after diving.
- Ensure that their diving equipment has been properly maintained, prepared, and tested before each dive. This requirement should never be delegated to others.
- Maintain a divers' logbook, which details all dives, medical examinations, courses taken, and personal equipment maintenance.
- Ensure their medical certificates are up to date and recorded in the diving logbooks. Divers will present their logbooks to the diving supervisor/lead diver at every job when requested.
- Ensure that he/she is not exposed to hyperbaric conditions against their will, except when necessary to complete decompression or treatment procedures.
- Maintain certification in CPR, First Aid, AED, and emergency oxygen administration.

A diver may refuse to dive, without fear of penalty, whenever they feel it is unsafe for them to make the dive. It is the diver's responsibility and duty to refuse to dive if, in their judgment, conditions are unsafe or unfavorable, or if they would be violating the precepts

of their training, abilities or the regulations and guidelines in this manual or the project DSPM.

6.8 Standby Diver

The standby diver is a fully qualified diver, assigned for backup to provide emergency assistance, and is ready to enter the water when conducting diving operations with a single-tended diver. When assigned during buddy diving, where two divers are conducting the dive together, he/she will be ready to enter the water prior to commencing the dive, and then may remove tank, mask, and fins at the diving supervisor/lead diver's discretion. Under no circumstances will he/she leave the dive site. The standby diver receives the same briefings and instructions as the working divers, wears the same diving equipment, monitors the progress of the dive, and is fully prepared to respond if called upon for assistance. While acting as a standby diver, **in addition to** the requirements listed above, the standby diver will:

- Be rested and fully capable of performing emergency rescue assistance.
- Be sufficiently free of residual nitrogen to allow for enough bottom time for the prescribed task at the working depth without exceeding the no-decompression limits for that depth.
- Be dressed appropriately to allow prompt entry into the water as directed by the diving supervisor/lead diver.
- Remain at their station throughout the entire dive.
- Refuse any tasks that might interfere with their duties as a standby diver whenever there is a diver in the water.

6.9 Dive Tender

The tender is a member of the dive team who works most closely with the diver on the bottom. Though it is preferred that the tender be a qualified diver, it is not mandatory. If the tender is not a qualified diver, they must be familiar with line pull signals and all emergency procedures. The tender is assigned by the diving supervisor/lead diver to continuously tend (monitor) the diver. They will devote their full attention to tending the diver they are assigned to, from preparation of the dive through its completion. They will not be assigned any other task while the diver is in the water. The tender shall further:

- Assist the diver in dressing and undressing and confirm that the diver's equipment is functioning properly.
- Always tend the diver’s safety line and be aware of the diver’s depth and location.
- Set up and operate all equipment as directed by the diving supervisor/lead diver.
- Immediately inform the diving supervisor/lead diver if they are assigned a task for which they do not consider themselves qualified either by training or experience.
- Be alert and immediately report any conditions that are hazardous or unsafe.
- Assist in topside work as required or directed.
- Maintain certification in CPR, first aid, AED, and emergency oxygen administration.

7.0 DIVING POLICY

It is the policy of TMR to consistently provide safe diving operations that meet the client's required level of work and that are following applicable laws and regulations. This work shall be consistent with the project-defined scope, schedule, budget, and level of quality. To accomplish this objective, TMR will provide the appropriate qualified personnel, resources, and guidance to the Operating Units where diving is required. Such resources may include specialized diver expertise that may be in another office, or corporate affiliate, or maybe subcontracted to the appropriate company.

This DSPM addresses procedures for the safe utilization of self-contained underwater breathing apparatus (SCUBA) and surface-supplied air diving operations. Mixed-gas diving is not authorized for employees of TMR covered under these procedures. All dives will be planned to adhere to the Standard Air, No Decompression, or Shallow Water dive tables set forth in the USN Diving Manual, refer to Attachment 10, available in the Guidelines Templates and Tools folder in the CRL.

The individual local or state requirements will be reviewed and incorporated into the project specific HASDP. This review will be performed prior to commencing any diving operations within the affected state. Prior to diving, the project specific HASDP must be approved by the Chairman of the TMR DRB for construction diving or the scientific DSO for scientific diving, with the approved copy forwarded to and retained by the TMR Chairman of the DRB.

8.0 SCIENTIFIC DIVING

All TMR Scientific diving will be conducted in accordance with Tetra Tech Corporate Safety DCN 02-15 Scientific Diving Program[1] in the Corporate Health and Safety Manual.

9.0 REQUIREMENTS FOR DIVING AND SNORKELING

9.1 General Requirements

The requirements presented in this section will be used in conjunction with procedures and requirements for individual dive techniques presented in the following sections of the DSPM. All dives will be executed under the regulations and guidelines outlined in Section 2.0.

- The qualifications of personnel and equipment requirements for snorkeling are the same as diving, except for the required air supply for diving.
- A ladder extending a minimum of 3 feet below the diving platform below the surface of the water and appropriate handrails will be provided to assist the diver on entry and exit from the water. (*Note: Inflatable boats are exempt from this requirement.*)
- A means will be provided to assist an injured diver from the water.

[1] https://tetratechinc.sharepoint.com/:b:/r/sites/Health-Safety/Health%20%20Safety%20Manual/02_General%20Health%20and%20Safety%20Programs/DCN%2002-15%20Scientific%20Diving%20Program.pd

- When diving from vessels, the international code alpha and recreational dive flag with a minimum dimension of 23 square inches will be displayed whenever diving operations are being conducted. The flag will not be removed until diving operations have been completed and all divers are safely out of the water. TMR divers will comply with all site-specific local, state, federal, and international regulations regarding marking of diving activities.
- For enclosed areas, i.e., Intracoastal Waterway or marinas, individual buoys with recreational diver flags will mark the outline of the diving area. The divers may have a "marker" buoy with the recreational dive flag to determine their exact location. A rigid replica of the International Code Alpha flag at least 1 meter in height and visible from all directions will be displayed at the dive location.
- A diver will be stationed at the underwater point of entry when diving is conducted in enclosed or physically confining spaces.
- Positive communications to the recompression facility, the designated medical facility, and any required transportation to these facilities (medivac, ambulance, etc.) will be checked daily. This communication will include cellular telephone or radio communications with a constantly manned location with telephone access at the dive site. Diving operations will not be conducted without established communications.
- The diving supervisor/lead diver will not be permitted to dive, unless another qualified supervisor is present and has assumed the dive supervisor/lead diver roles and responsibilities.

9.2 Snorkeling Requirements

TMR employees engaged in snorkeling operations will comply with the general requirements for diving and the following additional requirements, unless otherwise specified in a project specific and approved HASDP:

- Snorkeling will be conducted only with prior approval and acceptance of the district diving coordinator (DDC).
- Snorkeling will be allowed only for shallow water site assessments and reconnaissance. It will not be used for structural inspections or other work.
- An on-site snorkeling team shall be made up of no less than two persons: snorkeler and observer/assistant. Additional site personnel may be required by the DDC or safety office DSR based on site hazards and conditions. Snorkeling team plans and procedures shall be developed and enacted by a team supervisor who is qualified and experienced in snorkeling and incorporated in the HASDP.
- Snorkeling will only be done on the surface of the water. Breath-hold or free diving of any kind is not permitted.
- Generally, untethered snorkeling will NOT be allowed in waters deeper than 5 feet of seawater (FSW), in bodies of water that a snorkeler cannot wade across, or anywhere a pressure differential may exist.
- Snorkeling in open waters greater than 5 feet deep may be allowed by the DDC, based on an acceptable Activity Hazard Analysis (AHA) and compliance with the following:
  - Any requirements incorporated in the approved HASDP.

  - A single snorkeler shall be tethered with a harness and a maximum of 40 FSW of floating line. The tether must be constantly tended from the shore or boat.
  - The snorkeler must wear a device providing a minimum of 15.5 pounds of positive buoyancy (Type III personal flotation device [PFD], fully inflated snorkeling vest, etc.).
  - There are no potential tether entanglement hazards in the snorkeling area (e.g., overhanging branches, surface stumps, rocks, etc.).
- All snorkelers and observers/assistants will be certified as skin divers (snorkelers) or open water divers by a nationally recognized organization (e.g., Professional Association of Diving Instructors, National Association of Underwater Instructors, etc.) or the U.S. Forest Service Snorkel Safety Program.
- An observer/assistant will always accompany each untethered snorkeler either along the shore or in a boat and be within 50 feet of the snorkeler.
- Two untethered snorkelers in the same body of water may act as observer/assistant for each other if they remain within 50 feet of each other.
- Non-snorkeling observer/assistants shall wear a PFD and be equipped with a throw bag and/or ring buoy with at least 70 FSW of line and must be capable of performing a rescue on the specific snorkeler(s) in an emergency.
- Areas of extreme water velocity and turbulence will be avoided, especially those immediately upstream from debris jams or bedrock outcrops.
- Snorkelers will be provided with appropriate thermal protection.
- Employees will be determined medically fit by a licensed physician (doctor of osteopathy or medical doctor) prior to snorkeling. This certification shall be signed by a physician familiar with sports medicine, and state that each snorkeler is physically and medically fit to perform snorkeling activities according to commonly accepted sports medicine guidelines.
- All snorkeling team members shall be certified in first aid and CPR. Certification shall be in accordance with most recent emergency cardiovascular care guidelines, and/or American Heart Association or American Red Cross standards.
- A first aid kit will be available at each location where snorkeling is being performed. A means of securely transporting an unconscious person, such as a litter or stretcher, shall be provided when snorkeling is conducted in areas inaccessible to vehicles or boats.
- A means of communication capable of contacting emergency services must be available at locations where snorkeling is performed.
- Each snorkeler will be equipped with a professional grade mask, fins, snorkel, and snorkeling vest.
- A snorkeling protocol will be developed and included in the project HASDP. It will contain as a minimum, the following:
  - An AHA for each specific snorkeling mission (Particular detail will be given to currents and other environmental considerations.)
- Records for snorkeling activities will be maintained and will include as a minimum:
  - Snorkeler’s annual physician certifications

  - AHAs
  - A snorkeling plan incorporated in the HASDP that is based on the requirements of USACE EM 385-1-1; Section 30.A.15.a-e
- Snorkelers will wear apparel which provides appropriate protection from environmental conditions. The apparel must include fins or other appropriate foot protection.

9.3 SCUBA Diving Requirements

TMR employees engaged in SCUBA diving operations will comply with the general requirements for diving and the following additional requirements, unless otherwise specified in a project specific and approved HASDP:

- The minimum sized SCUBA tank allowed as primary air is a standard 80 cubic-foot aluminum tank pressurized to at least 90 percent, or 2,700 pounds per square inch (PSI) at the beginning of dive operations.
- Divers shall terminate their dive so that they reach the surface with a minimum tank pressure of 500 PSI.
- Audio communications are preferred in all diving situations. However, this type of communication is not required for a diver who is accompanied by another diver (buddy), or who can communicate with the tender on the surface via a safety line using line pull signals.
- The planned time of such a diving operation will not exceed the no decompression limits according to the USN Dive Manual, or the air supply duration of the cylinders in use, exclusive of the reserve supply. The cylinder pressure will be determined immediately before each dive.
- Each diver will be equipped with a knife, a diving wristwatch, a depth gauge or dive computer, a facemask, a submersible cylinder pressure gauge, and a buoyancy compensator.
- A weight belt or integrated weight system with a quick release that is appropriate for the suit and the depth of the dive will be worn.
- A cylinder harness with a quick release will be worn to secure the SCUBA cylinders to the diver.
- The weight belt and cylinder harness will be independently attached to permit release of either one without interference by the other.
- A personal flotation or buoyancy compensation device will be worn. An exception will be considered during approval of the HASDP for diving in enclosed spaces or under the ice.
- SCUBA diving operations will not be conducted at depths deeper than 100 feet.
- USACE or DDC exemption approval is required for dives to any depths from 100 feet to 130 feet, and if approved, a recompression chamber must be available within 5 minutes of reaching the surface.
- During all SCUBA dives, a standby diver will be available while a diver is in the water.

- A SCUBA diver will be line-tended from the surface or accompanied by another diver in the water in continuous visual contact during the diving operations. If any SCUBA diver is tended, they will wear a harness meeting the following standard:
  - Each tethered SCUBA diver shall wear a safety harness with a positive buckling device, 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.
- A diver-carried independent reserve breathing gas supply consisting of the following will be provided for each diver:
  - Each diver shall be equipped with a minimum 30 cubic-foot bailout bottle for emergency use pressurized to at least 90 percent of its working PSI rating and equipped with a separate first- and second-stage regulator. An "octopus" is not considered to be an alternate air source.

9.4 Surface-Supplied Diving Requirements

Employees engaged in surface-supplied diving will comply with the general requirements for diving, and the following additional requirements, unless otherwise specified in a project specific and approved HASDP:

- The approximate depth of each dive will be determined prior to the start of operations.
- A weight belt appropriate for the suit and depth of the dive will be worn, except when conditions dictate otherwise for the safety of the diver.
- A five-point safety harness, with a positive buckling device, will be worn under all other types of equipment (*except when diver is dressed in heavy gear*). This harness will have an attachment point for the umbilical to distribute the weight of the diver's body and prevent any strain from being placed on the diver's mask or helmet if/when the umbilical is pulled on. The safety harness will also have a lifting point to distribute the pull force of the line over the diver's body. The safety harness may be equipped with a backpack to contain a bailout bottle.
- Surface-supplied dives will not exceed 190 FSW and will not enter into exceptional exposure dives as set forth in the USN standard air decompression tables.
- A decompression chamber will be ready for use on site for any dive outside the no-decompression limits or deeper than 100 FSW.
- Each diver will be continuously tended by another dive team member while in the water.
- A diver will be stationed at the underwater entry point when diving is conducted in enclosed or physically confining spaces.
- A standby diver will be available while a diver is in the water.
- Each dive will have a primary air supply capable of supplying the diver(s) with the specified air volume, pressure, and flow rate, in accordance with the manufacturer's specifications associated with the diving apparatus worn, throughout the planned depth of the dive, including any required decompression.
- Each dive location will have a reserve breathing air supply, in line, capable of supporting the dive operation.

- A diver-carried reserve breathing gas supply will be provided for each diver on dives deeper than 60 FSW or outside no-decompression limits, or when the diver does not have direct access to the surface and on all surface-supplied dives operating under USACE EM 385-1-1. This does not apply when heavy gear is used.
- On all dives deeper than 100 FSW or outside the no-decompression limits, an extra breathing gas hose capable of supplying gas to the diver in the water will be available to the standby diver.
- On all dives deeper than 100 FSW or outside the no-decompression limits, an in-water stage will be provided.

10.0 DIVER TRAINING AND QUALIFICATIONS

The following section describes the minimum requirements for TMR divers. Additional training may be needed for site-specific conditions, or required under federal, state, or local regulations.

The level of experience or training required by the standard depends on 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.

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 and classroom training may be used to meet the requirements of the standard.

- Divers must have federal certificates (such as from the USACE, NOAA, and/or military diving school).
- Divers must have civilian diving school certificates of completion for the appropriate training level issued by schools associated with the ADCI.
- Each dive team member must be trained in CPR (American Red Cross or equivalent), first aid, AED, and emergency oxygen administration. Employees completing this training are issued a card certifying that they have successfully completed the course.
- Each member of the TMR diving team will be qualified to conduct the work assigned by completion of training and/or experience. This qualification will be documented by completion of a certified course of instruction, to include one or more of the following: a certified commercial course (Association of Commercial Diving Educators accredited), a civilian certification with experience for the profile of the dive, or a documented military diver training and experience.
- All divers will maintain a personal dive log that will document all hyperbaric exposures. Additionally, dates of diving physicals and a record of all relevant training will accompany the log. The following minimum information should be included in the log:

- Location of exposure
- Maximum depth
- Time left surface, total bottom time, and time reached surface
- Type of breathing apparatus and mixture used
- Task performed
- Decompression table and schedule used
- Any decompression sickness symptoms or injury
- Signature of the Diving Supervisor/Lead Diver
- Comments

10.1 Entry Level Training

All TMR non-divers who have the required skills and training to participate in diving-related activities must be certified by an internationally recognized agency.

10.2 SCUBA Training

All TMR divers will provide a copy of their diver certification to the Chairman of the DRB that represents successful completion of a swimming evaluation, practical diver training, written examination, and open water evaluation. Scientific divers will also provide a copy of their diver certification to the DSO. The certificate from the training activity will be used to document the location and date of training. The dive log will document the depth and number of diving qualification dives.

10.3 Surface-Supplied Diver Training

The training certificate to document previous training and dive log to document the number of dives and depth of diving qualifications will be provided. Training dives will be required to ensure all divers are current in the type of equipment and the depth expected of the diving project.

11.0 PERSONNEL REQUIREMENTS

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, and 29 CFR 1910.421(e), Hazardous Activities. The second provision requires employers to provide a means to assist an injured diver from the water, such as a small boat or stokes basket, which may necessitate additional dive team members.

11.1 Self-Contained Underwater Breathing Apparatus (SCUBA)

For diving that requiring the use of SCUBA, the following number of divers are required for the work:

Dive Team Composition SCUBA – Untethered, 0 to 100 FSW	
Personnel	**Number**
Diving Supervisor	1
Divers (in visual contact)	2
Standby Diver*	1
TOTAL TEAM	**4**

Dive Team Composition SCUBA – Tethered with communications, 0 to 100 FSW	
Personnel	**Number**
Diving Supervisor **	1
Diver in water	1
Standby Diver* (tethered with communications)	1
Tender	1
TOTAL TEAM	**4**

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

*** The supervisor may be the standby tender for dives under 100 FSW.*

11.2 Surface-Supplied Diving (0-100 FSW with no Decompression Diving)

For surface-supplied diving, from 0 to 100 FSW, the number of divers required to perform the work is listed below:

Dive Team Composition Surface Supplied Air – 0 to 100 FSW Within No Decompression Limits		
Personnel	**Number**	**Penetration Dive**
Diving Supervisor **	1	1
Diver	1	2
Standby Diver*	1	1
Tender	1	2
TOTAL TEAM	**4**	**6**

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

*** The supervisor may be the standby tender for dives under 100 FSW.*

11.2.1 Deploying the Standby Diver as a Worker Diver

The standby diver may be deployed as a working diver provided **all** the following conditions are met:

1) Surface-supplied no-decompression dive of 60 FSW or less;
2) Divers are in proximity, (based on site specific requirements), with unimpeded access to each other;
3) Divers always have communications with each other;
4) No entanglement hazards exist;
5) Prior to deploying the standby diver, the work area shall be determined to be free of hazards (i.e., suctions, discharges) by the first diver on the job site;
6) The dive is NOT a penetration or confined space dive; and
7) Each diver has a full-time tender (which brings the minimum number of team members to five).

11.3 Surface-Supplied Diving (Deeper than 100 FSW or decompression diving)

For surface-supplied diving deeper than 100 FSW, or decompression diving, the number of divers required to perform the work is listed below:

Dive Team Composition Surface Supplied Air – 0 to 100 FSW Requiring Decompression All Surface Supplied Air, 101 to 190 FSW			
Personnel	**No Decompression Dives**	**Decompression Dives**	**Penetration Dives**
Diving Supervisor	1	1	1
Chamber Operator**	1**	1***	1
Diver	1	1	2
Standby Diver*	1	1	1
Tender	1	1	2
Standby Diver Tender	1	1	1
TOTAL TEAM	**5/6**	**5/6**	**8**

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

*** The Competent Person/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 will serve as the chamber operator.*

**** The Competent Person/chamber operator may be any non-diving member of the dive team if all diving ceases during chamber decompression.*

11.4 Other Diving Operations

An additional dive crew member may be required for any diving operations involving an increased likelihood of diver entrapment or the potential for rendering the diver unconscious or incapacitated from chemical, physical, electrical, or topside hazards. These operations include, but are not limited, to:

- Diving on ordnance and/or explosives projects
- Diving from a small boat
- Diving in remote areas where assistance from non-diving crew personnel is not immediately available, but within communication range
- Penetration diving, both horizontal and vertical
- Diving requiring crane operations
- Diving in any situation where the diver uses surface-tended equipment
- Diving from a platform greater than 8 feet above the water surface

12.0 MEDICAL REQUIREMENTS

Each diver will receive a diving physical examination initially when assigned diving duties and yearly thereafter. In addition, a medical examination will be conducted whenever a diver has been hospitalized for more than 24 hours due to an injury or illness. A determination as to their fitness to continue to dive will be prepared by the examining physician. The physician will prepare a written report containing the following statement: "Based on the following, I certify the diver as 'Fit to Dive'." In addition, the report will contain the following information:

- Medical requirements of this standard and a summary of the nature and extent of hyperbaric exposure to which the diver will be exposed, including diving modes and types of work to be assigned (TMR will provide the dive information).
- The diver's medical history (a diver's Medical History and Supplemental Diving Questionnaire, available in the CRL), which will be filled out completely and will be provided to the examining physician.
- The results of the medical examination. A basic diving physical examination will be conducted initially and annually for all TMR divers, which will include a chest X-ray, vision testing, audiogram, pulmonary function test, blood chemistry panel, complete blood count with differential, urinalysis with microscopic analysis (U.S.), and any additional tests required by the examining physician. An electrocardiogram will be performed. An exercise stress test may be indicated based on a risk factor assessment performed by the doctor.
- The examining physician's opinion of the employee's fitness to be exposed to hyperbaric conditions, including any recommendations or limitations to such

exposure. TMR will provide the employee with a copy of the physician's written report.

Determination of the employee's fitness to dive will be based on the physician's written report and review by the DRB. If the physician has recommended a restriction or limitation on the employee's exposure to hyperbaric conditions, and the employee does not agree with the physician's findings, the employee has the right to obtain his own diving-certified physician to perform a diving physical. If the second physician does not agree with the findings of the first physician, a third physician will be consulted for resolution.

13.0 EQUIPMENT CONSIDERATIONS

The diving supervisor/lead diver, in conjunction with the DRB, will establish the equipment requirements for individual projects. This list will be included in the HASDP and will include the required dive gear, boat equipment, and any required task-specific equipment. This list should be submitted to the project manager when the HASDP has been approved. Each equipment modification, repair, test, calibration, or maintenance service that is required will be recorded by means of a tagging or logging system. This system will include the date, serial number of the item, nature of the work performed, and the initials of the person who conducted the work.

13.1 Equipment Maintenance

Typically, TMR underwater operations use a variety of diving systems and component equipment. This equipment is considered life support equipment and should be treated as such.

- All equipment will be maintained in accordance with the directives set forth by OSHA and the Manufacturer's Specifications.
- Any maintenance performed on equipment will be logged on the maintenance form and forwarded to the project equipment manager for entry into the Equipment Maintenance Log.
- Dive supervisor/lead divers shall have the required expertise to maintain the systems used by TMR.
- Dive Team Members shall treat all equipment in a responsible manner and immediately inform the dive supervisor/lead diver of any potential equipment problems that they may observe.
- Bi-annual air quality tests will be performed on all breathing air compressors, and the results kept on file by the Chairman of the DRB.
- Equipment requiring periodic calibrations shall be sent to their respective manufacturers or licensed professionals for proper maintenance and calibration. The dive supervisor/lead diver shall inform the project equipment manager of any equipment taken offline.

If the equipment was provided by the TMR warehouse, the equipment manager will manage and report equipment concerns in accordance with TMR Procedure PO-18, Warehouse Management.

13.2 Air Supply Requirements

Diver air will be procured from a facility where the compressors meet the requirements established in Compressed Gas Association Pamphlet G-7.1 or more stringent standards. The tanks will be filled with compressed air from a source that complies with, at a minimum, 29 CFR 1910.430 (equipment). The breathable air supplied to the diver will be tested every 6 months and will not contain:

- A level of carbon monoxide greater than 10 parts per million (ppm)
- A level of carbon dioxide greater than 1,000 ppm
- A level of oil mist greater than 5 milligrams per cubic meter
- A level of hydrocarbons, other than methane, greater than 25 ppm
- Noxious or pronounced odor

A copy of the latest air test results will be reviewed and/or obtained and filed with the HASDP. When using local established vendors, a check of current certification is required every 6 months. If air test results are not available, TMR will draw an air sample from the compressor for appropriate analyses.

13.3 Regulators

TMR divers will be responsible for inspecting and scheduling maintenance on their regulators prior to the first use and every 12 months thereafter. Documentation of the inspections and maintenance will be maintained in the TMR diving files.

13.4 Compressed Air Cylinders

Compressed breathing air cylinders will:

- Be constructed with seamless steel or aluminum that meets U.S. Department of Transportation (DOT) 3AA and DOT 3AL specifications.
- Have identification symbols stamped into the shoulder of the cylinder.
- Be inspected internally and externally for corrosion and pitting on an annual basis. If a defect is found that may impair the safety of the pressure vessel, a hydrostatic test must be performed.
- Be hydrostatically tested every fifth year in accordance with DOT regulations. The test dates will be stamped into the shoulder of each cylinder. Documentation of each cylinder inspection will be maintained in the TMR diving files.
- Be stored in a ventilated area and protected from excessive heat.
- Be secured from falling.
- Have shutoff valves recessed into the cylinder or protected by a cap, except when in use, when installed with a manifold, or when used for SCUBA diving.

13.5 Air Compressor Systems

Air compressors used to supply air to the diver will:

- Be equipped with a volume tank that has a check valve on the inlet side, a pressure gauge, a relief valve, and a drain valve.

- Have intakes located away from areas where exhaust fumes or other air contaminants may be present.
- Be tested every 6 months by means of samples taken at the connection to the distribution system to ensure that the air supplied meets all applicable standards (see Section 3.6.1, above). Non-oil lubricated compressors do not have to be tested for oil mist.
- Be equipped with a moisture separator and filtration system.

A log shall be maintained showing all tests, repairs, maintenance, and run time on all air compressors systems.

13.6 Surface Supplied Air

The diver's surface-supplied air supply may originate from an air compressor, a bank of high-pressure air flasks, or a combination of both. Regardless of the source, the air must:

- Meet the purity standards stated above;
- Be supplied in an adequate volume for breathing;
- Have a rate of flow that properly ventilates the helmet or mask; and
- Be provided at enough pressure to overcome the bottom water pressure and the pressure losses due to flow through the diving hose, fittings, and valves.

The air supply requirements depend on specific factors for each dive, such as depth, duration, level of work, number of divers being supported, and type of diving system being used.

The capacity of the primary air supply must meet the consumption rate for the designated number of divers for the full duration of the dive (bottom time plus decompression time). The maximum depth of the dive, the number of divers, and the equipment to be used must be considered when sizing the supply.

The secondary air supply must be sized to support recovery of all divers using the equipment and dive profile of the primary supply, if the primary supply malfunctions or fails at the worst-case time (i.e., immediately prior to completion of planned bottom time of maximum dive depth, when decompression obligation is greatest).

13.6.1 Breathing Gas Supply Hoses

Breathing gas supply hoses will:

- Have a working pressure at least equal to the pressure of the total breathing gas system;
- Have a rated bursting pressure at least 4 times the working pressure;
- Be tested annually (at a minimum) to 1.5 times their working pressure;
- Have their ends taped, capped or plugged when not in use;
- Have connections made of corrosion resistant material, and be resistant to accidental disengagement; and
- Have connectors with a working pressure at least equal to the hose to which they are attached.

13.6.2 Divers' Air Supply Hoses

Umbilical's will:

- Be marked (starting from the diver's end) at 10-foot increments for the first 100 feet; and 50-foot increments thereafter;
- Be made of kink-resistant material; and
- Have a working pressure greater than the pressure equivalent of the maximum depth of the dive plus 100 pounds per square inch.

13.7 Gauges and Timekeeping Devices

The following requirements apply to each diver's gauge or timekeeping device:

- Each depth gauge will be deadweight tested or calibrated against a master reference gauge every 6 months, and when there is a discrepancy greater than 2 percent of full scale between any two equivalent gauges.
- A cylinder pressure gauge that is capable of being monitored by the diver during the dive will be worn by each SCUBA diver and surface-supplied diver when equipped with a bailout bottle.
- Each SCUBA diver will wear a diving watch capable of displaying elapsed time.
- A timekeeping device will be available at each dive location.
- Dive computers will be approved for use after the review and approval of the DRB (see paragraph 13.10 below).

13.8 Buoyancy Control

The following requirements apply to each diver's buoyancy control device:

- A dry suit or buoyancy compensator not directly connected to the helmet or mask will be equipped with an exhaust valve.
- Helmets or masks directly connected to a dry suit or other buoyancy-changing device will be equipped with an exhaust valve.
- When used for SCUBA diving, a buoyancy compensator will have an inflation source separate from the breathing gas supply and a manual inflator hose.
- An inflatable flotation device capable of maintaining the diver at the surface in a face-up position, having a manual activated inflation source independent of the breathing gas supply, an oral inflation device, and an exhaust valve is required for SCUBA diving, except when diving in enclosed spaces or under the ice.

13.9 Masks and Helmets

The following requirements apply to each diver's mask or helmet:

- Surface-supplied masks/helmets will have a non-return valve at the attachment point between helmet or mask and hose that will close readily and positively. Masks/ helmets will also have an exhaust valve.
- Surface-supplied air masks and helmets will have a minimum ventilation rate capability of 4.5 actual cubic feet per minute at any depth at which they are operated, or they will have the capability of maintaining the diver's inspired carbon

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

13.10 Dive Computers

Dive computers that calculate decompression time based on time and depth are not to be used unless authorized by the dive supervisor/ lead diver and incorporated into the project specific HASDP. They must be checked for accuracy prior to use.

13.11 Backpacks

Backpacks worn during diving operations without integrated flotation devices and weight systems must be equipped with a quick-release device.

13.12 Handheld Power Tools

Handheld power tools are not normally used during SCUBA diving operations, but, if used, they will be used in accordance with the following safeguards:

- Handheld power tools and equipment will be de-energized before being placed into or out of the water.
- Handheld power tools will not be supplied with power from the dive location until requested from the diver.
- Two-way voice communications between divers and topside must be used.

13.13 Dive Tables

Dive tables shall be made available to divers at all diving locations.

13.14 Welding/Cutting/Burning

Welding, cutting, and burning procedures are not addressed in this manual. When a diving project requires welding, cutting, or burning operations, those specific procedures will be addressed in the project specific HASDP for that project.

13.15 First Aid/CPR/AED/Emergency Oxygen

A first aid kit, appropriate for diving operations and approved by a physician, will be available at the dive site. This kit will contain an American Red Cross standard first aid handbook or equivalent, a bag-type resuscitator with transparent mask and tubing, and a stokes litter or backboard with flotation capabilities.

Additionally, a portable source of oxygen will be available at the dive site for transport of a diving-related casualty to the hyperbaric treatment facility. One additional first aid kit will be the AED. It has been proved that, in the case of cardiac arrest, the AED, if used within the first 3 minutes, would save an additional 74 percent of patients.

13.16 Equipment Procedures Checklists

Pre-dive and post-dive checklists for both Surface-Supplied Air and SCUBA operations will be used during setup and breakdown of the dive station.

14.0 RECORDKEEPING REQUIREMENTS

The following records are required by 29 CFR 1910.401, Subpart T, and will be maintained as follows:

- The TMR Chairman, via the DRB, will maintain all historical records.
- Records will also be retained in the project, office, or department files, in accordance with TMR Procedure PO-08 Document Control and Records Management.
- Records and documents will be maintained in accordance with 29 CFR 1910.401, Subpart T, and will be provided upon request to employees, designated representatives, and others as determined by TMR.

14.1 Dive Profile Log (Depth-Time Profile)

The TMR Dive Smooth Log (Attachment 7, which is available in the native file format located in the Guidelines Templates and Tools folder in the CRL) will be forwarded to the Chairman of the DRB and maintained for 1 year. If there has been a diving-related illness or injury on the project, the records will be maintained for a period of 5 years. After the 5-year time limit, the records will be forwarded to the National Institute for Occupational Safety and Health (NIOSH). The TMR DSO will maintain copies for all scientific divers.

14.2 Diving-Related Injury Records

Any diving-related injury or illness, which requires any dive team member to be transported to a hospital for treatment related to any diving incident, will be reported to the safety and health manager (SHM) and documented by specifying the circumstances of the incident and extent of the injuries in the section provided in the Dive Profile Log.

The SSHO will subsequently report this accident/ incident to the TMR organization in accordance with procedure DCN 02-02, event reporting and investigation. The Dive Smooth Log and written Accident/Incident Report will then be forwarded to the designated SHM, who will forward it to the Chairman of the DRB. The Chairman will include the Dive Profile Log sheet in the TMR Dive Log, which is available in the native file format located in the Guidelines Templates and Tools folder in the CRL.

14.3 Recording of Dive

As stated above, a Dive Profile Log sheet will be completed for each dive, and, upon completion of the dive, will be forwarded to the Chairman of the DRB. The Chairman of the DRB will include the Dive Profile Log sheet in the TMR Dive Log, which will document all dives conducted by TMR personnel. The Diver's Medical History and Supplemental Diving Questionnaire must be completed for each diver before they commence diving.

14.4 Decompression Procedure Assessment Evaluation

In the event of a diving-related incident that requires treatment by recompression, the section of the Dive Profile Log sheet for Decompression Procedure Assessment Evaluation will be completed and forwarded to the Chairman of the DRB, who will include

the log in the TMR Dive Log. The Dive Log will be maintained for a period of 5 years. The Chairman of the DRB or designee will conduct the accident investigation.

14.5 Equipment Inspections and Testing Records

The current log entry or tag for required equipment must be maintained until the equipment is removed from service.

14.6 Records of Hospitalization

All medical records generated by a hospitalization visit must be forwarded to the TMR Medical Provider.

14.7 Diver Medical Records

The Tetra Tech Corporate Safety Procedure DCN 3-02F, MS-2, Release of Medical and Exposure Records[2] form is retained by TMR Human Resources Department. The Tetra Tech Corporate Safety Procedure DCN 3-02F, MS-1, Physician's Certification form[3] is retained by the Tetra Tech Medical Provider, and copies are maintained in project site files by the SSHO. All personal information protected by the Health Insurance Portability and Accountability Act is maintained by Tetra Tech's independent medical provider. Employee medical records will be handled in accordance with Tetra Tech Corporate Safety Procedure DCN 1-04, Recordkeeping and Reporting Requirements[4].

Diver qualification medical records that are signed by the TMR Medical Provider will be maintained for the duration of employment plus 30 years in accordance with 29 CFR 1910.1020(d).

14.8 Diving Safe Practices Manual

The current version of this DSPM is required to be maintained at the dive location.

14.9 Forwarding of Records

Employers are no longer required to notify and/or transfer records to NIOSH. OSHA's 29 CFR 1910.1020(h)(1) provides that whenever an employer is ceasing to do business, they must "transfer all records subject to this section to the successor employer. The successor employer shall receive and maintain these records.

14.10 Termination of Diving Operations

If TMR ceases to do business, the successor employer will receive and retain all dive and employee medical records required by 29 CFR 1910.1020(h)(2); The employer shall notify affected current employees of their rights of access to records at least three (3) months prior to the cessation of the employer's business

[2] https://tetratechinc.sharepoint.com/:b:/r/sites/Health-Safety/Health%20%20Safety%20Manual/03_Environmental%20and%20Remediation%20Operations/DCN%2003-02F%20MS-2%20Release%20of%20Medical%20and%20Exposure%20Records.pdf

[3] https://tetratechinc.sharepoint.com/:b:/r/sites/Health-Safety/Health%20%20Safety%20Manual/03_Environmental%20and%20Remediation%20Operations/DCN%2003-02F%20MS-1%20Physicians%20Certification%20Form.pdf

[4] https://tetratechinc.sharepoint.com/:b:/r/sites/Health-Safety/Health%20%20Safety%20Manual/01_Health%20and%20Safety%20Program%20Administration/DCN%2001-04%20Recordkeeping%20and%20Reporting%20Requirements.pdf

14.11 Training Records

Copies of each diver's successful completion of the USN Dive School or civilian certification, and any other certificates of any specialized training (relevant to the job), will be forwarded to the Chairman, of the DRB and kept on the project site. Additionally, any training conducted in preparation for the job will be documented and retained on site and copies forwarded to the Chairman of the DRB.

15.0 OPERATIONS PLANNING

This section provides guidance on effective dive planning for any size operation. The success of any diving operation is a direct outcome of careful, thorough planning. The site-specific circumstances of each operation determine the scope of the planning effort, but certain considerations apply to every operation.

The HASDP provides a basic outline of minimum required information to successfully plan the diving operation. A project specific plan will be developed and implemented by the DRB, Project Manager and designated Diving Supervisor/Lead Diver for each separate diving project. The TMR SSHO for the project shall complete applicable self-assessment checklists. A project HASDP shall be developed to address the general diving and to include the following:

- Describe dive team composition, personnel qualifications, and responsibilities, along with the proper up-to-date documentation.
- Provide name and qualifications of the designated person in charge/diving supervisor responsible for diving activities (that is, years and type of experience and training background).
- Describe safe work practices for other activities to be performed during this project (for example, use of ladders, fall protection, use of electrical power tools, and use of personal protective equipment).
- Describe site-specific training, diver workups, equipment uses, and other training requirements (e.g., hazard communication, first aid, and CPR).
- Describe methods to identify and protect wetlands, endangered species, or cultural/historic resources, if applicable.
- Describe procedures for operating in inclement weather, including lightning, high winds, and severe rainstorms.
- Describe the Emergency Response Plan for equipment, incident response, treatment, evacuation, and notifications.
- Provide supplemental diving safety procedures.

The HASDP can reference overlapping plans or other pertinent project documents to minimize redundancy.

15.1 Risk Management and Assessment

Identifying the risks of the dive and developing a plan of action to minimize one’s exposure to risk is crucial to safe and effective diving operations. The HASDP will be developed to address possible emergencies that may arise at each specific dive site. This plan shall

incorporate steps for extraction of a stricken diver from the water, subsequent first aid and emergency response, and evacuation to a higher level of care. Job hazard analysis forms and safety checklists that are site-specific may be substituted providing they meet or exceed the requirements outlined in this manual and are approved by the diving supervisor/lead diver. Each team member shall be provided a copy of the HASDP prior to starting a job.

Once on the job, the diving supervisor/lead diver shall give a safety briefing to the dive team prior to each day of diving, and at the start of a new task. Emergency procedures will be reviewed on site to include local emergency/rescue points of contact. Wherever practicable, dives will be planned within the No Decompression Limits according to the USN dive tables and procedures.

The project manager and diving supervisor/lead diver, prior to the start of any fieldwork, must complete detailed planning and all required forms. Dive Team members must be made aware of the following:

- All known and potential hazards at the job site as reflected on the Job Hazard Analysis form.
- Required scope of work and individual responsibilities as detailed in the Pre-Dive Briefing Form.
- Equipment and tool requirements for all tasks
- Contingency and emergency plans

Diving shall be discontinued if sudden squalls, electric storms, heavy seas, unusual tide, or any other condition exists that, in the opinion of the diving supervisor/lead diver, jeopardizes the safety of the divers. It must be noted here that **ANYONE ON A TMR DIVE TEAM CAN STOP WORK** on a job if they feel that the work environment is/becomes unsafe.

Prior to diving, the diving supervisor/lead diver shall be responsible for examining the dive site to identify potential hazards. Some examples of potential surface and subsurface hazards include the following:

- Surface vessel traffic and/or vehicular traffic
- Swift currents and sea state
- Subsurface/underwater debris
- Overhead crane operations
- Mooring lines
- Pedestrian traffic/onlookers
- Petroleum products and/or other materials that are hazardous to divers and/or tenders
- Airborne contaminants
- Contaminated water
- Outfall and intake pipes

- Flotsam/jetsam (marine debris)
- Propeller/thrusters and intake/discharges of moored vessels
- Potential for structural collapse
- Hazardous marine life
- Limited access and/or confined workplace
- Fishing lines and nets
- Turbid (limited visibility) water
- Hazardous materials
- Abandoned piles and/or other structures
- Sonar equipment likely to be used or tested on nearby vessels

15.2 Termination of Dive Operations

The working interval of a dive will be terminated under any of the following conditions:

- The activities are completed as planned.
- A diver requests termination.
- A diver fails to respond correctly to communications.
- Communications are lost and cannot be quickly re-established between the diver and a dive team member at the dive location, or between the designated person-in-charge and the person controlling the vessel in live boating operations.
- A diver begins to use diver-carried reserve breathing gas or the dive location reserve breathing gas.
- The diving supervisor/lead diver determines that any unsafe condition exists.

16.0 CONSIDERATIONS FOR DIVE PLANNING

TMR diving mode options include Surface-Supplied Air Diving, Lightweight Surface-Supplied Air Diving, and SCUBA (with or without communications). Specific tasks and environmental conditions will dictate the safest and most efficient diving mode; however, there are certain requirements that must be followed regardless of the chosen dive mode selected.

16.1 Primary Breathing Air Supply

Air will be the primary breathing gas used during diving operations. A low-pressure air compressor, volume tank and filter assembly or high-pressure cylinders, with a regulated supply, provide the breathing air during Surface-Supplied Air diving. Compressed air cylinders worn by the diver supply the primary breathing air during SCUBA diving operations.

16.2 Reserve Breathing Air Supply

High-pressure air cylinders connected to the dive manifold supply the reserve air to the Surface-Supplied Air Diver. Additionally, the diver carries a reserve breathing air supply

known as a bail-out system. The bail-out system provides a reserve air supply for the diver when surface-supplied air is compromised.

A redundant tank and regulator, or spare air cylinder carried by the diver provide the reserve air supply for SCUBA diving operations.

16.3 Exposure Protection

The site and environmental conditions are directly related to the type and amount of exposure protection required for a diver's comfort and safety. In cold or contaminated water, a dry suit with an adequate thermal undergarment is required. In the absence of contaminants, a neoprene wetsuit may be worn. A lightweight wetsuit, dive skin, or swimsuit with chaffing coveralls may be considered in warmer climates, providing the environment in which the dive will take place is free of contamination. Divers will wear some form of hand and foot protection while working in the water to minimize the possibility of injury. A neoprene or Lycra wetsuit hood is suggested when using SCUBA to provide protection for the diver's head and ears.

16.4 Dive Team Assignments

Each TMR Dive Team will have, as a minimum, four qualified personnel. The diving program manager will assign personnel to the dive teams. Personnel requirements are outlined in Section 11. Team assignments will be based on the scope of the project and the availability of qualified personnel. The logistics of the project and any unusual safety considerations at the job site may dictate additional personnel requirements.

- Additional personnel may be required to supplement the dive team in order to comply with standards set forth by a client or agency. In these instances, the required standards will be reviewed and strictly adhered to.
- All diving projects undertaken by the company for TMR government clients (e.g. USN or the USACE) will be carried out in strict compliance with DDESB TP-18, reference (c).

16.5 Decompression Procedures

The TMR standard of practice is to plan dives as no decompression dives according to the USN no-decompression limits. Should situations arise that necessitate the use of decompression diving to safely and efficiently complete the scope of work, USN Standard Air Dive Tables and outlined ascent procedures will be implemented and incorporated into the HASDP at that time.

16.6 Water Entry/Egress

A securely attached ladder or similar device will be provided for the diver to enter and exit the water. The ladder must extend at least 3 feet below the surface of the water and be capable of supporting the combined loads of both the diver and tender.

Divers shall enter the water in a controlled manner. In turbid or low visibility water conditions, there is always a possibility of submerged hazards or protruding objects that could pose a danger to the diver; therefore, extreme caution must be exercised during water entry.

Equipment required for the safe extraction of an unconscious diver from the water shall be provided at each dive site.

16.7 Warning Display

An International Alpha code flag and recreational “Diver Down” flag shall be prominently displayed during all diving operations. Flags will be placed in a highly visible position to provide as much warning as possible for all approaching vessels. For work in navigable waters, flag dimensions shall be at least one meter in height and width (or as specified by local jurisdictions) and illuminated at night.

16.8 Pre-Dive Brief

Prior to each dive, the diving supervisor/lead diver shall conduct a pre-dive Briefing to inform each Dive Team Member of the following:

- Diver’s health and readiness
- Standard and emergency procedures for diving mode employed and location of work
- Review of the AHAs, equipment checklists, and hazards or environmental variables that will impact diving operations
- Any deviations from standard procedures which may be necessitated by the operation
- Diver re-call procedure
- Factors which will terminate the dive

17.0 SPECIAL CONSIDERATIONS FOR DIVE PLANNING

In addition to the requirements above, there are many other items or circumstances that must be considered when planning a dive, regardless of the chosen diving mode.

17.1 Hazardous Environmental Conditions

Effective dive planning must provide for extremes in environmental conditions. Diving will be discontinued if sudden squalls, electric storms, heavy seas, unusual tide, or any other condition exists that, in the opinion of the diving supervisor/lead diver, jeopardizes the safety of the divers.

17.2 Communications

Adequate communications for the dive site will be provided as follows:

- **Diver to diver** – Wireless electronic communication is preferred for SCUBA operations, but diver-to-diver hand signals or line pull signals, in accordance with the Navy Diving Manual, are acceptable, refer to Attachment 8 USN Diving Line Pull and Hand Signals, which is also available in the native file format located in the Guidelines Templates and Tools folder in the CRL. Surface-supplied diving requires an operational two-way audio communication system between the diver and topside.

- **Surface to Diver/Diver to Surface** – Wireless electronic communication is preferred for SCUBA operations, but line pull signals in accordance with the USN Diving Manual, are acceptable. Surface-supplied diving requires an operating two-way audio communication system between the diver and topside.
- **Emergency Assistance** – Telephone communications will be maintained on site via a landline, cell phone, or two-way radio communications with a constantly manned location to activate emergency services if required.

17.3 Cold Water Diving

Cold water diving is defined as diving in water at or below a temperature of 37 degrees Fahrenheit. Cold water diving requires the use of special equipment and techniques. All dives conducted in cold water will be in accordance with Attachment 9, Cold Water Considerations and Safety Precautions, which is available in the native file format located in the Guidelines Templates and Tools folder in the CRL.

Hypothermia demands immediate treatment and prompt evacuation to a medical facility. The Diving Supervisor/Lead Diver will also take into consideration hypothermia for the surface support personnel. The responding medical facility must be notified of the possibility of hypothermia prior to the commencement of diving operations. Emergency re-warming and evacuation plans should be established with the medical facility's recommendations.

Diving under the ice requires extremely specialized training and equipment and **will not** be performed by TMR employees.

17.4 Diving at Altitude

Diving operations may be required in bodies of water at higher altitudes. Because of the reduced atmospheric pressure, dives conducted at altitude require more decompression than identical dives conducted at sea level. Standard air decompression tables, therefore, cannot be used as written.

Planning must address the effects of the atmospheric pressures that may be lower than those at sea level.

- No correction is required for dives conducted at altitudes between sea level and 300 feet; the additional risk associated with these dives is minimal.
- At altitudes between 300 and 1,000 feet, correction is required for dives deeper than 145 FSW (actual depth).
- At altitudes above 1,000 feet, correction is required for all dives.

High-altitude diving requires special equipment and techniques and will be conducted in accordance with the provisions of the USN Diving Manual.

Additionally, Standard Operating Procedures (SOPs) addressing the special requirements and support will be developed prior to commencing any high-altitude diving and included in the project specific HASDP.

17.5 Diving on UXO

Diving in the vicinity of explosive ordnance combines the inherent risk of diving and the explosive hazards of ordnance. Diving to investigate, recover, or dispose of explosive ordnance found underwater, regardless of the type or fuzing, will only be accomplished by specifically trained and qualified UXO divers (in accordance with DDESB TP-18).

Generally, it is safer for divers to work in pairs rather than alone. However, when diving on explosive ordnance, the use of two divers doubles the exposure to the ordnance and the amount of bottom time expended and increases the risk to life from an unplanned detonation. Consequently, the Diving Supervisor/SUXOS should employ a single tended or marked diver when any manipulation or removal of the ordnance is anticipated. However, the option to use two divers for ordnance search operations is authorized and preferred.

When performing activities not involving intentional contact with munitions and explosives of concern (MEC) while using anomaly avoidance techniques within a MEC environment, it is preferred to deploy two UXO divers. Deploying one UXO diver and one non-UXO diver is allowable if authorized by a NOSSA-approved or DDESB-approved ESS/Explosives Safety Submittal.

The development and use of SOPs to address the hazards associated with explosive ordnance is required when conducting UXO diving.

17.6 Diving in Contaminated Water

Divers may encounter dangerous or unpleasant forms of pollution such as effluent from a sewer or industrial outfall, oil leaking from a wellhead or damaged fuel tank, toxic materials or volatile fuels leaking from barges or tanks, and ordnance or chemical warfare material, which can cause severe problems.

The dive team should not conduct the dive until the contaminant has been identified, the safety factors evaluated, and the process for decontamination set up. When diving in a known or suspected radiological environment, proper radiological procedures must be followed.

When diving in contaminated waters, the appropriate dress should be a fully contained dry suit with gloves and hood, with a positive-pressure full face mask or the Dirty Harry surface-supplied diving system. Technical advice for contaminated water diving is available from the NOAA Hazardous Materials Department at (206) 526-6317.

18.0 DIVING HAZARDS

In addition to environmental hazards, and the hazards directly attributable to diving, a diver may occasionally be exposed to operational hazards that are not unique to the diving environment. These hazards are described below.

- **Underwater Obstacles** – Various underwater hazards, such as broken pilings, rocks, wrecks, dumping grounds, and discarded munitions, offer serious hazards to divers.

- **Electrical Shock** – Electrical shock is rare underwater but may occur when using power equipment underwater or topside. A ground fault interrupter must be used with electrical equipment employed on the dive site, both on the surface and underwater.
- **Explosions** – Explosions may occur during demolition tasks or during ordnance clearance operations, intentionally or accidentally. When using explosives, or as identified during UXO diving, separate SOPs and work plans will be developed to cover all aspects of the use or possibility of encountering explosives/ordnance underwater. All divers will be out of the water prior to any planned detonation of explosives or ordnance.
- **Explosives** – All diving-related explosives will be pre-approved by the Manager of UXO Operations. The procedures for explosives handling, use, storage, and underwater procedures will be detailed in the specific HASDP for the project.
- **Sonar** – Additional precautions are required when diving in the vicinity of vessels that employ active sonar. Ships use low-frequency sonar for object location and depth finding. It is a dense, high-energy pulse of sound that can cause damage to divers' ears. Avoid diving in the vicinity of low-frequency sonar and approach no closer than 600 yards. The optimal separation distance is 3,000 yards.

Additionally, the USN Diving Manual has a worksheet to compute actual time and distance restrictions for various types of sonar. This worksheet considers such variables as depth, time, diving apparatus, and wetsuit hoods. High-frequency (greater than 100 kilohertz), short-duration sonar, such as that used with side-scan and hand-held sonar, poses little danger to the diver. The diver will abort the dive if active low-frequency sonar is energized while they are in the water.

- **Marine Life** – Certain marine life, because of its aggressive or venomous nature, may be dangerous to man. Some species of marine life are extremely dangerous, while some are merely an uncomfortable annoyance. Most marine life poses little threat, as they tend to leave humans alone. The diver's best defense against injury is knowledge. All divers should be able to identify the dangerous species that are likely to be found in the area of operations and should be able to deal with each appropriately. The USN Diving Manual provides specific information about dangerous marine life.
- **Ascent to Altitude including Flying after Diving** – Leaving the dive site may require temporary ascent to a higher altitude. For example, divers may drive over a mountain pass at higher altitude or leave the dive site by air. Ascent to altitude after diving increases the risk of decompression sickness because of the additional reduction in atmospheric pressure. The higher the altitude, the greater the risk. The cabin pressure in commercial aircraft is maintained at a constant value regardless of the actual altitude of the flight. Though cabin pressure varies somewhat with aircraft type, the nominal value is 8,000 feet.

For all diving projects, divers will wait at least **12 hours** before flying after any dive, or **24 hours following multiple days of repetitive dives**. The ascent to altitude table located in the USN Diving Manual gives the surface interval (hours, minutes) required before making a further ascent to altitude. The surface interval depends on the planned increase in altitude and the highest repetitive group designator obtained in the previous 24-hour period. Enter the table with the highest repetitive group designator obtained in the previous

24-hour period and read the required surface interval from the column for the planned change in altitude.

18.1 Boating

All boating activities will be conducted according to applicable state, USCG, and Tt Procedure. Further, the following guidelines will be adhered to:

- Diving operations involving live boating will not be conducted unless cleared by the DDC in writing in the approved HASDP or subsequent Field Change Request.
- Live boating will not be conducted unless 1) using surface-supplied air at depths that are restricted to no deeper than 100 FSW, in rough seas that significantly impede diver mobility or work function, or 2) in non-daylight hours.
- The propeller of the vessel will be stopped before the diver enters or exits the water.
- A device will be used that minimizes the possibility of entanglement of the diver's hose in the propeller of the vessel.
- Two-way voice communication between the designated person-in-charge (Dive Supervisor/Lead Diver) and the person controlling the vessel will be available while the diver is in the water.
- Each diver engaged in live boating operations will carry a diver-carried reserve breathing gas supply.

19.0 OTHER HAZARDS

Other diving-related hazards that may be encountered by TMR divers are described below.

19.1 Noise

Some operations may require the use of generators, pumps, compressors, engines, and other equipment that can generate high levels of noise. Short-term exposure to extremely loud noise and/or long-term exposure to low level noise can cause hearing loss. Personnel assigned to a high noise area will wear proper hearing protection and be enrolled in a hearing conservation program.

19.2 Lifting Hazards

During some operations, there may be several instances when personnel will be called on to lift and/or carry a heavy load, sometime over rough or unstable terrain. When doing so, personnel should be instructed to observe the following rules:

- Test the load to ensure it can be moved safely.
- Plan the move to ensure the travel path is clear.
- Keep the back in its normal arched position while lifting, bend at the knees to lift.
- Lift with the legs and stand up in one smooth motion.
- Move the feet to change direction, do not twist at the waist.

20.0 DIVING EMERGENCY PROCEDURES

20.1 Surface Supplied Diving

20.1.1 Loss of Primary Air Supply

- Activate the secondary back up breathing air supply.
- If necessary, ensure diver goes on bail-out bottle.
- Alert the standby diver.
- Have Diver surface and proceed to ladder or stage.
- Terminate the dive (if instructed by Dive Supervisor/Lead Diver).

20.1.2 Loss of Communications

- Attempt to establish line-pull signals.
- Alert the standby diver.
- If unable to establish any form of communications with the diver within 60 seconds, immediately deploy the standby diver for assistance.
- Ensure diver proceeds to the ladder or stage.
- Terminate the dive.

20.1.3 Fouled or Entrapped Diver

- Diver informs Surface Support.
- Alert the standby diver.
- Diver determines the nature and extent of entrapment.
- Diver attempts to free them.
- If required, deploy the standby diver to assist the diver.
- When free, diver and tender confirm that direct contact with each other is re-established.

20.1.4 Injured Diver in Water

- Diver informs Surface Support (if possible).
- Alert the standby diver.
- Diver determines nature and extent of injury.
- Deploy the standby diver to assist diver (if necessary).
- Standby diver remains with diver.
- Extract the diver and provide first aid or oxygen accordingly.
- Request immediate medical assistance and emergency evacuation (if required).

20.1.5 Severance of Complete Umbilical

- Diver activates bail-out bottle.

- Establish line pull signals, if possible, try to inform surface support of the situation.
- Top side crew should secure primary the air supply and activate the air supply to the pneumo hose. If the diver can maintain a hold of the severed section of the hose, they can use it for breathing air and call follow it up to the surface.
- Diver surfaces and terminates the dive.

20.1.6 Unconscious Diver

- Attempt to establish voice and line pull communications with the diver.
- Deploy the standby diver.
- Determine the nature and extent of the diver's situation.
- Secure the diver and ensure an open airway; open the dive helmet free flow if the diver is not breathing.
- Extricate the diver, provide First Aid, CPR, AED, and/or emergency oxygen accordingly.
- Request immediate medical assistance and emergency evacuation.

20.1.7 Activate the secondary back up breathing air supply

- Inform the diver of the situation and establish line pull signals if necessary.
- Diver activates bail-out bottle (if necessary).
- Extinguish fire and secure the equipment.
- Diver surfaces and terminates the dive.
- Determine the damage and test all equipment prior to continuing the dive.

20.1.8 Equipment Failure – Diver in the Water

- Inform the diver of the situation and establish line pull signals if necessary.
- Evaluate the effect on the diver.
- Alert the standby diver.
- Diver informs topside of their readiness.
- Terminate the dive.

20.2 SCUBA Diving

20.2.1 Out of Air – Primary Source

- Diver activates secondary the air supply.
- Diver informs buddy diver or topside crew.
- Terminate the dive.

20.2.2 Out of Air – Primary and Secondary Source

- Diver surfaces with controlled ascent and informs buddy diver or topside crew.
- Buddy diver gives secondary air source to diver.

- Terminate the dive.

20.2.3 Fouled or Entrapped Diver

- Diver determines the extent of entrapment.
- Diver attempts to correct the situation.
- Diver informs topside or buddy diver; deploy the standby diver if required
- When clear, diver returns to ladder and evaluates situation with the Dive Supervisor/ Lead Diver.
- Dive Supervisor/Lead Diver decides to continue or terminate the dive.

20.2.4 Diver Injured in Water

- Diver determines nature and extent of injury.
- Diver informs topside or buddy diver.
- Alert the standby diver and deploy if necessary.
- Buddy/standby diver remains with the diver.
- Extract the diver and terminate the dive.
- Provide First Aid or oxygen accordingly.
- Request medical assistance and emergency evacuation (if necessary).

20.2.5 Equipment Failure

- Evaluate effect on the system and the diver
- Diver informs topside or buddy diver.
- Deploy the standby diver (if necessary).
- Terminate the dive.

20.2.6 Lost Diver and Communication

- Use the Buddy Recall System.
- Each diver surfaces.
- If a diver is not quickly located, the Dive Supervisor/Lead Diver immediately initiates search procedures.
- Deploy additional diver (if necessary).
- When located, divers return to ladder and evaluates the situation with the Dive Supervisor/ Lead Diver.
- Dive Supervisor/Lead Diver decides whether to continue or terminate the dive.

20.2.7 Diver Rapid Ascent or Blow up to Surface

- Buddy diver surfaces in a controlled ascent.
- Both divers terminate the dive.
- Deploy the standby diver to assist; if necessary.

- Monitor the diver and provide oxygen accordingly.
- Immediately notify emergency and medical personnel and inform them of omitted decompression.

20.2.8 Loss of Consciousness

- Buddy diver/standby diver initiates rescue diving.
- Determine the nature and extent of the diver's situation.
- Secure the diver and ensure an open airway; overpressure second stage (if possible) if diver is not breathing.
- Extricate diver, provide First Aid, CPR/AED and/or oxygen accordingly.
- Request immediate medical assistance and emergency evacuation.

21.0 DIVING SPECIFIC EMERGENCY MEDICAL TREATMENT

21.1 DCS Type 1 – (Pain only)

Diver surfaces with or develops joint pain (dull ache) that gradually worsens over time, develops skin problems such as itching or a rash, or develops swelling and pain in lymph nodes. Time to onset of symptoms is 0 to 24 hours. Actions to be taken:

- Perform necessary first aid and give 100 percent emergency oxygen upon surfacing.
- Contact local emergency resources for transport to nearest hyperbaric facility.
- Follow USN Dive Manual Treatment Table procedures.

21.2 DCS Type 2 – Central Nervous System (CNS)

Diver has DCS symptoms in water, or surfaces with any neurological symptoms (numbness, tingling, decrease touch sensation, muscle weakness, or paralysis). Time to onset of symptoms is 0 to 24 hours. Actions to be taken:

- Perform necessary first aid and give 100 percent oxygen upon surfacing.
- Contact local emergency resources for transport to nearest hyperbaric facility.
- Follow USN Dive Manual Treatment Table procedures.

21.3 Arterial Gas Embolism (AGE)

Diver surfaces or becomes unconscious within 10 minutes of surfacing, exhibits signs of a stroke or other neurological disorder, blurred vision, or convulsions. Actions to be taken:

- Perform necessary first aid or CPR.
- Administer 100 percent oxygen with the diver supine or in the recovery position.
- Contact local emergency resources for immediate transport to the nearest hyperbaric facility and initiate recompression treatment as soon as possible.

21.4 Chokes (Heart Pumps Frothy Blood)

Diver surfaces with chest pain aggravated by inspirations, an irritating cough, an increased breathing rate, increased lung congestion with subsequent heart attack. Death is imminent due to heart attack. Actions to be taken:

- Perform necessary first aid and give 100 percent oxygen upon surfacing.
- Contact local emergency resources for immediate transport to nearest hyperbaric facility.

21.5 Pneumothorax

Diver displays difficult or rapid breathing leans towards affected side and experiences pain while inhaling deeply. Hypotension, cyanosis, and shock may be present, leading to death. Actions to be taken:

- Position diver on affected side.
- Administer 100 percent oxygen and treat for shock.
- Contact local emergency resources for immediate transport to nearest medical facility (air must be vented from chest cavity).

22.0 VESSEL OPERATIONS DURING DIVING OPERATIONS

22.1 Safe Boating Guidelines

These procedures are for the safety of the employees and other vessels on the waterways during waterborne operations. If a conflict arises between the current edition of this section and the approved project specific HASDP, applicable federal, state, local laws or other legal directives, the latter shall take precedence.

22.2 Preparing for Waterborne Operations

All personnel on board a vessel employed on a TMR assignment will be fully competent in the vessel operations, maintenance, and equipment usage. The Dive Supervisor/Lead Diver shall complete any project Pre-Operation Maintenance and Safety Inspection Checklists prior to casting off.

22.3 Operations

All TMR employees regularly involved in boat operations must be knowledgeable and capable in the area of rules of the road, vessel maintenance, marine safety, and vessel registration requirements.

22.4 Rules of the Road

As with vehicular traffic on land, rules exist to promote safe vessel movement on navigable waterways. All employees engaged in waterborne operations will know the rules of the road specific to the project area. The local rules can be researched through the USCG or the applicable state government agency that governs a body of water. Several topics included in the rules of the road, relevant to TMR operations, are listed below.

22.5 Navigation, Signals, Markers and Signs

Each crewmember will know the meaning and use of each signal for meeting and passing situations while underway, for leaving a mooring, and signals used in limited visibility conditions. The required signals will be used in accordance with the rules of the road.

Each crewmember will know and understand the meaning of all navigation markers, buoys, and lights on the waterways. The vessel operator will follow the directions of each navigation marker, buoy and light unless evidence indicates the marker is damaged and providing inaccurate information.

22.6 Anchoring and Mooring

Vessel crewmembers will know how to properly anchor and moor the vessel from which they are operating. They will ensure that the anchor, chain, all lines, fenders, bumpers, and cleats are in good working order. The anchor line should be at least seven times longer than the working water depth. Crewmembers will continually monitor anchor and mooring lines while moored in areas affected by tides and strong currents.

22.7 Required Safety Equipment

All vessels operated by TMR, except for vessels less than 18 feet in length, will have the following equipment on board and in operating condition:

- A fixed fire extinguishing system installed in machinery space(s) or B-1 type extinguishers
- Type 1 PFD required for each person on board plus one throw able Type 4 life ring or cushion
- A Coast Guard approved flare kit
- A sounding device to signal maneuvering intentions and position during periods of reduced visibility
- A fully charged and tested VHF radio, prior to departure from dock
- A bilge pump appropriately sized for the vessel
- Additional engine fluids
- Vessels operated by TMR that are less than 18 feet in length shall have a Type 1 PFD for each person onboard.

22.8 Vessel Maintenance

Due to the difficulty of performing repairs afloat, regular maintenance and necessary services shall be carried out onshore before commencing operations. Use of the owner's manuals, maintenance checklists, and repair logs are necessary to track equipment usage and inform future operators of equipment status.

Engine – The owner's manual will be stored on board each vessel in a watertight bag and compartment. Suggested maintenance schedules will be followed. The engine fuel and oil levels will be checked before each use. Other engine components and propeller(s) will be checked for proper function.

Batteries – Each battery will be checked for proper charge level, cleanliness of contact posts, condition of wiring, and water level if required. Batteries will be secured, and all electrical systems turned off after operations are completed. Bilge pumps are directly wired and as such, will remain in constant operation.

Fuel – Check fuel level of primary tanks and emergency supply tanks prior to embarkation. Refill all fuel tanks, with the proper fuel, to the full level after returning each day. Inspect all fuel lines, bilge, and areas around the vessel for leaks.

Electronic Systems – Inspect all circuits to ensure good connections and operation of all components and equipment. Have spare batteries, fuses, and wiring available for repairs. Ensure connection of shore power after returning, when deemed necessary.

Checklists and Logs – Accurately complete checklists and logs prior to and after each day's operation of the vessel.

Safety Equipment – Inspect all fire extinguishers for annual inspection and pressure, first aid kits for required and expired items, PFD for proper fit or deterioration and for spare carbon dioxide cartridges, signaling devices for expired or deteriorated items, and radios for proper functioning.

22.9 General Marine Safety

Dive operations conducted from the relative stability of a pier or shoreline requires safety awareness and constant diligence. Conducting operations from the deck of a pitching/rolling vessel only compound these requirements. All personnel will conduct themselves in a safe and responsible manner while near or on board any vessel and in accordance with SWP 5- 06 Working over or near water. These guidelines are in place for the safety and wellbeing of TMR employees involved in marine operations.

- A USCG-approved PFD must be available for each person on board the vessel. The PFD must have a proper fit for the individual who will be using it and each person should know how to don the PFD in the vessel and in the water. PFDs must be inspected regularly for damage and excessive wear.
- Shoes should have non-skid soles. Personnel should maintain three points of contact when transferring equipment or personnel to and from the vessel. Deck area should be clear of lines, hoses and unnecessary clutter.
- Personnel should not sit on the edge of a vessel or on lifelines while underway.
- Personnel should avoid sailing at night, in fog, in poor visibility, in ice flows, during flood conditions, debris flows, small craft advisories, gales, hurricanes, or other heavy surf conditions, whenever possible.
- Personnel should be familiar with and have the means to handle emergency situations, including man overboard, abandon ship, fire, loss of power or propulsion, storm, and use of emergency signaling devices, as well as how to recover a person in the water.
- Personnel should know what emergency and standard equipment is required on each TMR owned vessel, where it is located and how to operate that equipment.

- Detailed tide, current, and marine weather forecast should be obtained before commencing waterborne operations.
- Ensure that all equipment is secure or lashed properly when underway.
- Personnel should be familiar with, and anticipate water and weather states and conditions respectively, when mooring.

22.10 Vessel Registration

Each vessel operating on navigable waterways requires a state registration identification sticker or USCG Certification. The designated Equipment Manager will ensure that each TMR vessel maintains a current state registration for the state in which the vessel is located. Trailer registrations, if applicable, will also be kept up to date.

22.11 Chain of Command

22.11.1 Projects that are Captained and Crewed by a Subcontractor

The designated Captain of the vessel will have overall authority for the vessel and personnel aboard. They will work with the Project Manager, Dive Supervisor/Lead Diver and SSHO to ensure the safety of all personnel.

22.11.2 Projects that are not Captained and Crewed by a Subcontractor

The Project Manager shall designate the vessel operator for each project. If a designee has not been assigned, the Dive Supervisor/Lead Diver will assume or designate the position of vessel operator. The vessel operator has overall authority and responsibility of the crew, passengers, and vessel operations safety while moored or underway. Before embarking, the Dive Supervisor/Lead Diver will assign crew positions and responsibilities to each team member. They will also designate a chain of command should the vessel operator become injured or is away from the vessel. The vessel operator will work with the Dive Supervisor/Lead Diver and project DSO and SSHO to ensure the safety of all personnel.

22.12 Offshore Operations

When the vessel will be operating greater than 500 yards from the shoreline, in breaking waves, or in a strong current, additional safety precautions are warranted. Under such conditions, any vessel employed on a TMR assignment must adhere to the following:

- The vessel shall be operated by an experienced and qualified boat operator as approved by the Project Manager.
- The vessel operator must perform research on local conditions and be aware of potential hazards.
- A marine weather radio shall be on-board the vessel and periodically monitored to keep abreast of changing weather conditions.
- The vessel must be equipped with a backup propulsion system, such as an extra motor, that can return the vessel to a safe harbor in the event of failure of the primary propulsion system.

- The vessel shall be thoroughly examined by the vessel operator to verify the sound mechanical condition of the vessel and bilge pump, and the presence of appropriate safety equipment as designated above.

23.0 REQUIRED FORMS AND CHARTS

23.1 Forms

The vessel operator will ensure that all required forms are accurately and filled out before embarkation. Spare forms should be kept on board each TMR-operated vessel. The HASDP and Attachment 11, Equipment Checklists, will provide the required forms listed below:

- BOAT PRE-OPERATION CHECKLIST
- DIVE EQUIPMENT CHECKLIST (GENERAL, MEDICAL, SCUBA)
- PRE-DIVE: SSA DIVE HELMET CHECKOFF SHEET
- PRE-DIVE: SURFACE SUPPLIED LIGHTWEIGHT (AGA)

23.2 Charts

The vessel operator will ensure that all required charts and maps for navigation to, from, and within the area of operations are on board before embarkation. All crewmembers will review and become familiar with these charts. These documents should be continually revised, as updates become available.

24.0 REFERENCES

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[5] https://intranet.tetratech.com/healthsafety/Manual/DCN%2001-04%20Recordkeeping%20and%20Reporting%20Requirements.pdf
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25.0 ATTACHMENTS

Attachment 1 – Diving Supervisor/Lead Diver Dive Plan Brief

Attachment 2 – Diving Supervisor/Lead Diver Pre-Dive Checklist

Attachment 3 – Diving Supervisor/Lead Diver Post-Dive Checklist

Attachment 4 – Emergency Procedures

Attachment 5 – Emergency Phone Numbers Checklist

Attachment 6 – Working Dive Log

Attachment 7 – Dive Smooth Log

Attachment 8 – USN Diving Line Pull and Hand Signals

Attachment 9 – Cold Water Considerations and Safety Precautions

Attachment 10 – U.S. Navy Dive Tables

Attachment 11 – Equipment Checklists

GLOSSARY

Definitions are provided for the purpose of understanding their intent as they pertain to a procedure and projects requiring quality program planning. A Master List of Definitions is located in the CRL on the TMR intranet (https://tetratechinc.sharepoint.com/sites/OU-TMR). In addition, the definitions provided below are specific to this manual.

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.

Arterial Gas Embolism (AGE)

An embolism caused by entry of gas bubbles into the arterial circulation system then act as blood vessel obstructions called emboli.

Atmosphere Absolute (ATA)

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

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.

Bottom Time

The total elapsed time from when the divers leave the surface to the time (rounded up to the next whole minute) they begin their ascent from the bottom or from the deepest depth attained. This time is measured in minutes.

Breath-Holding Diving

A diving mode in which the diver uses no self-contained or surface-supplied air or oxygen supply.

Buddy Breathing

Sharing of a single air source between divers.

Buddy Diver

Second (paired) member of the dive team set.

Buddy System

Two comparably equipped self-contained underwater breathing apparatus (SCUBA) divers in the water in constant communication.

Buoyant Ascent

An ascent made using some form of positive buoyancy.

Bursting Pressure

The pressure under which a pressure-containment device would fail structurally.

Certified Diver

A diver who holds a recognized valid certification from an organizational member, internationally recognized certifying agency, or through military training.

Chairman, Diving Review Board (DRB)

Environment, Safety, Security and Quality (ESSQ) Department member who manages and oversees the DRB.

Controlled Ascent

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

Cylinder

A pressure vessel for the storage of gases.

Decompression Chamber

A pressure vessel for human occupancy. Also called a hyperbaric chamber.

Decompression Schedule

A specific decompression procedure for a given combination of depth and bottom time as listed in a decompression table. It is normally indicated as feet/minutes.

Decompression Sickness

A condition with a variety of symptoms, which may result from the presence of gas and bubbles in the tissues of divers after pressure reduction.

Decompression Table

A profile or set of profiles of depth-time relationship for ascent rates and breathing mixtures to be followed by divers after a specific depth-time exposure or exposures.

Decompression Time

Elapsed time from when the divers leave the bottom to the time when they reach the surface.

Descent Time

The total elapsed time from when the divers leave the surface to the time, they reach the bottom. Descent time is rounded up to the next whole minute.

Dive Computer

A microprocessor-based device that computes a diver's theoretical decompression status, in real time, by using pressure (depth) and time as an input to a decompression model, or set of decompression tables, programmed into the device.

Dive Location

The surface location from which diving operations are conducted, such as a vessel, barge, wharf, pier, riverbank or offshore rig.

Dive Location Reserve Breathing Gas

A supply system of air at the dive location that is independent of the primary system and enough to support divers during the planned decompression.

Dive Team

Divers and support employees involved in a diving operation, including the Diving Supervisor/Lead Diver.

Diver

An employee working in water using underwater apparatus, including snorkel, that supplies breathing gas at the ambient pressure.

Diver-Carried Reserve Breathing Gas

A diver-carried independent supply of air enough under standard operating conditions to allow the diver to reach the surface, or another source of breathing gas, or to be reached by another driver.

Diving Review Board

The TMR Review Board has oversight for all diving operations within the company. Board members will review the diving procedures and qualification of divers before authorization is given to conduct diving operations. The board is made up of qualified divers from the UXO Group, the Science Department, and the ESSQ Department.

DSO

The individual who manages the TMR science diving program and represents the science divers on the Diving Review Board.

Diving Mode

A type of diving requiring specific equipment, procedures and techniques (SCUBA, surface-supplied air, or mixed gas).

Equivalent Single Dive Time

The sum of the residual nitrogen time and the bottom time of a repetitive dive. Equivalent single dive time is used to select the decompression schedule for a repetitive dive. This time is expressed in minutes.

Heavy Gear

Deep-sea dress, including helmet, breast plate, dry suit, and weighted shoes. 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 drysuit, forming a self-contained pressure envelope for the diver) constitutes heavy gear as well.

Hyperbaric Conditions

Pressure conditions in excess of surface pressure.

In-water stage

A suspended underwater platform that supports a diver in the water.

Lead Diver

A certified diver with the experience and training to lead the diving operations.

Live Boating

The practice of supporting a surface-supplied-air diver from a vessel which is underway

Mixed-Gas Diving

A diving mode in which the diver is supplied in the water with a breathing gas other than air.

No Decompression (No "D") Limits

The depth-time limits of the ‘‘no-decompression limits and repetitive dive group designation table for no-decompression air dives,’’ USN Diving Manual or equivalent limits which the employer can demonstrate to be equally effective.

Penetration Diving

Passing through a barrier where the diver’s lifeline/umbilical requires tending by another diver or swimmer.

Pressure-Related Injury

An injury resulting from pressure disequilibrium within the body as the result of hyperbaric exposure. Examples include decompression sickness, pneumothorax, mediastinal emphysema, air embolism, subcutaneous emphysema, or ruptured eardrum.

Pulmonary Over Inflation Syndrome

Disorders that are caused by gas expanding in the lungs, and include arterial gas embolism, pneumothorax, mediastinal and subcutaneous emphysema.

Recompression/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.

Repetitive Dive

Any dives conducted within 12 hours of a previous dive.

Repetitive Group Designation

A letter that is used to relate directly to the amount of residual nitrogen remaining in a diver's body.

Residual Nitrogen

Nitrogen gas that is still dissolved in a diver's tissues after surfacing.

Residual Nitrogen Time

Time, in minutes, which must be added to the bottom time of a repetitive dive to compensate for the nitrogen still in solution in a diver's tissues from a previous dive.

Safety and Health Manager (SHM)

The individual responsible for all safety aspects of the diving evolution. The on-site SSHO qualified person reports to the SHM on all safety related matters.

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: Placing or removing heavy objects underwater; inspection of pipelines and similar objects; construction; demolition; cutting or welding; or the use of explosives.

SCUBA Diving

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

Single Dive

Any dives conducted more than 12 hours after a previous dive.

Standby Diver

A designated safety diver at the dive location properly equipped and available to assist a working diver in the water.

Surface Interval

The time a diver has spent on the surface following a dive. It begins as soon as the diver surfaces and ends as soon as he starts his next descent.

Surface-Supplied Air 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. The umbilical supplies a helmet or full-face mask. The diver may rely on the tender at the surface to keep up with the diver's depth, time, and diving profile.

Tended/Marked Diver

A diver who has a buoy line to the surface or is tended by another diver located in the diving boat or on the surface platform.

Treatment Table

A USN developed and tested depth-time and breathing gas profile designed to treat decompression sickness or pulmonary over inflation syndromes.

Total Bottom Time

The total elapsed time from when the divers leave the surface to the time (rounded up to the next whole minute) they begin their ascent from the bottom or from the deepest depth attained. This time is measured in minutes.

Total Decompression Time

The total elapsed time from when the divers leave the bottom to the time to the time all decompression obligations are met. For No Decompression dives, this is the time the diver reaches the surface. This time is measured in minutes.

Total Time of Dive

The total elapsed time from when the divers leave the surface to the time (rounded up to the next whole minute) until the diver reaches the surface. This time includes all ascent delays and decompression time. This time is measured in minutes.

Umbilical

The composite hose bundle between a dive location and the diver or bell, or between a diver and a bell, which supplies the diver or bell with breathing gas, communications, power, or heat as appropriate to the diving mode or conditions. This includes a safety line between the diver and the dive location or dive bell.

Volume Tank

A pressure vessel connected to the outlet of a compressor and used as an air reservoir.

Working Pressure

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

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ATTACHMENT 1
DIVING SUPERVISOR/LEAD DIVER DIVE PLAN BRIEF

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ATTACHMENT 1

DIVING SUPERVISOR/ LEAD DIVER DIVE PLAN BRIEF

PROJECT NAME/NUMBER: _____

1. **NOTIFICATIONS –** The following list of notifications is not to be considered all-inclusive and should be modified to fit the intended task. Check off each representative as notified, include the phone number and person talked to:

   Harbor Master: _____

   Pipeline Manager: _____

   Boat Pilot: _____

   Port Services: _____

   Cognizant Authority: _____

   Ambulance/Air Evacuation: _____

   Recompression Chamber: _____

   Medical Facility: _____

   Coast Guard: _____

   U.S. Army Corps of Engineers Representative: _____

   U.S. Navy Representative: _____

   Support Personnel: _____

2. **PERSONNEL ASSIGNMENTS**

   Diving Supervisor/Lead Diver: _____

   Senior UXO Supervisor: _____

   Diver/s: _____

   Tender: _____

   Standby Diver: _____

   Tender: _____

   Coxswain: _____

   Assistance: _____

	YES	NO	COMMENTS
• Has any diver been diving in the last 12 hours?	____	____	_____
• Is any diver taking any type of medication?	____	____	_____

ATTACHMENT 1

DIVING SUPERVISOR/ LEAD DIVER DIVE PLAN BRIEF

PROJECT NAME/NUMBER: _____

	YES	NO	COMMENTS
• Does any diver have any aches or pains?	____	____	_____
• Can divers clear on the surface?	____	____	_____
• Is any diver wearing contact lenses?	____	____	_____
• Do divers feel well enough to make the dive?	____	____	_____
• Do divers have any problem making the dive?	____	____	_____
• Do divers know the emergency procedures for the diving mode?	____	____	_____

3. **ENVIRONMENTAL DATA**:

Temperature: Water: _____Air: _____

Tide: High: _____/_____ Low: _____/_____

Visibility expected: _____ Bottom type: _____

Current speed/direction: _____

Wind Direction/Speed: _____/_____

Landmarks: _____

Sunrise/Sunset: _____/_____

Wave action: Height: _____ Direction: _____

Dive platform: _____

4. **OBJECTIVES:**

Purpose of the dive (TASK): _____

Location: _____
General comments: _____

Dive schedule: _____/_____ Depth: _____ Max depth: _____

Dive mode to be used: _____

ATTACHMENT 1

DIVING SUPERVISOR/ LEAD DIVER DIVE PLAN BRIEF

PROJECT NAME/NUMBER: _____

5. **ANTICIPATED HAZARDS**:

Boating: _____

☐ Ensure the "Code ALPHA" flag is flying from the vessel, or a 1-meter rigid "Code ALPHA" flag is prominently displayed from the non-vessel dive platform (pier, shore, etc.).

☐ Ensure the "Divers down" flag is also displayed.

Climate: _____

Sea Life: _____

Expected Ordnance: _____

Pollution: _____

Other: _____

6. **EQUIPMENT REQUIREMENTS**:

Diving Mode: _____

Search Equipment: _____

Recovery Equipment: _____

Explosive Disposal Equipment: _____

Special Task Equipment: _____

7. **GENERAL DIVING SAFETY PRECAUTIONS CHECKLIST**

- Ensure divers are physically and mentally ready to perform the assigned dive task.
- Determine the exact depth of the dive site through use of lead line or Fathometer.
- Gauge diving and emergency air cylinders prior to diving.
- All dives will be no-decompression dives.
- Ensure the dive platform is in a position for rapid and safe recovery of the divers.
- Each diver is responsible for the condition of his/ her own diving equipment.
- Ensure the standby diver is well briefed and ready to enter the water.
- The buddy system will be used whenever possible. If the buddy system is not used or inappropriate for the dive, the diver will be tended.

ATTACHMENT 1

DIVING SUPERVISOR/ LEAD DIVER DIVE PLAN BRIEF

PROJECT NAME/NUMBER: _____

- Ensure the international code “alpha” and “divers down” are prominently displayed. If diving is not conducted from a vessel, then a 1-meter square rigid replica of the “alpha” flag will be displayed.
- Ensure divers are briefed and protected against local harmful marine life.
- The Diving Supervisor/ Lead Diver must be aware of local ship and small boat traffic in the vicinity of the diving operation.
- Ensure the appropriate diving mode and dress have been selected for the task at hand.
- All dives conducted where there is not free access to the surface must be tended dives.
- Do not inflate life jacket or BCD where ascent to the surface is restricted.
- The Diving Supervisor/ Lead Diver will use the Pre-dive and Post-dive check-off sheets, Attachment 2 and 3, respectively.
- Review the methods of diver recall IAW the HASDP.
- The dive will be aborted in the event of any equipment malfunction.
- Inflate your life vest if surfacing with injuries or excessive fatigue.
- Use the proper ascent and descent rates of 75 feet per minute for descent and 30 feet per minute for ascent.
- Divers will not position themselves between any objects (camels, pier, boat, etc.).
- Brief task-specific safety precautions (UXO diving, altitude diving, ordnance/ explosive safety, etc.).
- Brief special line-pull signals Attachment 8.
- Brief appropriate ordnance safety precautions.
- If necessary, review cold water precautions (EHS 2-02 Attachment 9).

8. **COMMUNICATIONS:**

Radio frequency: _____

Radio call signs:

Primary: _____

Secondary: _____

Telephone location: _____

Site cell phone number: _____

Other cell phones: _____

ATTACHMENT 1

DIVING SUPERVISOR/ LEAD DIVER DIVE PLAN BRIEF

PROJECT NAME/NUMBER: _____

9. **SPECIAL CONSIDERATIONS**:

   Meals: _____ Water: _____ Heat source: _____

   Clothing change: _____

10. **EMERGENCY PROCEDURES**: Review as outlined in Project HASDP and TtEC DSPM (EHS 2-02 Attachments 4 and 5).

ATTACHMENT 1

DIVING SUPERVISOR/ LEAD DIVER DIVE PLAN BRIEF

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ATTACHMENT 2
DIVING SUPERVISOR/LEAD DIVER PRE-DIVE CHECKLIST

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ATTACHMENT 2

DIVING SUPERVISOR/ LEAD DIVER PRE-DIVE CHECKLIST

PROJECT NAME/NUMBER:_____

1. DIVING SUPERVISOR/ LEAD DIVER PRE-DIVE CHECKLIST FOR SCUBA DIVING

a. All divers shall have the following minimum equipment:

_____ Proper dress for dive conditions, dry/wet suit, coveralls

_____ Safety Harness w/tending line or witness float attached for single diver
***NOTE*: Mandatory for projects which fall under EM385-1-1 (if any diver is tended).**

_____ Adequate emergency breathing supply with separate independent regulator

_____ SCUBA with regulator

_____ Buoyancy Compensator (BC)

_____ Submersible cylinder pressure gauge

_____ Weight belt

_____ Mask

_____ Knife

_____ Depth gauge

_____ Diving watch or diving computer

_____ Fins

_____ Cylinder pressure is adequate for both the emergency air supply ***(90% capacity @ 2700 psig)*** and primary SCUBA supply ***(2500 psig minimum)***.

_____ All quick-release buckles and fastenings can be reached by either hand and are properly rigged for quick release.

_____ Weight belt is outside of all other belts, straps, and equipment, and is not likely to become pinched under the bottom edge of the cylinders.

_____ Buoyancy Compensator is not constrained, is free to expand.

_____ Check position of the knife to ensure that it will remain with the diver no matter what equipment he may jettison.

_____ Conduct time check and synchronize watches.

_____ Open cylinder valve and then back off 1/4 to 1/2 turn.

_____ Ensure all inflation hoses are attached and function properly.

ATTACHMENT 2

DIVING SUPERVISOR/ LEAD DIVER PRE-DIVE CHECKLIST

PROJECT NAME/NUMBER:_____

_____ Depth gauge is zeroed.

_____ AGA/ FFM Pre-Dive Checks (***Skip if not applicable***)

- ☐ Adjust pressure equalizer pad.
- ☐ Ensure all screws on mask are tight, and exhaust valve retaining ring is tight.
- ☐ Check connection from mask to supply hose.
- ☐ Check comm wire connection and through water transmitter.
- ☐ Don Mask.
- ☐ Inhale deeply to turn on positive pressure. (*If equipped*)
    - Check positive pressure flow.

_____ Have diver breathe for 30 seconds. While doing this, diver should be alert for any impurities in the air or for any unusual physiological reactions.

_____ Conduct final review of the dive plan.

_____ Brief the divers on the following reasons for terminating the dive:

- ☐ The diver requests termination.
- ☐ The diver fails to respond correctly to communications or signals.
- ☐ Communications are lost and cannot be quickly reestablished.
- ☐ The diver begins to use his/her reserve breathing air.
- ☐ Puncture/tear of a dry suit.

_____ Divers physically and mentally ready to enter the water.

_____ Ladder is in place to retrieve divers from water.

_____ Divers know the maximum depth and bottom time.

_____ Review proper/special line pull signals.

_____ Code Alpha and Divers Down flags are displayed.

_____ Conduct Dive Supe checks on Standby diver.

ATTACHMENT 2

DIVING SUPERVISOR/ LEAD DIVER PRE-DIVE CHECKLIST

PROJECT NAME/NUMBER:_____

_____ Ensure standby diver knows searching signals.

_____ Verify that personnel and equipment are ready to give proper visual, sound, or radio signals to warn off other vessels.

_____ Ensure O_2 kit is on dive station with adequate supply, and the O2 bottle has been gauged and documented.

_____ Diver or divers are now ready to enter the water.

b. Surface Check :

_____ Conduct a breathing check of the SCUBA. Breathing should be easy, without resistance, and with no evidence of water leaks.

_____ Visually check dive partner's equipment for leaks, especially at all connection points (cylinder valves hoses at regulator and mouthpiece).

_____ Check face mask seal.

_____ Check partner for loose or entangled straps.

_____ Check buoyancy. SCUBA divers should strive for neutral buoyancy.

_____ If divers are wearing a dry suit, check valve function and for leaks.

_____ Orient yourself with your surroundings. Note any obstructions that you may encounter upon surfacing.

NOTES:

1. ***Ensure divers are not sick or have not been recently treated for an injury or illness.***
2. ***Ensure all dive station personnel are monitored during surface intervals when extreme weather conditions exist.***

DIVING SUPERVISOR/ LEAD DIVER PRE-DIVE CHECKLIST

PROJECT NAME/NUMBER:_____

2. DIVING SUPERVISOR'S PRE-DIVE CHECKLIST FOR SURFACE-SUPPLIED DIVING

CAUTION: ***This checklist is an overview intended for use with the detailed Operating Procedures (OPs) from the appropriate equipment checklists as outlined in Attachment 11 and the specific equipment O&M technical manual.***

a. Basic Preparation:

_____ ***Dives deeper than 100 FSW or dives requiring decompression***, verify that a recompression chamber is present on the diving station and is on line.

_____ Verify that proper signals indicating underwater operations being conducted are displayed correctly.

_____ Ensure that all personnel concerned, or in the vicinity, are informed of diving operations.

_____ Determine that all valves, switches, controls, and equipment components affecting diving operations are tagged-out to prevent accidental shut-down or activation.

b. Equipment Protection:

_____ Assemble all members of the diving team and support personnel (winch operators, boat crew, etc.) for a pre-dive briefing.

_____ Assemble and lay out all dive equipment, both primary equipment and standby spares for diver (or standby diver), including all accessory equipment and tools.

_____ Check all equipment for superficial wear, tears, dents, distortion, or other discrepancies.

_____ Check all masks, helmets, view ports, faceplates, seals, and visors for damage.

_____ Check all harnesses, laces, strain relief, and lanyards for wear; replace as needed.

c. Helmets and Masks:

_____ Ensure that all set up and operating procedures have been completed in accordance with the appropriate Technical Manual and Operating Procedures.

d. General Equipment:

_____ Check that all accessory equipment – tools, lights, special systems, spares, etc. are on site and in working order. In testing lights, tests should be conducted with lights submerged in water and extinguished before removal, to prevent overheating and failure.

DIVING SUPERVISOR/ LEAD DIVER PRE-DIVE CHECKLIST

PROJECT NAME/NUMBER:_____

_____ Erect diving stage or attach diving ladder. In the case of the stage, ensure that the screw pin shackle connecting the stage line is securely fastened with the shackle pin seized with wire or a safety shackle is used to help prevent opening.

_____ Ensure first aid kits, portable O_2, and automatic external defibrillators are available and working.

e. Preparing the Diving System:

_____ Check that a primary and suitable back-up air supply is available with a capacity in terms of purity, volume, and supply pressure to completely service all divers and standby diver, including decompression, recompressions, and accessory equipment throughout all phases of the planned operation.

_____ Verify that all diving system operating procedures have been conducted to properly align the dive system.

_____ Ensure that qualified personnel are available to operate and stand watch on the dive system.

f. Compressors:

_____ Determine that sufficient fuel, coolant, lubricants, and antifreeze are available to service all components throughout the operation. All compressors should be fully fueled, lubricated, and serviced (with all spillage cleaned up completely).

_____ Check maintenance and repair logs to ensure the suitability of the compressor (both primary and back-up) to support the operation.

_____ Verify that all compressor controls are properly marked and appropriate valves are tagged with ***"Divers Air Supply - Do Not Touch"*** signs.

_____ Ensure that the compressor is secure in the diving craft and will not be subject to operating angles, caused by roll or pitch that will exceed 15 degrees from the horizontal.

_____ Verify that oil in the compressor is an approved type. Check that the compressor oil does not overflow the FULL mark; contamination of air supply could result from fumes or oil mist.

_____ Check that compressor exhaust is vented away from work areas and, specifically, does not foul the compressor intake.

_____ Check that compressor intake is obtaining a free and pure suction without contamination. Use pipe to lead intake to a clear suction location if necessary.

_____ Check all filters, cleaners, and oil separators for cleanliness.

DIVING SUPERVISOR/ LEAD DIVER PRE-DIVE CHECKLIST

PROJECT NAME/NUMBER:_____

_____ Bleed off all condensed moisture from filters and from the bottom of volume tanks. Check all manifold drain plugs, and that all petcocks are closed.

_____ Check that all belt-guards are properly in place on drive units.

_____ Check all pressure-release valves; check valves and automatic unloaders.

_____ Verify that all supply hoses running to and from compressor have proper leads, do not pass near high-heat areas such as steam lines, are free of kinks and bends, and are not exposed in such a way that they could be rolled over, damaged, or severed by machinery or other means.

_____ Verify that all pressure supply hoses have safety lines and strain reliefs properly attached.

g. Activate the Air Supply in accordance with approved Operating Procedures.

1. Compressors

_____ Ensure that all warm-up procedures are completely followed.

_____ Check all petcocks, filler valves, filler caps, overflow points, bleed valves, and drain plugs for leakage or malfunction of any kind.

_____ Verify that there is a properly functioning pressure gauge on the air receiver and that the compressor is meeting its delivery requirements.

2. Cylinders

_____ Gauge all cylinders for proper pressure.

_____ Verify availability and suitability of reserve cylinders.

_____ Check all manifolds and valves for operation.

_____ Activate and check delivery.

For all air supply systems, double check "Do Not Touch" tags (tag out).

h. Diving Hoses:

_____ Ensure all hoses have a clear lead and are protected from excessive heating and damage.

ATTACHMENT 2

DIVING SUPERVISOR/ LEAD DIVER PRE-DIVE CHECKLIST

PROJECT NAME/NUMBER:_____

_____ Ensure that the hose (or any length) has not been used in a burst test program. No hose length involved in such a program will be part of an operational diving hose.

_____ Check that hoses are free of moisture, packing material, or chalk.

_____ Soap test hose connections after connection to air supply and pressurization.

_____ Ensure umbilical boots are in good condition.

i. Test Equipment with Activated Air Supply:

_____ Hook up all air hoses to helmets, masks, and chamber; make connections between back-up supply and primary supply manifold.

_____ Verify flow to helmets and masks from primary and secondary air supply.

_____ Check all exhaust and non-return valves.

_____ Hook up and test all communications.

_____ Check air flow from both primary and back-up supplies to chamber.

j. Recompression Chamber Checkout (Pre-dive only):

_____ Check that chamber is completely free and clear of all combustible materials.

_____ Check primary and back-up air supply to chamber and all pressure gauges.

_____ Check that chamber is free of all odors or other “contaminants.”

_____ Hook up and test all communications.

_____ Check air flow from both primary and back-up supplies to chamber.

k. Final Preparations:

_____ Verify that all necessary records, logs, and timesheets are on the diving station.

_____ Check that appropriate decompression tables are readily at hand.

_____ Place the dressing bench in position, reasonably close to the diving ladder or stage, to minimize diver travel.

l. Dress Diver/s:

_____ Dress divers in accordance with requirements of approved workplan and in considerations of the site environmental conditions.

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ATTACHMENT 3
DIVING SUPERVISOR/LEAD DIVER POST-DIVE CHECKLIST

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ATTACHMENT 3

DIVING SUPERVISOR/ LEAD DIVER POST-DIVE CHECKLIST

PROJECT NAME/ NUMBER:_____

_____ Check the physical condition of the diver.

_____ Instruct the diver to report any physical problems or adverse physiological effects including symptoms of decompression sickness.

_____ Advise the diver of the location of the closest recompression chamber that is ready for use.

_____ Alert the diver to the potential hazards of ascending to altitude, including flying after diving (see DSPM Section 18)

_____ Assemble diving equipment and return to site support facility.

_____ Have divers shower and consume warm liquids, avoid beverages with caffeine.

_____ Observe the divers on the surface for symptoms of diving disorders for a minimum of 10 minutes before allowing the divers to leave the dive site.

_____ Wash all diving equipment in fresh water and hang to dry.

_____ Reorder/replace equipment as necessary.

_____ Complete a dive profile log for all divers and submit the log to the Chairman of the Diving Review Board for input into TtEC's master dive log.

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ATTACHMENT 4
EMERGENCY PROCEDURES

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ATTACHMENT 4

EMERGENCY PROCEDURES

GENERAL DIVING EMERGENCY PROCEDURES

1. **Decompression Sickness or Arterial Gas Embolism**:
   - Recall all divers.
   - Administer first aid, CPR and emergency O_2 as required.
   - Notify Recompression Chamber.
   - Begin transport to chamber on oxygen.
2. **Fire in Equipment**:
   - Evaluate effect of fire on diver AND topside crew.
   - Terminate dive.
   - Inform crew and diver of action planned.
   - Activate plan outlined in Project HASDP.
3. **Explosive Detonation with Divers in the Water**:
   - Try to establish communications with the divers using standard line pull signals or communications.
   - If contact is established with the divers, recall, recover, and administer first aid as required. Transport in accordance with project HASDP as required.
   - If communications cannot be established, activate the standby diver and recover the divers via the tending line, and administer first aid as required.
   - Request medical assistance and remember that unconscious divers should be treated for possible arterial gas embolism (AGE)
   - Discontinue diving operations until the cause of the explosion is determined.
4. **Boat Breakdown:**

   This situation is considered to constitute an emergency due to the loss of control of the divers.
   - Recall and recover the divers.
   - Discontinue diving operations.
   - Deploy the anchor
   - Request assistance via radio, phone, or signals.
5. **Variations in Ascent Rate**

   Always ascend at a rate of 30 feet per minute (FPM) (20 seconds per 10 feet of seawater [FSW]). Minor variations in the rate of travel between 20 and 40 FSW/minute are acceptable. Any variation in the rate of ascent must be corrected in accordance with the following procedures; however, a delay of up to 1 minute in reaching the first decompression stop can be ignored.
   - **Travel Rate Exceeded.** On a Standard Air Dive, if the rate of ascent is greater than 30 FPM, STOP THE ASCENT, allow the watches to catch up, and then

continue ascent. If the decompression stop is arrived at early, start the stop time after the watches catch up.

- **Delay greater than 1 minute, deeper than 50 FSW**. Add the total delay time (rounded up to the next whole minute) to the bottom time, re-compute a new decompression schedule, and decompress accordingly.
- **Delay greater than 1 minute, shallower than 50 FSW**. If the rate of ascent is less than 30 FPM, add the delay time to the diver's first decompression stop. If the delay is between stops, disregard the delay. The delay time is rounded up to the next whole minute.

6. Unplanned Ascent (Blowup)

- **Ascent from 20 Feet or Shallower with No Decompression Stops Required.** No recompression is required if the diver surfaces from 20 feet or shallower but was within no-decompression limits and is asymptomatic. The diver should be observed on the surface for 1 hour. Consider administering O_2.
- **Ascent from 20 Feet or Shallower (Shallow Surfacing) with Decompression Stops Required.** If decompression is required and the diver surfaces from 20 FSW or shallower (missed the 20- and/or 10-foot stop) and is asymptomatic, the diver is returned to that decompression stop.
    - If the time from the surface back to the stop was less than 1 minute, add 1 minute to the stop.
    - If the time from the surface back to the stop was more than 1 minute and the diver remains asymptomatic, multiply the 20- and/or 10-foot stops by 1.5.
    - Observe diver for 1 hour. Consider administering O_2.
- **Ascent from Deeper than 20 Feet (Uncontrolled Ascent).** Any unexpected surfacing of the diver from depths in excess of 20 feet is considered an uncontrolled ascent. If the diver is within no-decompression limits and asymptomatic, he/she should be observed for at least 1 hour on the surface. Recompression is not necessary unless symptoms develop. Consider administering emergency O_2.
- **Asymptomatic Uncontrolled Ascent.** Asymptomatic divers who experience an uncontrolled ascent and who have missed decompression stops are treated by recompression based on the amount of decompression missed as follows:
    - **Oxygen Available.** Immediately compress the diver to 60 feet in the recompression chamber. If less than 30 minutes of decompression (total ascent time from the tables) was missed, decompress from 60 feet on appropriate Treatment Table. If more than 30 minutes of decompression was missed, decompress from 60 feet on appropriate Treatment Table.
    - **Oxygen Not Available**. If less than 30 minutes of decompression was missed, compress the diver to 100 feet in the recompression chamber and treat on appropriate Treatment Table. If more than 30 minutes was missed, compress to 165 feet and treat on appropriate Treatment Table.

- **Symptomatic Uncontrolled Ascent.** If a diver has had an uncontrolled ascent and has any symptoms, he/she should be recompressed immediately in a recompression chamber to 60 FWS.
    - If the diver surfaced from 60 FWS or shallower, compress to 60 FSW and begin appropriate Treatment Table.
    - If the diver surfaced from a greater depth, compress to 60 FSW or depth where the symptoms are significantly improved, not to exceed 165 FSW, and begin appropriate Treatment Table.

7. Emergency Evacuation

- Notify diver and dive team of emergency and abort dive.
- Evacuate all unnecessary personnel.
- Decompress the diver (if required) and recover. If decompression is not possible, follow omitted decompression procedures.

ATTACHMENT 4

EMERGENCY PROCEDURES

SCUBA EMERGENCY PROCEDURES

1. **Buddy Separation** – Make a 360-degree check, above and below; if your buddy is not found, surface immediately. Check the surface for bubbles and notify the Diving Supervisor/ Lead Diver immediately.
2. **Lost Diver** – The first stage of a lost diver is when communications have been lost and emergency recall has failed.
    - Initiate diver recall.
    - Wait 1 minute for response.
    - Deploy lost diver buoy.
    - Deploy standby diver (Dive Supervisor's/ Lead Diver's discretion); follow bubbles or conduct expanding circle line search from last known position.
    - Notify ships/ boats in the area to look out for lost diver and request assistance from the Coast Guard Rescue Center, if necessary.
3. **Loss of Air/Equipment Malfunction (SCUBA)**
    - Signal buddy/surface and abort dive.
    - Buddy breath/activate reserve/breath from emergency air supply.
    - Exhale to the surface.
4. **Mechanical Injury:**
    - Signal buddy/surface and abort dive.
    - Inform Diving Supervisor/Lead Diver.
    - Rule out possible decompression sickness.
    - If immediate treatment required, recall all divers and transport to hospital.
5. **Fouled/Trapped Diver**:
    - Don't panic, stop and think!
    - Notify your buddy diver or topside, if possible (2-2-2 fouled and need assistance, or 3-3-3 fouled and can clear myself).
    - Carefully and calmly try to work yourself free of the entanglement.
    - If required, ditch your equipment and make a buoyant ascent to the surface.
    - If the diver is trapped, the buddy diver should mark the position of the trapped diver with a circle line, his tending line or any available method of marking the trapped diver's position, and then surface and report to the Diving Supervisor.
    - The Diving Supervisor/ Lead Diver will formulate a rescue plan, while the diver delivers additional air to the trapped diver.
    - The Diving Supervisor/Lead Diver will then brief the rescue plan to the dive team and execute the rescue.

ATTACHMENT 4

EMERGENCY PROCEDURES

After rescue, observe the divers on the surface for signs of AGE, asphyxia, physical injury, omitted decompression, and hypothermia.

SURFACE SUPPLIED EMERGENCY PROCEDURES

1. Loss of Breathing Media

- Re-establish breathing media supply:
  - Activate topside secondary breathing media supply
  - Diver initiate emergency procedure using bailout bottle.
  - **ONLY AS A LAST RESORT** – Pressurize the diver's pneumofathometer hose (135 PSI) and have the diver insert the hose into his/her helmet or mask.
- Alert standby diver.
- Have stricken diver go to bell, stage or ladder.
- If required, send standby diver to assist.
- Terminate dive.

2. Loss of Communications

- Attempt to establish communications with line pull signals.
- Put constant air to the diver's pneumofathometer.
- Alert standby diver.
- If communications are established using line pull signals, abort dive and decompress if required.
- If communications are not established, send stand-by diver to diver's assistance, abort dive, and decompress if required.

3. Fouled or Trapped Diver

- Avoid panic and ensure diver does NOT ditch equipment.
- Diver informs topside — gives a detailed report.
- Alert standby diver.
- Diver determines the extent of entrapment.
- Diver attempts to free yourself.
- If required, deploy standby for assistance.
- Abort dive and decompress if required

4. Injury in the Water

- Diver informs topside of injury and extent — gives a detailed report.
- Alert standby diver.

- If required, deploy standby diver to assist stricken diver.
- Abort dive and follow decompression protocol, unless injury indicates a greater risk than omitted decompression. Check surface decompression tables for alternate protocol.
- Request required medical assistance.

5. Severance of Divers Air Supply

- Diver initiates emergency procedure using bailout bottle.
- **If pneumofathometer hose intact and then ONLY AS A LAST RESORT –** Pressurize the diver's pneumofathometer hose (135 PSI) and have the diver insert the hose into his helmet or mask.
- Alert standby diver.
- Abort dive and decompress.
- Deploy standby diver with more air and/or assist stricken diver if required.

6. Severance of Complete Umbilical

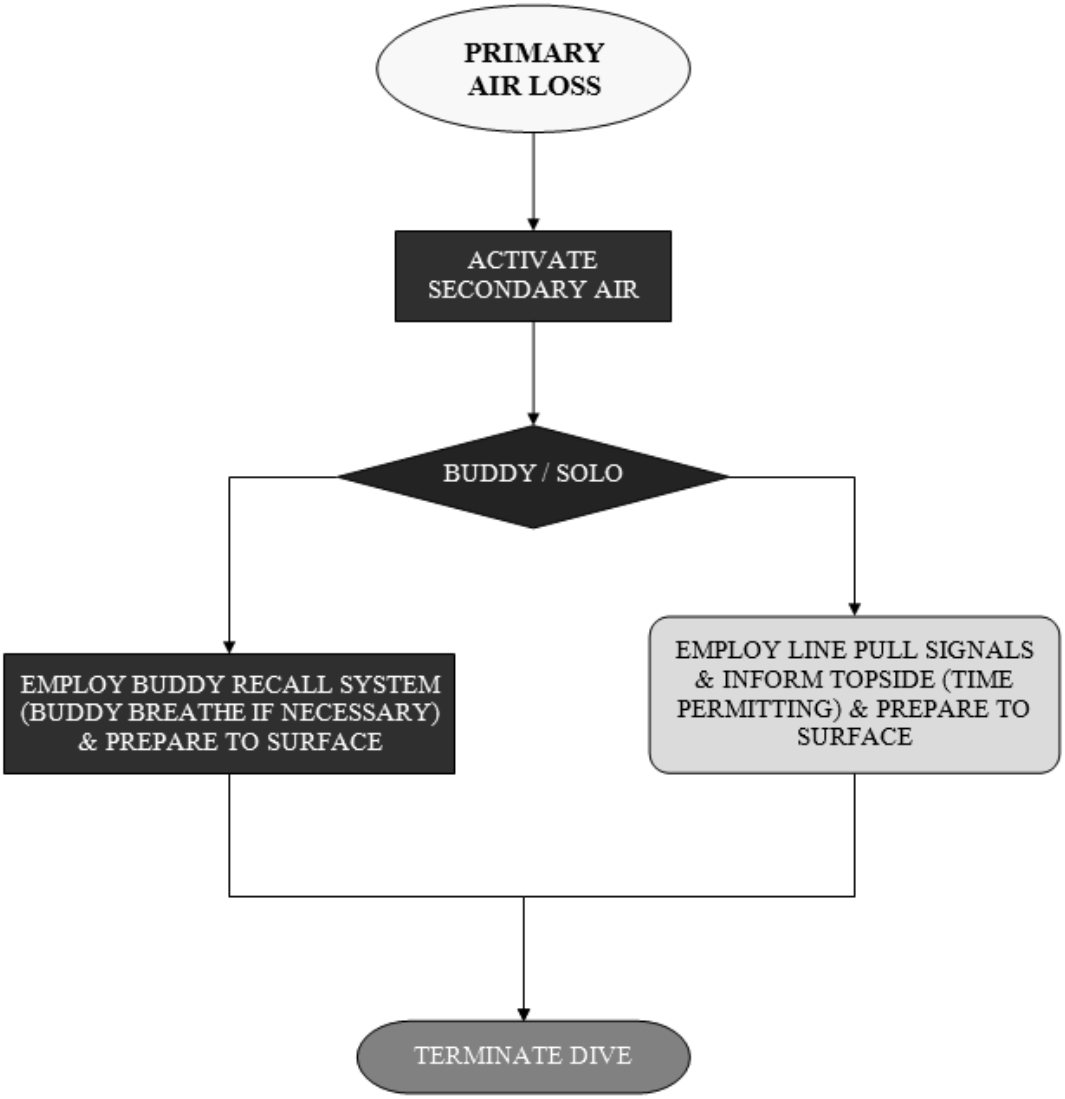
- Diver initiates emergency procedure using bailout bottle.
- Topside alerts standby diver.
- Deploy standby diver down stage line, diver's umbilical (if visible), or descent line with additional air supply (pneumofathometer, if necessary) to assist stricken diver and inform topside of conditions.
- Abort dive and decompress. Check surface decompression tables for shorter water time.

ATTACHMENT 4

EMERGENCY PROCEDURES

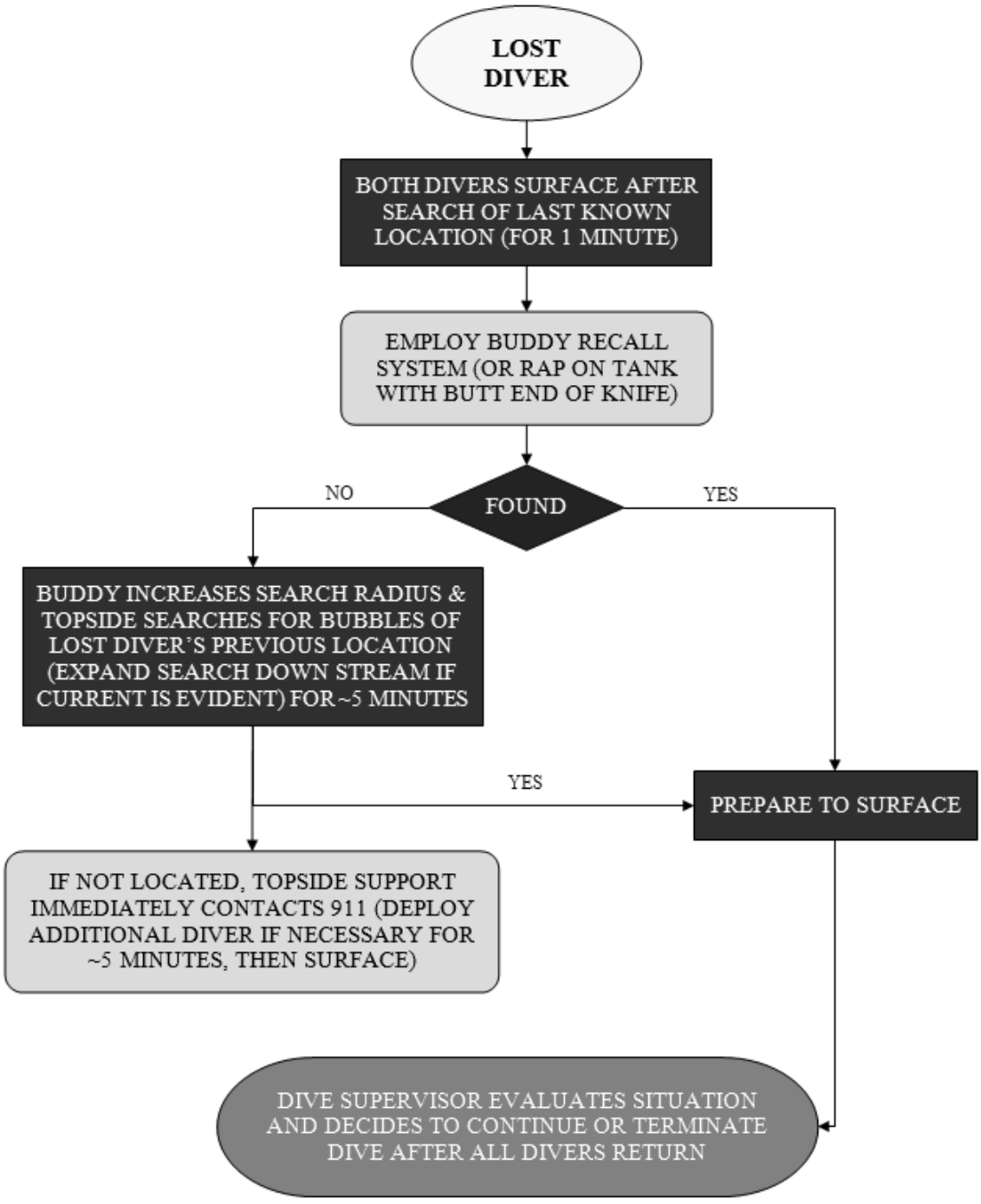
DIVING EMERGENCY DECISION FLOW CHARTS

SCUBA EMERGENCY PROCEDURES



ATTACHMENT 4

EMERGENCY PROCEDURES



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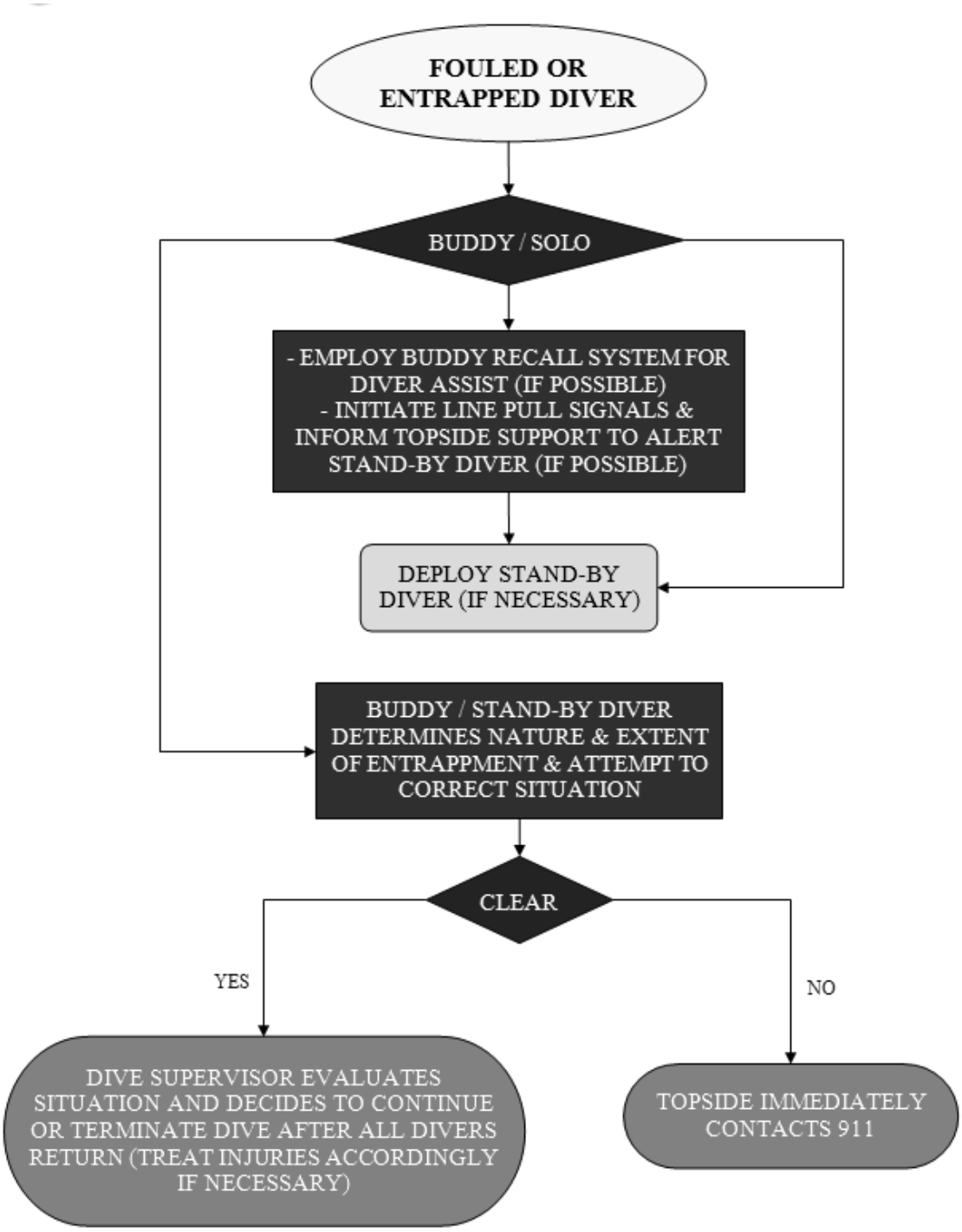
EMERGENCY PROCEDURES



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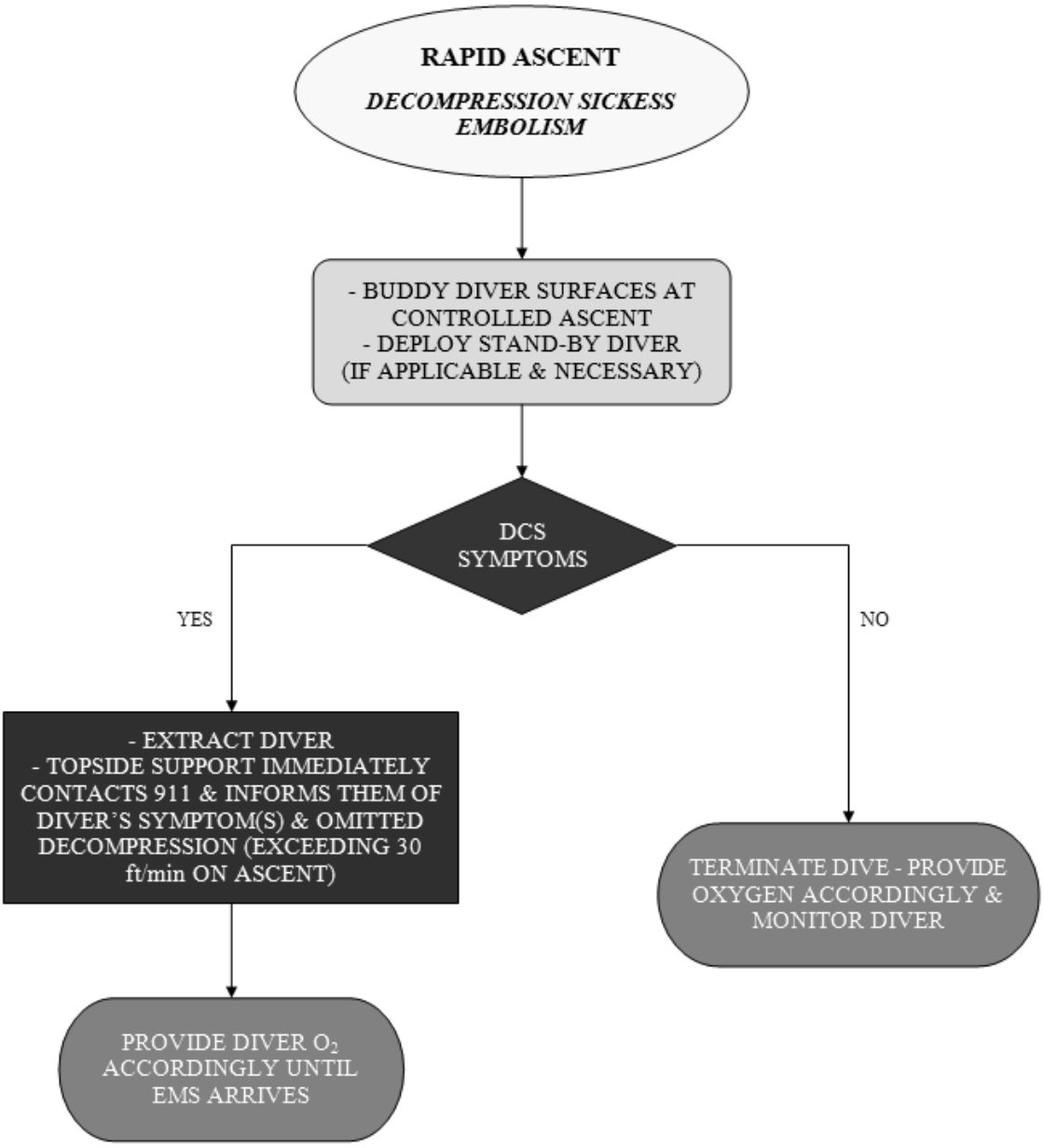
EMERGENCY PROCEDURES



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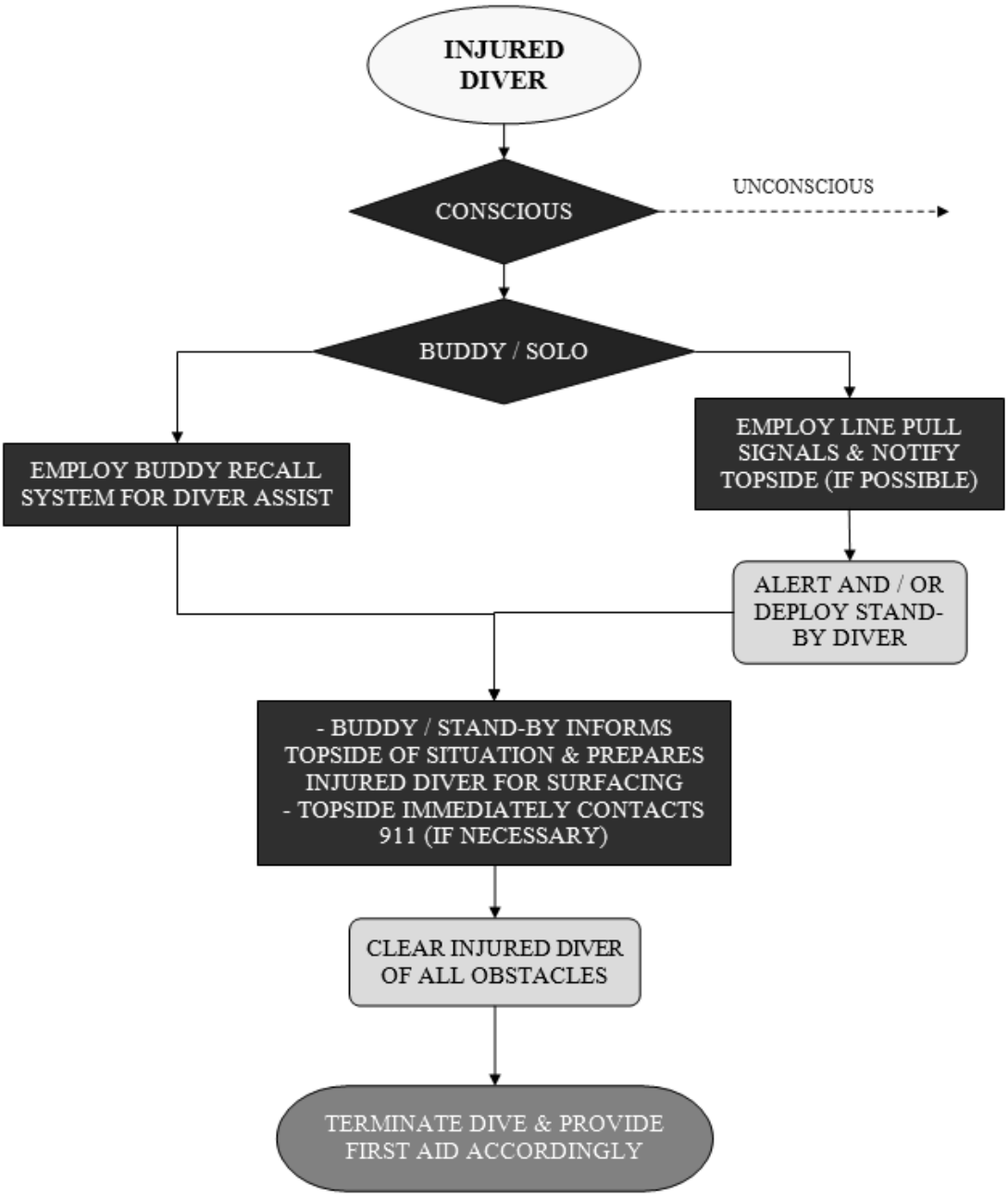

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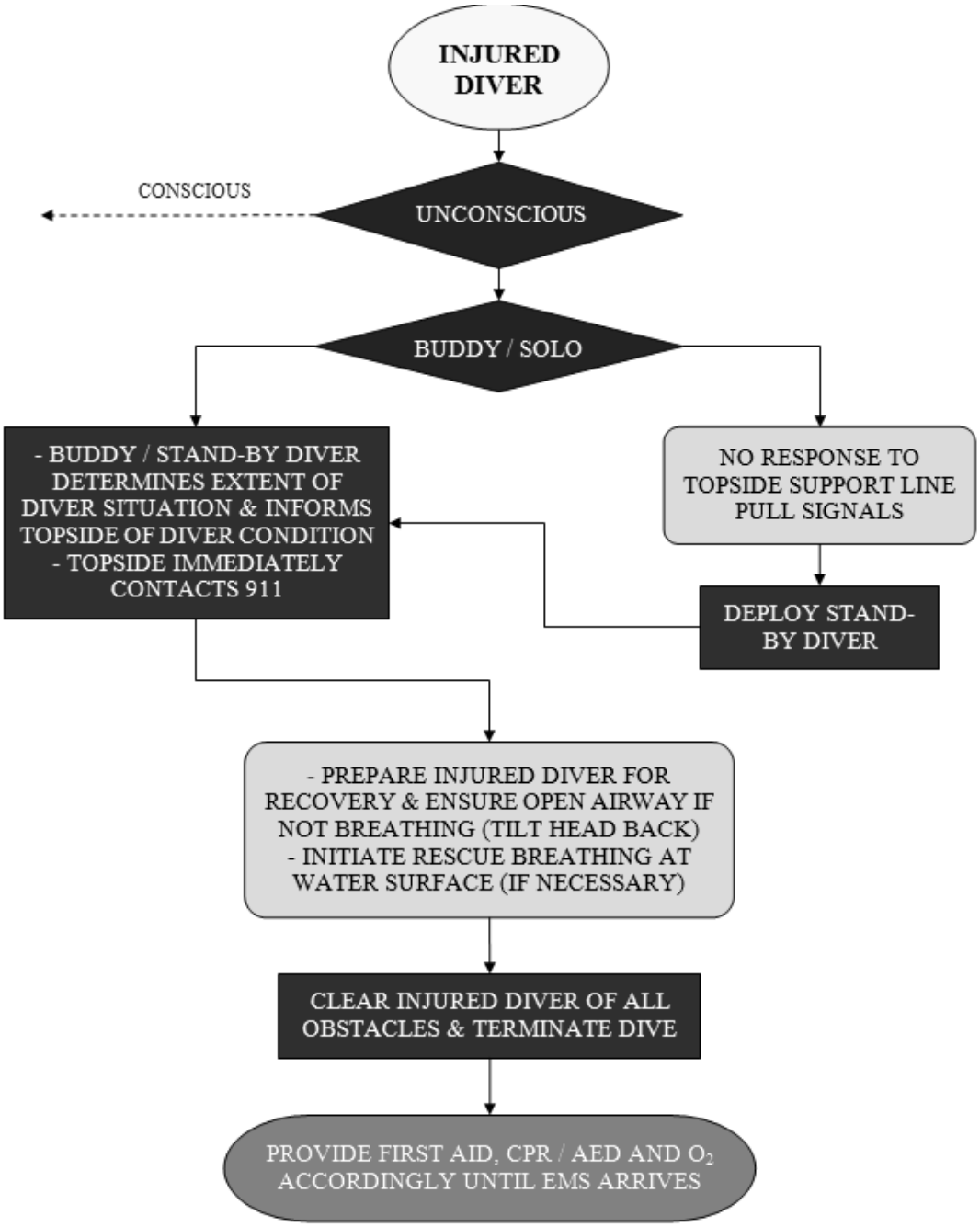
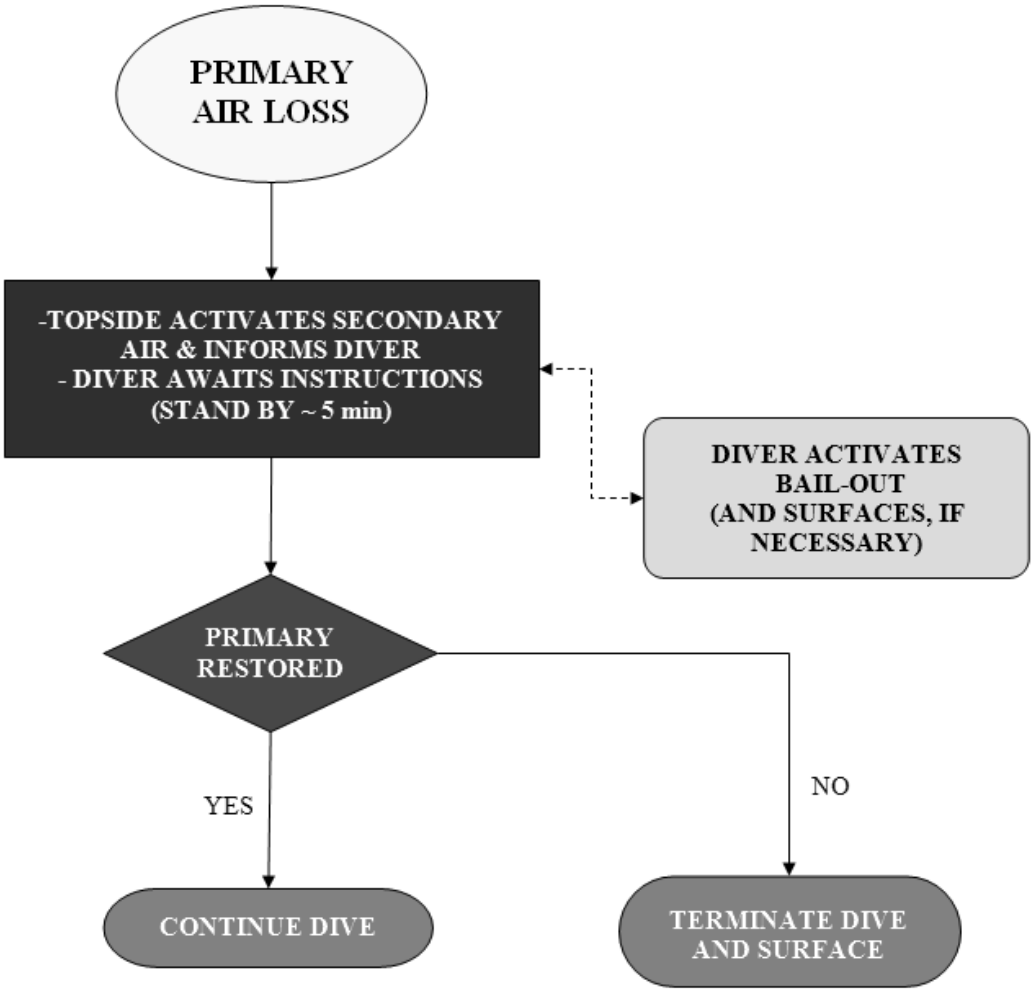
EMERGENCY PROCEDURES



ATTACHMENT 4

EMERGENCY PROCEDURES

SURFACE SUPPLIED EMERGENCY PROCEDURES



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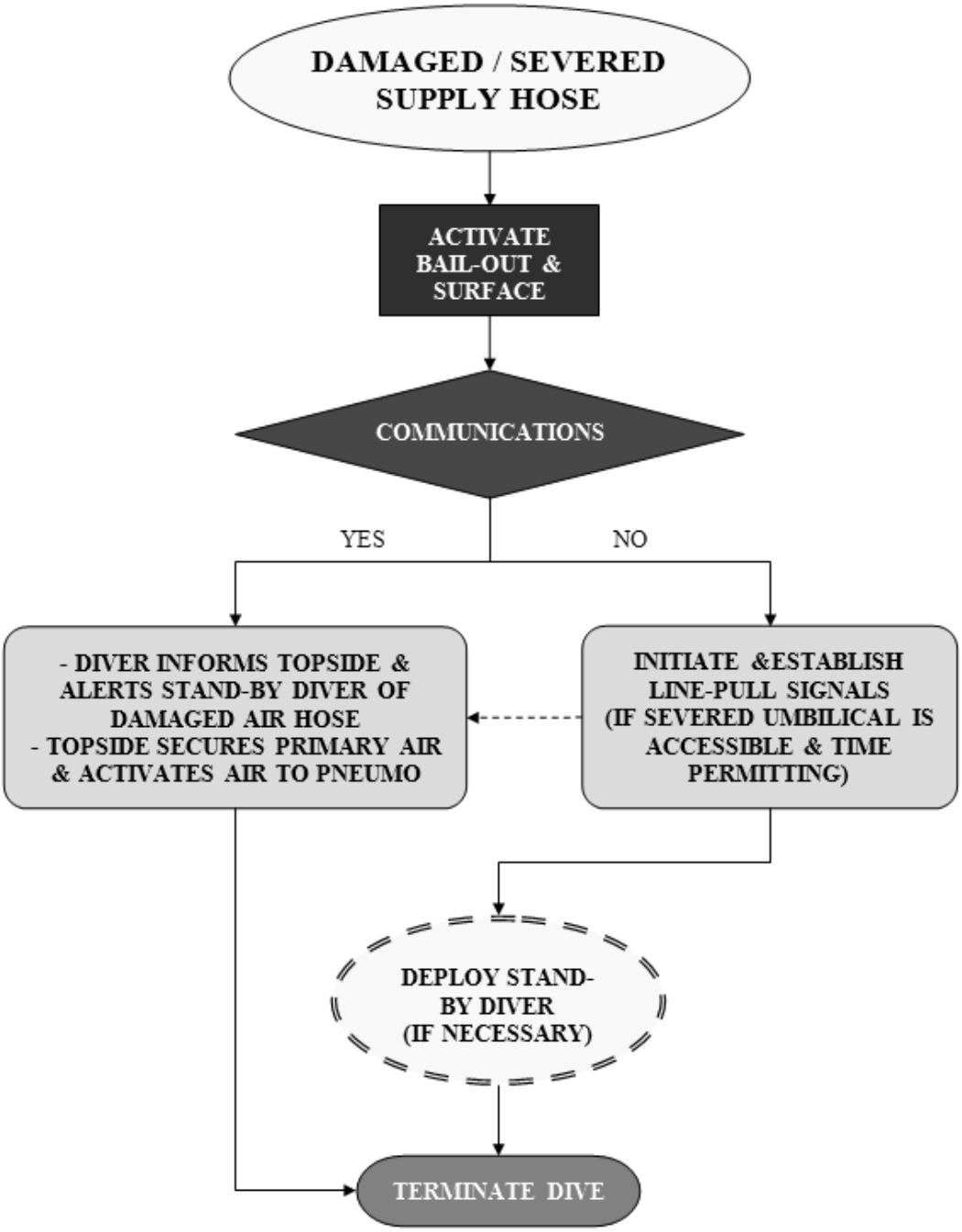
EMERGENCY PROCEDURES



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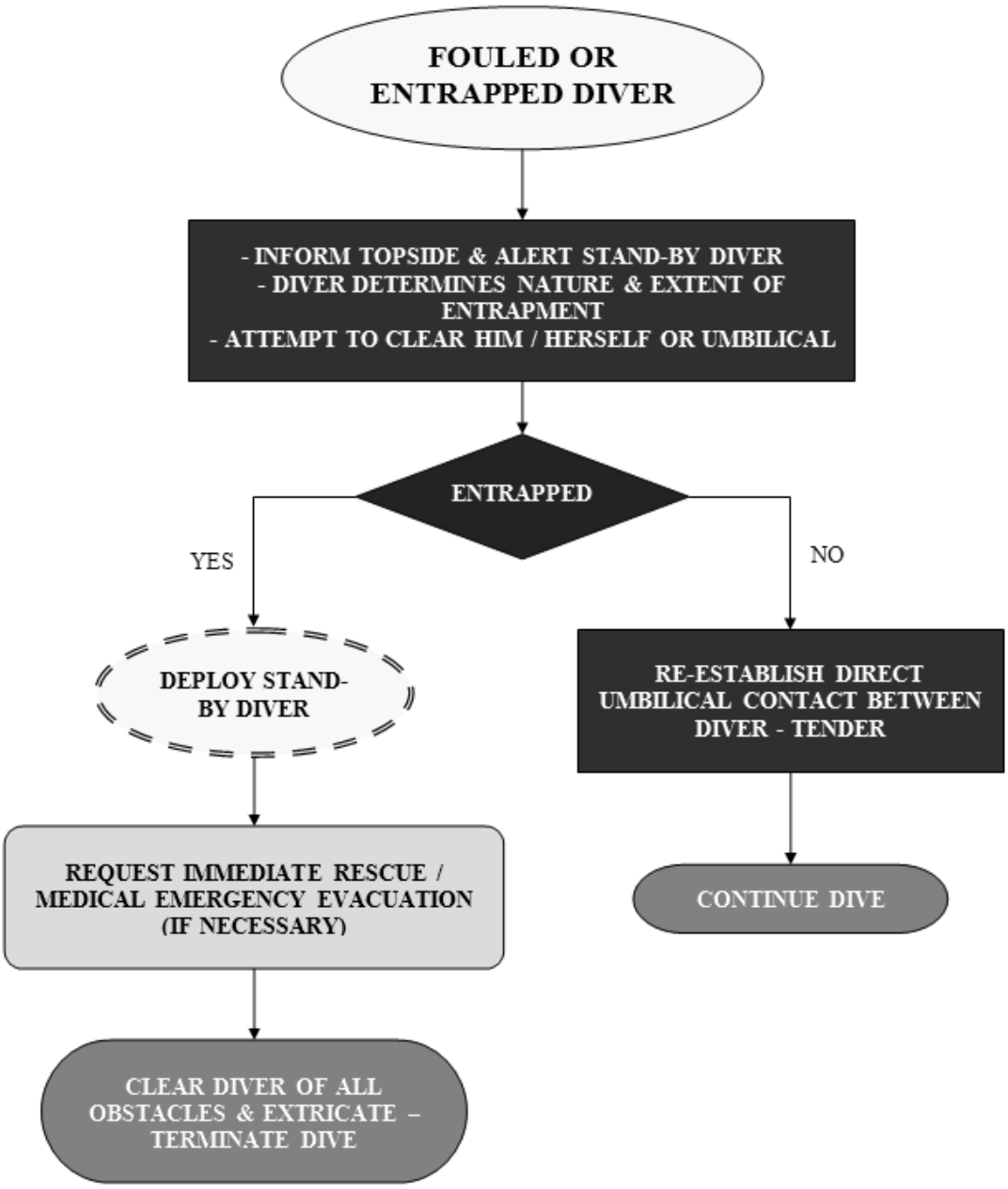
EMERGENCY PROCEDURES



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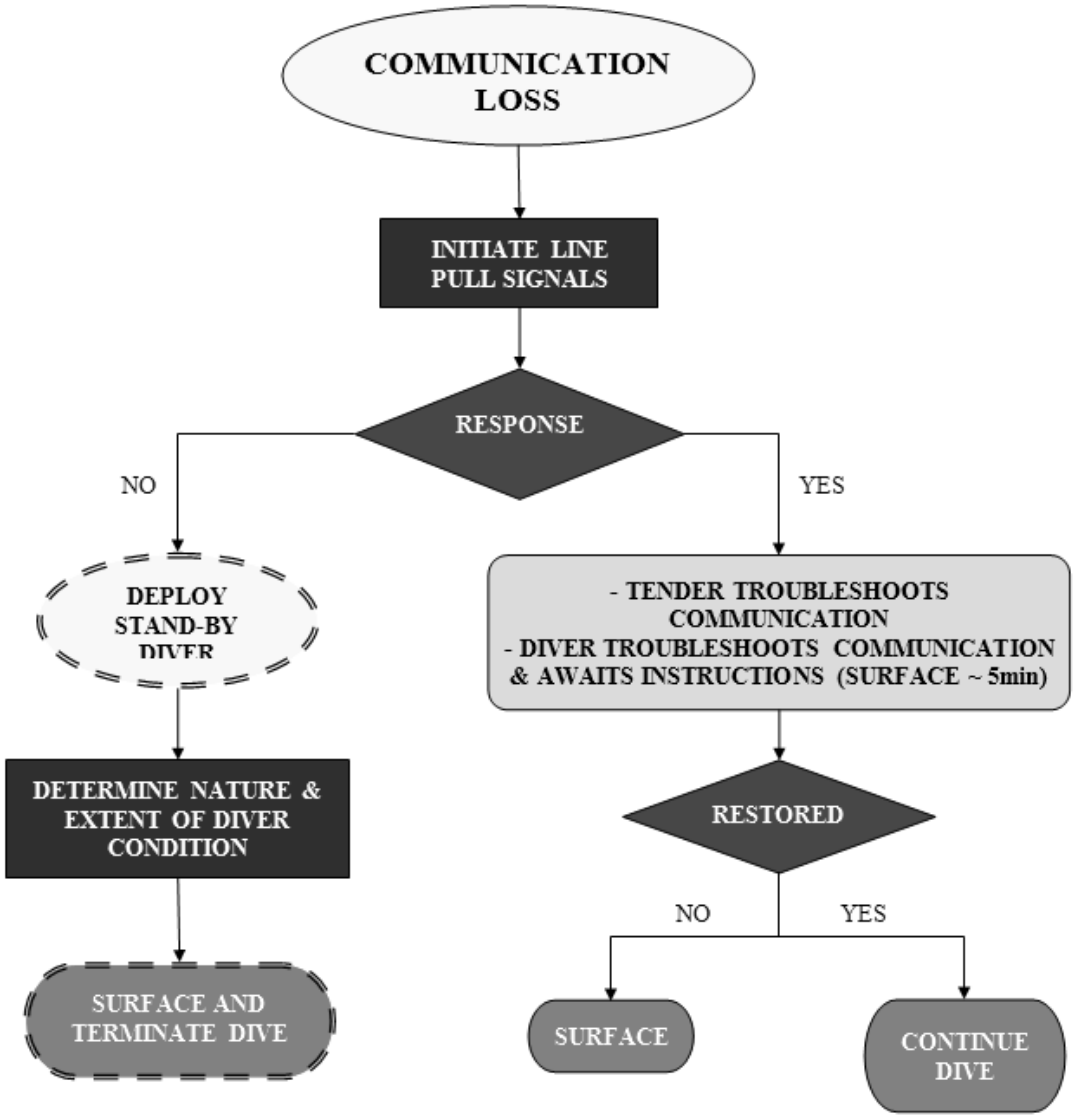

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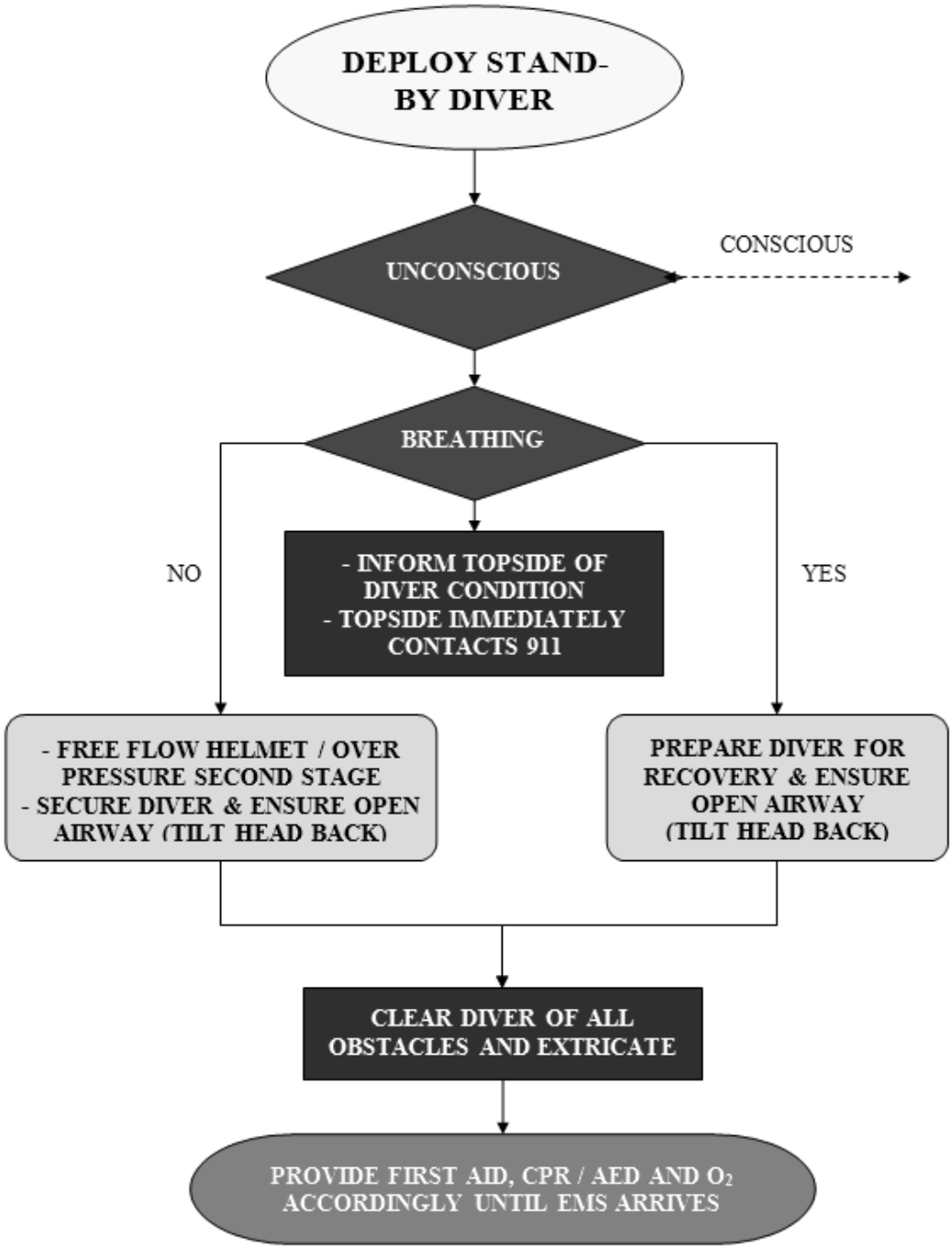

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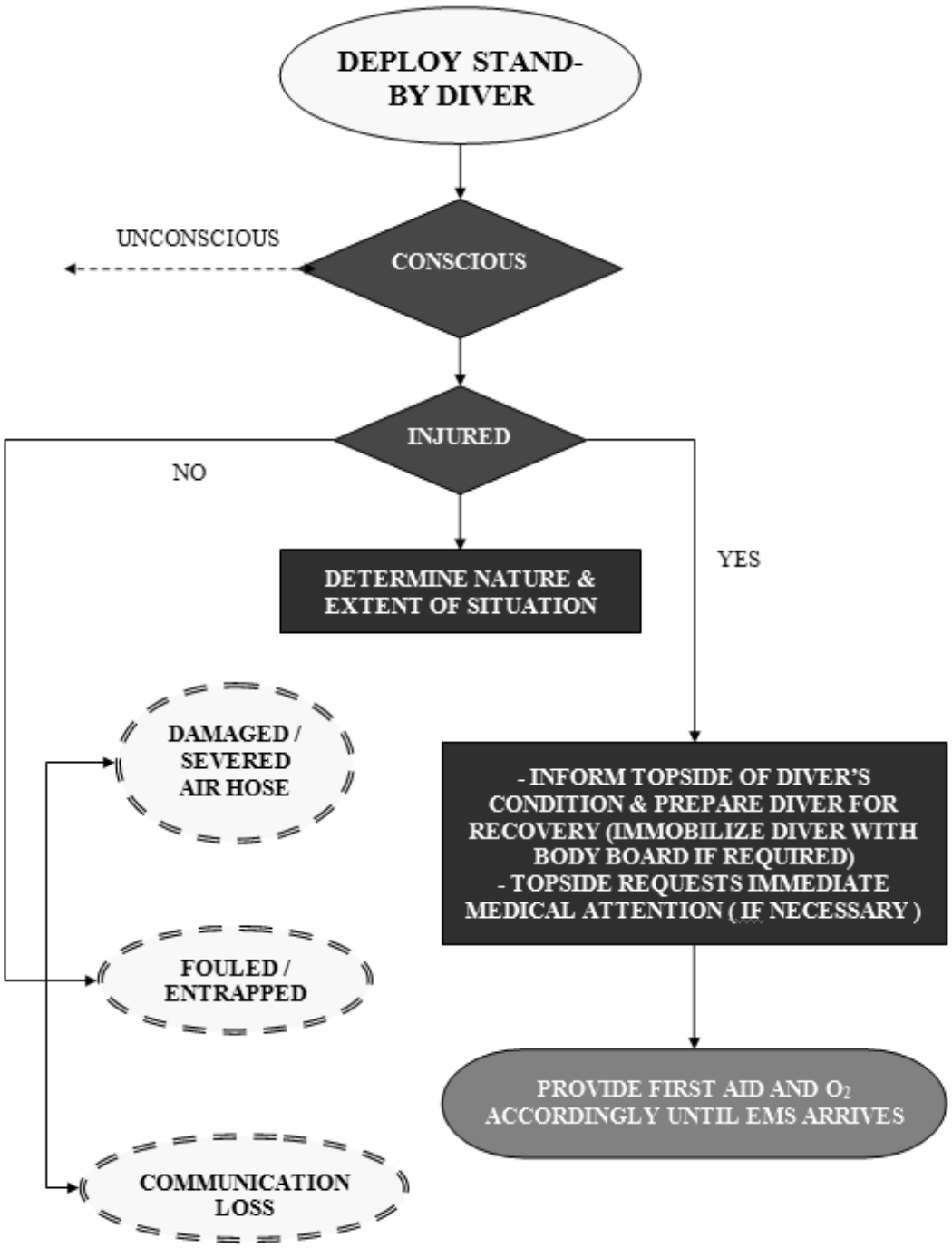

ATTACHMENT 5
EMERGENCY PHONE NUMBERS CHECKLIST

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ATTACHMENT 5

EMERGENCY PHONE NUMBERS CHECKLIST

PROJECT NAME/NUMBER: _____

RECOMPRESSION CHAMBER:

ADDRESS/ LAT-LONG _____

PHONE NUMBER: _____

POC: _____

RESPONSE TIME: _____

HOSPITAL:

ADDRESS/ LAT-LONG _____

PHONE NUMBER: _____

POC: _____

RESPONSE TIME: _____

AIR TRANSPORTATION:

ADDRESS/ LAT-LONG _____

PHONE NUMBER: _____

POC: _____

RESPONSE TIME: _____

SEA TRANSPORTATION:

ADDRESS/ LAT-LONG _____

PHONE NUMBER: _____

POC: _____

RESPONSE TIME: _____

ATTACHMENT 5

EMERGENCY PHONE NUMBERS CHECKLIST

PROJECT NAME/NUMBER: _____

AMBULANCE:

ADDRESS/ LAT-LONG _____

PHONE NUMBER: _____

POC: _____

RESPONSE TIME: _____

PHYSICIAN:

ADDRESS/LAT-LONG _____

PHONE NUMBER: _____

POC: _____

RESPONSE TIME: _____

COMMUNICATIONS:

ADDRESS/ LAT-LONG _____

PHONE NUMBER: _____

POC: _____

RESPONSE TIME: _____

USCG RESCUE:

ADDRESS/ LAT-LONG _____

PHONE NUMBER: _____

POC: _____

RESPONSE TIME: _____

NOTE – THIS CHECKLIST WILL BE PROMINENTLY POSTED AT THE DIVE SITE AND BE PLACED IN ALL BOATS AND RESPONSE VEHICLES.

ATTACHMENT 6
WORKING DIVE LOG

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ATTACHMENT 6

TETRA TECH TMR WORKING DIVE LOG

1. All Tetra Tech TMR (Tt TMR) dives will be recorded on this attachment during field operations each dive day.

2. The information on these working Dive Logs will be then transferred/ recorded on the Tt TMR Dive Smooth Log by the Dive Supervisor/ or designee and forwarded to the Project Manager for the official project files. A copy will be further forwarded to the Chairman of the Tt TMR Diving Review Board.

   For scientific divers, a copy will also be sent to the Tt TMR Diving Safety Officer. The Chairman of the Diving Review Board will retain this log for 1 year, except where there has been an injury or incident of decompression sickness and then the record will be retained for 5 years.

3. Definitions:

   a. Old Group – Repetitive group designation from previous dive. Leave blank if this is the first dive.

   b. Surface Interval – The time, which a diver has spent on the surface following a dive. It begins as soon as the diver surfaces and ends as soon as the diver starts his/her next descent. Not required for first dive.

   c. RNT – RESIDUAL NITROGEN TIME – Time, in minutes, which must be added to the bottom time of a repetitive dive to compensate for the nitrogen still in solution in a diver's tissues from a previous dive.

   d. Depth – Depth of current dive.

   e. Bottom Time – The total elapsed time from when the divers leave the surface to the time (rounded up to the next whole minute) they begin their ascent from the bottom.

   f. Decompression time – Decompression schedule/decompression time.

   g. Equivalent Single Dive Time – RNT plus actual bottom time.

   h. New Group – REPETITIVE GROUP DESIGNATION – A letter, which is used to relate directly to the amount of residual nitrogen remaining in a diver's body.

4. RNT Exception Rule – If performing a repetitive dive to the same depth or deeper, and the RNT is greater than the bottom time of the previous dive, use the bottom time of the previous dive as the RNT.

5. See Attachment 10 for the required U.S. Navy Dive Tables needed to complete these logs.

ATTACHMENT 6

TETRA TECH EC WORKING DIVE LOG

PROJECT NAME/NUMBER: _____ **DATE: _____**

NAME	LS	RS	TBT	DEPTH	TDT	RNT	ESDT	T/S	REPET GROUP	SI
DIVE SUPERVISOR					STBY DIVER					

ATTACHMENT 7
DIVE SMOOTH LOG

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ATTACHMENT 7

TETRA TECH TMR DIVE SMOOTH LOG

PROJECT NAME/ NUMBER: _____

1. All Tetra Tech TMR dives will be recorded on this attachment and be the final legal record concerning a diver's hyperbaric exposure during operations.

2. Upon completion of the project or weekly, all working Dive Logs from Attachment 6 will be recorded on this Dive Smooth Log by the Dive Supervisor/ Lead Diver and forwarded to the Project Manager for the Project files and the Chairman Diving Review Board. For science divers, a copy will also be sent to the Tt TMR Diving Safety Officer. The Chairman of the Diving Review Board will retain this log for 1 year, except where there has been an injury or incident of decompression sickness and then the record will be retained for 5 years.

3. Data field definitions:

   a) Date – Date of the diving operation.
   b) Project Name – Name of the Project that dive operations are supporting.
   c) Project Number – Associated Project number.
   d) Location – General Project Location.
   e) Platform – Platform from which the dive operations are conducted.
   f) Gas Source – Source of diver's breathing medium.
   g) Apparatus – The diving mode and equipment used during the operation.
   h) Dress – The exposure protection used by the diver(s).
   i) Project Location – The specific location in the project location that the dive is conducted.
   j) Air Temp – The ambient air temperature at the project dive site.
   k) Current – The observed or reported current at the dive site.
   l) Visibility – The observed underwater visibility reported by the diver(s) at depth.
   m) Altitude – The observed altitude recorded at the dive site.
   n) Water Temp – The observed underwater temperature reported by the diver(s) at depth.
   o) Wave Ht. – The observed wave height recorded at the dive site.
   p) Bottom Type – The observed bottom type reported by the diver(s) at depth.
   q) Tools Used – The tools used for the specific Project task during the dive.
   r) Divers Name – Self-explanatory.
   s) Left Surface (LS) – The recorded time that the diver(s) left the surface (begin descent)
   t) Left Bottom (LB) – the recorded time that the diver(s) left the bottom. (begin ascent)
   u) Total Bottom Time (TBT) – the recorded bottom time (From when diver LS to diver LB).
   v) Total Decompression Time (TDT) – The recorded time of ascent (to include any decompression stops or delays) from when diver LB to diver RS.

   w) Reach Surface (RS) – The recorded time that the diver(s) reach the surface.

PROJECT NAME/ NUMBER: _____

x) Total Time of Dive (TTD) – The recorded time from when the diver(s) LS to when the diver(s) RS.

y) Depth – The deepest depth recorded of the reported dive.

z) Surface Interval (SI) – The time, that a diver has spent on the surface following a dive. It begins as soon as the diver surfaces and ends as soon as the diver starts his/her next descent. Not required for first dive.

aa) Residual Nitrogen Time (RNT) – Time, in minutes, which must be added to the bottom time of a repetitive dive to compensate for the nitrogen still in solution in a diver's tissues from a previous dive.

bb) Equivalent Single Dive Time (ESDT) – A diver's RNT time plus total bottom time. Used to measure remaining time and new schedule for repetitive dives

cc) Table and Schedule (T/S) – The Table and Schedule used to measure a diver's hyperbaric exposure for a recorded dive.

dd) Repetitive Group (RG) – Repetitive group designation from previous dive and used for repetitive and final dive calculations. Leave blank if this is the diver's first dive.

4. RNT Exception Rule – If performing a repetitive dive to the same depth or deeper, and the RNT is greater than the bottom time of the previous dive, use the bottom time of the previous dive as the RNT.

5. Repetitive Group Designation – A final letter designation, which is used to relate directly to the amount of residual nitrogen remaining in a diver's body after that dive.

6. Use the applicable U.S. Navy Dive Tables located in Attachment 10. These tables are required to complete this log.

TETRA TECH

DIVE LOG

Project

Date: _____ Project Name: _____ Location: _____

Project Number: _____

Equipment

Platform: _____ Gas Source: _____ Apparatus: _____ Dress: _____

Environment

Project Location: _____ Altitude: _____ Tools Used: _____

Air Temp: _____ Water Temp: _____

Current: _____ Wave Ht. _____

Visibility: _____ Bottom Type: _____

Dive Data

Diver (Last, First MI)	LS	LB	TBT	TDT	RS	TTD	Depth	SI	RNT	ESDT	T/S	RG	NOTES

Dive Description

Purpose: _____

Description: _____

Approval

Signature: _____ Date: _____

Dive Supervisor: _____

ATTACHMENT 8
USN DIVING LINE PULL AND HAND SIGNALS

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ATTACHMENT 8

USN DIVING LINE PULL AND HAND SIGNALS

From Tender to Diver		From Diver to Tender	
1 Pull	Are you all right? When diver is descending, 1 pull means STOP.	1 Pull	I am all right. When diver is descending, 1 pull means I am on the bottom.
2 Pulls	Leave surface; Go down.	2 Pulls	Give me slack.
3 Pulls	Standby to come up.	3 Pulls	Take up my slack.
4 Pulls	Come up.	4 Pulls	Haul me up.
7 Pulls	On/Off search signals.	7 Pulls	On/Off search signals.
1 Pull	Stop and search where you are at.	2-1 Pull	I understand, Talk to me.
2 Pulls	Move directly away from the tender if given slack; Move towards the tender if strain is taken.	3-2 Pulls	More air.
3 Pulls	Face umbilical, take a strain, and move RIGHT.	4-3 Pulls	Less air.
4 Pulls	Face umbilical, take a strain, and move LEFT.	1-2-3 Pulls	Send me a square mark.
2-1 Pull	I understand, talk to me.	2-1-2 Pulls	Send me a slate.
3-2 Pulls	Ventilate rig.	5 Pulls	Send me a line.
4-3 Pulls	Circulate rig.	5-5 Pulls	Reacquired anomaly *(for UXO tasking only).*
EMERGENCY—From Diver to Tender			
2-2-2 Pulls	I am fouled and need assistance (“I need you”).		
3-3-3 Pulls	I am fouled but can clear myself (“I need me”).		
4-4-4 Pulls	Haul me up immediately.		

ATTACHMENT 8

USN DIVING LINE PULL AND HAND SIGNALS

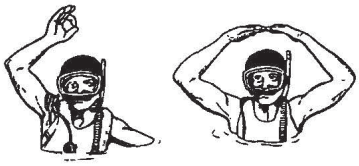
	Meaning/Signal	Comment
	**STOP** Clenched fist.	
	**SOMETHING IS WRONG** Hand flat, fingers together, palm out, thumb down then hand rocking back and forth on axis of forearm.	This is the opposite of Okay. The signal does not indicate an emergency.
	**I AM OKAY or ARE YOU OKAY?** Thumb and forefinger making a circle with three remaining fingers extended (if possible).	Divers wearing mittens may not be able to extend three remaining fingers distinctly. Short range use.
	**OKAY ON THE SURFACE (CLOSE)** Right hand raised overhead giving Okay signal with fingers. **OKAY ON THE SURFACE (DISTANT)** Both hands touching overhead with both arms bent at 45° angle.	Given when diver is close to pickup boat. Given when diver is at a distance from the pickup boat.
	**DISTRESS or HELP or PICK ME UP** Hand waving overhead (diver may also thrash hand in water).	Indicates immediate aid is required.
	**WHAT TIME? or WHAT DEPTH?** Diver points to either watch or depth gauge.	When indicating time, this signal is commonly used for bottom time remaining.
	**GO DOWN or GOING DOWN** Two fingers up, two fingers and thumb against palm.	
	**GO UP or GOING UP** Four fingers pointing up, thumb against palm.	
	**I'M OUT OF AIR** Hand slashing or chopping at throat. **I NEED TO BUDDY BREATHE** Fingers pointing to mouth or regulator.	Indicates signaler is out of air. Signaler's regulator may be in or out of mouth.

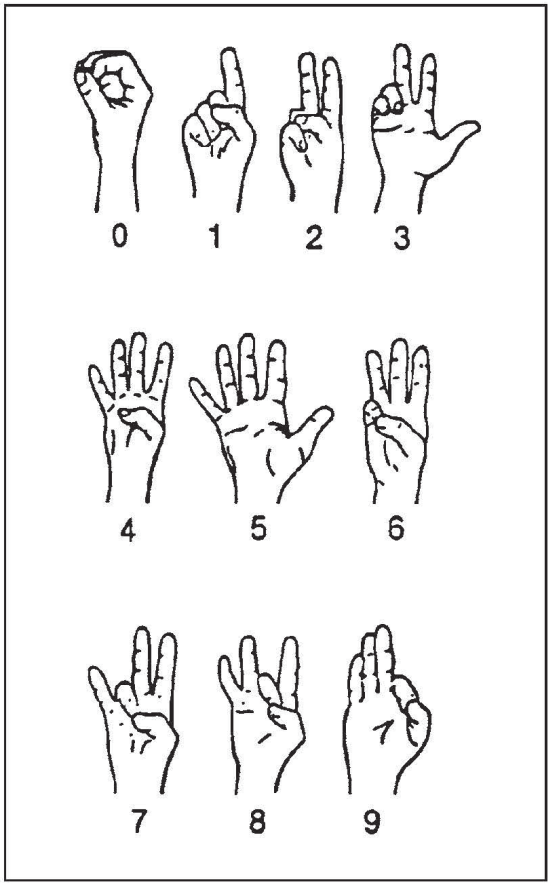
Figure 7-9. SCUBA Hand Signals (page 1 of 3).

ATTACHMENT 8

USN DIVING LINE PULL AND HAND SIGNALS

	Meaning/Signal	Comment
	**COME HERE** Hand to chest, repeated.	
	**ME or WATCH ME** Finger to chest, repeated.	
	**OVER, UNDER, or AROUND** Fingers together and arm moving in and over, under, or around movement.	Diver signals intention to move over, under, or around an object.
	**LEVEL OFF or HOW DEEP?** Fingers and thumb spread out and hand moving back and forth in a level position.	
	**GO THAT WAY** Fist clenched with thumb pointing up, down, right, or left.	Indicates which direction to swim.
	**WHICH DIRECTION?** Fingers clenched, thumb and hand rotating right and left.	
	**EAR TROUBLE** Diver pointing to either ear.	Divers should ascend a few feet. If problem continues, both divers must surface.
	**I'M COLD** Both arms crossed over chest.	
	**TAKE IT EASY OR SLOW DOWN** Hand extended, palm down, in short up-and-down motion.	
	**YOU LEAD, I'LL FOLLOW** Index fingers extended, one hand forward of the other.	

Figure 7-9. SCUBA Hand Signals (page 2 of 3).



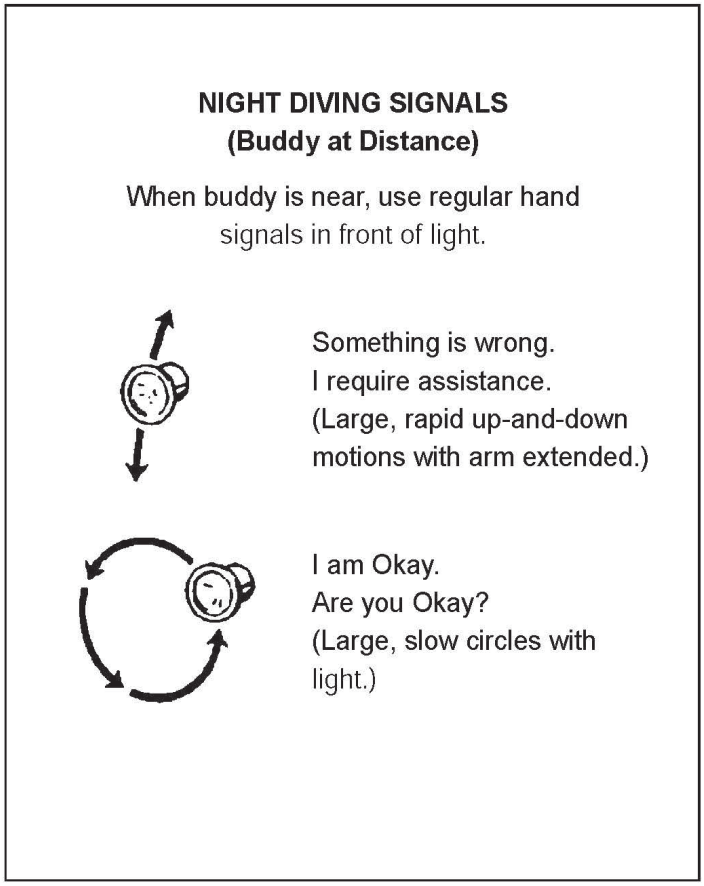


Figure 7-9. SCUBA Hand Signals (page 3 of 3).

ATTACHMENT 9
COLD WATER CONSIDERATIONS AND SAFETY PRECAUTIONS

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ATTACHMENT 9

COLD WATER CONSIDERATIONS AND SAFETY PRECAUTIONS

UNDER ICE DIVING

Diving under the ice requires extremely specialized training and equipment and will not be performed by Tetra Tech TMR employees unless approved by the Diving Review Board.

COLD WATER DIVING

In addition to decompression, thermal problems arising from exposure to cold water pose the major consideration when planning operational dives and selecting equipment. The working diver commonly experiences heat loss during immersion and often expects to be uncomfortably chilled at the end of a dive. Bottom time limits may be determined by the diver's cold tolerance rather than by decompression considerations.

An individual thoroughly conditioned physically can be transported from warm climates into cold climates and immediately begin diving without harmful effects. However, individuals differ in how well suited they are for cold weather operations. At least half of the diving team should have previous experience in ice or cold water diving operations and should be well qualified to train the less experienced.

Personnel scheduled to go to Polar Regions should be instructed in cold weather physiology and the prevention of cold injuries. To prevent injury, any techniques that aid heat balance, protection, and basic metabolism should be used.

Cold water immersion may also cause excessive urination, severely dehydrating the diver. This in turn reduces performance and may increase the risk of developing decompression sickness. A diver who is dehydrated may appear normal in the water. However, exiting the water combined with warming of the skin may cause pooling of the blood in the extremities leading to fainting. This means that divers who have been in cold water for any period of time and who appear cold should be assisted from the water and sit or lie down and take fluids until they are sure they can stand without problems.

Vertigo is caused by cold water stimulating the balance mechanism of the inner ear.

In repetitive diving with cold exposure, the operation should be planned so that the diver is re-warmed to the point of sweating before diving again. If cold water exposures are severe and if more than a 30-minute duration, then consideration should be given to requiring an overnight rest between exposures. The diver must also have sufficient non-caffeine beverages to replace the excessive body fluid loss from cold water induced urination.

The support equipment required for ice and cold water diving must be carefully evaluated for effectiveness and suitability.

Maintaining proper body temperature is particularly difficult for a diver working underwater. The principal temperature control problem encountered by divers involves keeping the body warm. The high thermal conductivity of water, coupled with the normally cool-to-cold waters in which divers operate, can result in rapid and excessive heat loss. At extremely low temperatures or with prolonged immersion, body heat loss will reach a point at which death will occur. Appropriate dress can greatly reduce the effects of heat loss, and a diver with proper dress can work in very cold water for reasonable periods of time.

ATTACHMENT 9

COLD WATER CONSIDERATIONS AND SAFETY PRECAUTIONS

In very cold water, the wet suit is only a marginally effective thermal protective measure and its use exposes the diver to hypothermia and restricts available bottom time. The use of alternative thermal protective equipment should be considered in these circumstances.

The variable volume dry suit and hot water suit are effective means of thermal protection for cold water diving. Wet suits made of incompressible material are now available. Such suits offer more protection at depth than standard wet suits of the same thickness. Prior to the use of variable volume dry suits and hot water suits in cold and ice-covered waters, divers must be trained in their use and be thoroughly familiar with the operation of these suits.

More weight must be used with a variable volume dry suit than with a wet suit due to the great positive buoyancy of a dry suit. Manufacturer's recommendations should be followed to select starting weight. The additional weight makes use of a weight vest or harness desirable. A shoulder harness is one method of preventing the heavy, awkward belts from slipping down during a dive. A few heavy hip hugger weights are better than several smaller weights.

Both single- and double-hose regulators are used for ice and cold water diving. The single-hose regulator is preferred for buddy breathing, is less bulky, and is easier to maintain than the double-hose; however, it is more subject to freeze-up than the double-hose regulator. Due to the serious nature of the freeze-up problems in single-hose regulators, they should not be allowed to free-flow or be purged for over five seconds at a time. Only regulators having a cold water conversion will be used for ice/cold water diving.

The single-hose regulator should be kept in a warm place before diving. It is important that the divers test the regulator in a warm place, then refrain from breathing it until submerging. When returning to the surface, the regulator should remain submerged and the diver should refrain from breathing from the regulator until re-submerging. The diver's time on the surface should be kept to a minimum. Once under the water, chances of a freeze-up are reduced. However, if a regulator is allowed to free-flow at depth for as little as 5 seconds, freeze-up may occur. The diver should therefore avoid purging the second stage of the regulator when diving in cold water. If water needs to be purged from the mouthpiece, the diver should do so by exhaling into it.

Where water temperature is at or below 37ºF, a redundant SCUBA system (twin SCUBA bottles, each having a "K" valve and an approved cold water regulator) or twin SCUBA bottles with one common manifold and an approved cold water regulator (with octopus) may be used. When selecting the redundant SCUBA system, maximum depth and bottom time are greatly reduced because the extra SCUBA will be used for emergencies only.

Using surface supplied diving in cold water requires detailed operations planning and extensive logistical support. This includes thermal protection for an elaborate dive station and recompression chamber and hot water heating equipment. In addition, dive equipment may require cold climate modification. Because of logistical considerations, scuba is used in most ice diving situations. However, surface supplied diving may be required because of prolonged bottom times, depth requirements, and complex communications between topside and diver. When diving in cold water that is not ice covered, logistic and equipment

support requirements are reduced; however, very cold water poses many of the same dangers to the surface-supplied diver as ice diving.

The diver's mask may show an increased tendency to fog in cold water. An anti-fog solution should be used to prevent this from occurring. Saliva will not prevent this fogging.

HYPOTHERMIA

When diving in cold water, hypothermia may predispose the diver to decompression sickness. Hypothermia is easily diagnosed. The hypothermic diver loses muscle strength, the ability to concentrate, and may become irrational or confused. The victim may shiver violently, or, with severe hypothermia, shivering may be replaced by muscle rigidity. Profound hypothermia may so depress the heartbeat and respiration that the victim appears dead. However, a diver should not be considered dead until the diver has been re-warmed and all resuscitation attempts have been proven to be unsuccessful.

Hypothermia demands immediate treatment and prompt evacuation to a medical facility. A hypothermic diver must not be allowed to walk; i.e., the diver should be transported in a horizontal position. Improper handling of the diver can cause dangerous rhythms of the heart and a drop in the body core temperature, known as after drop. The local/responding medical facility must be notified of the possibility of hypothermia PRIOR to the commencement of diving operations. Emergency re-warming and evacuation plans should be established with their recommendations.

Some of the signs and symptoms of hypothermia are shivering, mental confusion, and loss of memory, speech /sensory impairment, and hallucinations. At approximately 88ºF, all shivering stops, the victim will not recognize familiar people, followed by the victim experiencing muscle rigidity and loss of consciousness.

ATTACHMENT 9

COLD WATER CONSIDERATIONS AND SAFETY PRECAUTIONS

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ATTACHMENT 10
U.S. NAVY DIVE TABLES

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ATTACHMENT 10

U.S. NAVY DIVE TABLES

1. All Tetra Tech TMR dive logs will use the tables in the attachment to complete the dive logs in Attachment 6 and 7 and when developing any Tt TMR project Health and Safety Dive Plans.

2. **U.S. Navy No-Decompression Table (Table 9-7)** – This table gives the maximum time that can be spent at a given depth without the need for decompression stops during the subsequent ascent to the surface. This table is sometimes called the "no-stop" table. At depths of 20 feet of seawater (FSW) and shallower, there is no limit on the amount of time that can be spent at depth. Deeper than 20 FSW, the time that can be spent is limited. For example, at 60 FSW, any dive longer than 63 minutes will require decompression stops.

   The No-Decompression Table also provides the repetitive group designators for dives that fall within the no-decompression limits. Even though no decompression stops are required during ascent, the diver still surfaces with some residual nitrogen in his tissues. This residual nitrogen needs to be accounted for if a repetitive dive is planned. If a diver exceeds the limits given in the No-Decompression Table, then the decompression stop requirement must be calculated using U.S Navy Standard Air Table (Table 9-9).

   For each depth listed in the No-Decompression Table, the corresponding no decompression limit is indicated in the second column. This limit is the maximum bottom time that a diver may spend at that depth and still return to the surface without taking decompression stops. To find the no-decompression limit, enter the table at the depth equal to or next greater than the maximum depth of the dive.

   Follow that row to the second column to obtain the no-decompression limit. The columns to the right of the no-decompression limit column contain the repetitive group designators for dives with bottom times equal to or shorter than the no-decompression limit. A repetitive group designator must be assigned to a diver after every dive, even a no-decompression dive.

3. **Optional Shallow Water No-Decompression Table (Table 2A-1)** – This table contains an expanded version of Table 9-7 and Table 9-8 covering the depth range of 30–50 FSW in one-foot increments. In this depth range, a small change in the diver's maximum depth can make a substantial difference in the allowable no-decompression time. For example, at 35 FSW the no-decompression limit is 232 minutes; at 40 FSW it is only 163 minutes, more than an hour less. When the diver's maximum depth is accurately known at the beginning of the dive, for example in ballast tank dives, or when continuous depth recording is available, for example with a decompression computer, the expanded table can be used to maximize no-decompression time.

   These optional tables are most suited to ship husbandry diving, but can be used in other shallow air diving applications as well.

4. **Residual Nitrogen Time Table for Repetitive Air Dives (Figure 9-8)** - The procedures for conducting a repetitive dive are summarized in this table. Upon completing the first dive, the diver is assigned a repetitive group designator from either the Air Decompression Table or the No-Decompression Table. This designator tells the diver how much residual nitrogen he has

upon surfacing from the first dive. A diver in Group A has the lowest amount of residual nitrogen; a diver in Group Z has the highest.

As nitrogen passes out of the diver's body during the surface interval, the repetitive group designation changes to a lower letter group to reflect the lower quantity of residual nitrogen.

The top half of the table allows the repetitive group designator to be determined at any time during the surface interval. The lower half of the table gives the Residual Nitrogen Time (RNT) corresponding to the repetitive group designator at the end of the surface interval and the depth of the repetitive dive. The residual nitrogen time is the time a diver would have had to spend at the depth of the repetitive dive to absorb the amount of nitrogen he has left over from the previous dive. The residual nitrogen time is added to the bottom time of the repetitive dive to obtain the Equivalent Single Dive Time (ESDT).

The decompression schedule for the repetitive dive is obtained by entering either the Air Decompression Table or the No-Decompression Table at the depth of the repetitive dive and the equivalent single dive time.

NOTE: When using the Optional Shallow Water No Decompression Tables above ensure the corresponding *Residual Nitrogen Timetable for Repetitive Shallow Water Air Dives (Table 2A-2)* is used for your repetitive dive calculations.

5. **U.S Navy Standard Air Table (Table 9-9)** – This table combines three modes of decompression into one table. These modes are: (1) in-water decompression on air, (2) in-water decompression on air and oxygen, and (3) surface decompression on oxygen.

   Refer to reference (b), Chapter 9, when using the Standard Air Tables in any of the above modes when developing HASDPs where decompression diving profiles are anticipated.

   These tables are to be available to the Dive Supervisor/ Lead Diver on Tt TMR dive sites for emergency procedure in water decompression on planned no decompression dive plans.

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	1102	20	33	47	62	78	97	117	140	166	198	236	285	354	469	992	1102
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	63	7	12	17	22	28	33	39	45	51	57	63					
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	33	4	7	11	14	17	21	24	28	31	33						
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	12	2	4	6	9	11	12										
140	10	2	4	6	8	10											
150	8		3	5	7	8											
160	7		3	5	6	7											
170	6			4	6												
180	6			4	5	6											
190	5			3	5												

* Highest repetitive group that can be achieved at this depth regardless of bottom time.

Table 9-8. Residual Nitrogen Time Table for Repetitive Air Dives.

Locate the diver's repetitive group designation from his previous dive along the diagonal line above the table. Read horizontally to the interval in which the diver's surface interval lies.

Next, read vertically downward to the new repetitive group designation. Continue downward in this same column to the row that represents the depth of the repetitive dive. The time given at the intersection is residual nitrogen time, in minutes, to be applied to the repetitive dive.

* Dives following surface intervals longer than this are not repetitive dives. Use actual bottom times in the Air Decompression Tables to compute decompression for such dives.

Repetitive Group at Beginning of Surface Interval

Z	O	N	M	L	K	J	I	H	G	F	E	D	C	B	A
:10 :52	:10 :53	:10 :53	:10 :53	:10 :53	:10 :53	:10 :53	:10 :53	:10 :53	:10 :53	:10 :52	:10 :52	:10 :52	:10 :55	:10 1:16	:10 2:20 *
:53 1:44	:52 1:44	:52 1:44	:52 1:44	:52 1:44	:52 1:44	:52 1:44	:52 1:44	:52 1:44	:52 1:44	:52 1:44	:52 1:44	:52 1:47	:55 2:11	1:16 3:36 *	
1:45 2:37	1:45 2:37	1:45 2:37	1:45 2:38	1:45 2:38	1:45 2:37	1:45 2:37	1:45 2:38	1:45 2:37	1:45 2:38	1:44 2:37	1:44 2:39	1:47 3:03	2:11 4:31 *		
2:38 3:29	2:37 3:29	2:38 3:29	2:38 3:30	2:38 3:30	2:37 3:29	2:38 3:29	2:37 3:29	2:38 3:29	2:37 3:29	2:37 3:31	2:39 3:55	3:03 5:23 *			
3:30 4:21	3:29 4:21	3:30 4:21	3:29 4:21	3:30 4:22	3:29 4:21	3:30 4:21	3:29 4:21	3:30 4:22	3:29 4:21	3:31 4:48	3:55 6:15 *				
4:22 5:13	4:21 5:13	4:22 5:13	4:21 5:13	4:22 5:14	4:21 5:13	4:22 5:13	4:21 5:13	4:22 5:14	4:21 5:13	4:48 7:08 *					
5:14 6:06	5:13 6:06	5:14 6:07	5:13 6:06	5:14 6:07	5:13 6:06	5:14 6:06	5:13 6:06	5:14 6:07	5:13 6:06						
6:07 6:58	6:06 6:58	6:07 6:59	6:06 6:58	6:07 6:59	6:06 6:58	6:07 6:58	6:06 6:58	6:07 6:59	6:06 6:58						
6:59 7:50	6:58 7:50	6:59 7:51	6:58 7:50	6:59 7:51	6:58 7:50	6:59 7:50	6:58 7:50	6:59 7:51	6:58 7:50						
7:51 8:42	7:50 8:42	7:51 8:43	7:50 8:42	7:51 8:43	7:50 8:42	7:51 8:42	7:50 8:42	7:51 8:43	7:50 8:42						
8:43 9:34	8:42 9:34	8:43 9:35	8:42 9:37	8:43 9:38	8:42 9:34	8:43 9:34	8:42 9:34	8:43 9:35	8:42 9:34						
9:35 10:27	9:34 10:27	9:35 10:28	9:37 10:53	9:38 10:54	9:34 10:29	9:35 10:27	9:34 10:27	9:35 10:28	9:34 10:29						
10:28 11:19	10:27 11:21	10:28 11:20	10:53 13:13 *	10:54 11:46	10:29 11:45	10:28 12:37	10:27 12:37	10:28 11:22	10:29 11:45						
11:20 12:13	11:21 12:37	11:20 12:14	11:46 14:05 *	11:45 12:38	11:45 14:58 *	11:22 13:31	11:20 13:30	11:45 15:50 *							
12:14 13:30	12:37 14:58 *	12:14 13:31	12:38 15:50 *												
13:31 15:50 *															

Dive Depth	Repetitive Group at the End of the Surface Interval															
	Z	O	N	M	L	K	J	I	H	G	F	E	D	C	B	A
10	**	**	**	**	**	**	**	**	**	**	**	427	246	159	101	58
15	**	**	**	**	**	**	**	**	450	298	218	164	122	89	61	37
20	**	**	**	**	**	462	331	257	206	166	134	106	83	62	44	27
25	†	†	470	354	286	237	198	167	141	118	98	79	63	48	34	21
30	372	308	261	224	194	168	146	126	108	92	77	63	51	39	28	18
35	245	216	191	169	149	132	116	101	88	75	64	53	43	33	24	15
40	188	169	152	136	122	109	97	85	74	64	55	45	37	29	21	13
45	154	140	127	115	104	93	83	73	64	56	48	40	32	25	18	12
50	131	120	109	99	90	81	73	65	57	49	42	35	29	23	17	11
55	114	105	96	88	80	72	65	58	51	44	38	32	26	20	15	10
60	101	93	86	79	72	65	58	52	46	40	35	29	24	19	14	9
70	83	77	71	65	59	54	49	44	39	34	29	25	20	16	12	8
80	70	65	60	55	51	46	42	38	33	29	25	22	18	14	10	7
90	61	57	52	48	44	41	37	33	29	26	22	19	16	12	9	6
100	54	50	47	43	40	36	33	30	26	23	20	17	14	11	8	5
110	48	45	42	39	36	33	30	27	24	21	18	16	13	10	8	5
120	44	41	38	35	32	30	27	24	22	19	17	14	12	9	7	5
130	40	37	35	32	30	27	25	22	20	18	15	13	11	9	6	4
140	37	34	32	30	27	25	23	21	19	16	14	12	10	8	6	4
150	34	32	30	28	26	23	21	19	17	15	13	11	9	8	6	4
160	32	30	28	26	24	22	20	18	16	14	13	11	9	7	5	4
170	30	28	26	24	22	21	19	17	15	14	12	10	8	7	5	3
180	28	26	25	23	21	19	18	16	14	13	11	10	8	6	5	3
190	26	25	23	22	20	18	17	15	14	12	11	9	8	6	5	3

Residual Nitrogen Times (Minutes)

** Residual Nitrogen Time cannot be determined using this table (see paragraph 9-9.1 subparagraph 8 for instructions).

† Read vertically downward to the 30 fsw repetitive dive depth. Use the corresponding residual nitrogen times to compute the equivalent single dive time. Decompress using the 30 fsw air decompression table.

Table 2A-1. *No-Decompression Limits and Repetitive Group Designators for Shallow Water Air No-Decompression Dives.*

Depth (fsw)	No-Stop Limit (min)	Repetitive Group Designation															
		A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	Z
30	371	17	27	38	50	62	76	91	107	125	145	167	193	223	260	307	371
31	334	16	26	37	48	60	73	87	102	119	138	158	182	209	242	282	334
32	304	15	25	35	46	58	70	83	98	114	131	150	172	197	226	261	304
33	281	15	24	34	45	56	67	80	94	109	125	143	163	186	212	243	281
34	256	14	23	33	43	54	65	77	90	104	120	137	155	176	200	228	256
35	232	14	23	32	42	52	63	74	87	100	115	131	148	168	190	215	232
36	212	14	22	31	40	50	61	72	84	97	110	125	142	160	180	204	212
37	197	13	21	30	39	49	59	69	81	93	106	120	136	153	172	193	197
38	184	13	21	29	38	47	57	67	78	90	102	116	131	147	164	184	
39	173	12	20	28	37	46	55	65	76	87	99	112	126	141	157	173	
40	163	12	20	27	36	44	53	63	73	84	95	108	121	135	151	163	
41	155	12	19	27	35	43	52	61	71	81	92	104	117	130	145	155	
42	147	11	19	26	34	42	50	59	69	79	89	101	113	126	140	147	
43	140	11	18	25	33	41	49	58	67	76	87	98	109	122	135	140	
44	134	11	18	25	32	40	48	56	65	74	84	95	106	118	130	134	
45	125	11	17	24	31	39	46	55	63	72	82	92	102	114	125		
46	116	10	17	23	30	38	45	53	61	70	79	89	99	110	116		
47	109	10	16	23	30	37	44	52	60	68	77	87	97	107	109		
48	102	10	16	22	29	36	43	51	58	67	75	84	94	102			
49	97	10	16	22	28	35	42	49	57	65	73	82	91	97			
50	92	9	15	21	28	34	41	48	56	63	71	80	89	92			

Table 2A-2. *Residual Nitrogen Time Table for Repetitive Shallow Water Air Dives.*

Locate the diver's repetitive group designation from his previous dive along the diagonal line above the table. Read horizontally to the interval in which the diver's surface interval lies.

Next, read vertically downward to the new repetitive group designation. Continue downward in this same column to the row that represents the depth of the repetitive dive. The time given at the intersection is residual nitrogen time, in minutes, to be applied to the repetitive dive.

* Dives following surface intervals longer than this are not repetitive dives. Use actual bottom times in the Air Decompression Tables to compute decompression for such dives.

Repetitive Group at Beginning of Surface Interval

A	:10	2:20 *														
B	:10	1:16	1:17	3:36 *												
C	:10	:55	:56	2:11	2:12	4:31 *										
D	:10	:52	:53	1:47	1:48	3:03	3:04	5:23 *								
E	:10	:52	:53	1:44	1:45	2:39	2:40	3:55	3:56	6:15 *						
F	:10	:52	:53	1:44	1:45	2:37	2:38	3:31	3:32	4:48	4:49	7:08 *				
G	:10	:52	:53	1:44	1:45	2:37	2:38	3:29	3:30	4:23	4:24	5:40	5:41	8:00 *		
H	:10	:52	:53	1:44	1:45	2:37	2:38	3:29	3:30	4:21	4:22	5:16	5:17	6:32	6:33	8:52 *
I	:10	:52	:53	1:44	1:45	2:37	2:38	3:29	3:30	4:21	4:22	5:13	5:14	6:08	6:09	7:24	7:25	9:44 *
J	:10	:52	:53	1:44	1:45	2:37	2:38	3:29	3:30	4:21	4:22	5:13	5:14	6:06	6:07	7:00	7:01	8:16	8:17	10:36 *
K	:10	:52	:53	1:44	1:45	2:37	2:38	3:29	3:30	4:21	4:22	5:13	5:14	6:06	6:07	6:58	6:59	7:52	7:53	9:09	9:10	11:29 *
L	:10	:52	:53	1:44	1:45	2:37	2:38	3:29	3:30	4:21	4:22	5:13	5:14	6:06	6:07	6:58	6:59	7:50	7:51	8:44	8:45	10:01	10:02	12:21 *
M	:10	:52	:53	1:44	1:45	2:37	2:38	3:29	3:30	4:21	4:22	5:13	5:14	6:06	6:07	6:58	6:59	7:50	7:51	8:42	8:43	9:37	9:38	10:53	10:54	13:13 *
N	:10	:52	:53	1:44	1:45	2:37	2:38	3:29	3:30	4:21	4:22	5:13	5:14	6:06	6:07	6:58	6:59	7:50	7:51	8:42	8:43	9:34	9:35	10:29	10:30	11:45	11:46	14:05 *
O	:10	:52	:53	1:44	1:45	2:37	2:38	3:29	3:30	4:21	4:22	5:13	5:14	6:06	6:07	6:58	6:59	7:50	7:51	8:42	8:43	9:34	9:35	10:27	10:28	11:21	12:37	14:58 *
Z	:10	:52	:53	1:44	1:45	2:37	2:38	3:29	3:30	4:21	4:22	5:13	5:14	6:06	6:07	6:58	6:59	7:50	7:51	8:42	8:43	9:34	9:35	10:27	10:28	11:19	11:20	12:13	12:14	13:30	13:31	15:50 *

Repetitive Group at the End of the Surface Interval

Dive Depth	Z	O	N	M	L	K	J	I	H	G	F	E	D	C	B	A
30	372	308	261	224	194	168	146	126	108	92	77	63	51	39	28	18
31	334	282	243	210	183	159	139	120	103	88	74	61	49	38	27	17
32	305	262	227	198	173	151	132	115	99	85	71	59	47	36	26	17
33	282	244	213	187	164	144	126	110	95	81	69	57	46	35	25	16
34	262	229	201	177	156	138	121	105	91	78	66	55	44	34	25	16
35	245	216	191	169	149	132	116	101	88	75	64	53	43	33	24	15
36	231	204	181	161	143	126	111	98	85	73	62	51	41	32	23	15
37	218	194	173	154	137	122	107	94	82	70	60	50	40	31	23	14
38	207	185	165	148	132	117	103	91	79	68	58	48	39	30	22	14
39	197	177	158	142	127	113	100	88	77	66	56	47	38	29	21	14
40	188	169	152	136	122	109	97	85	74	64	55	45	37	29	21	13
41	180	163	146	132	118	105	93	82	72	62	53	44	36	28	20	13
42	173	156	141	127	114	102	91	80	70	61	52	43	35	27	20	13
43	166	150	136	123	110	99	88	78	68	59	50	42	34	26	19	12
44	160	145	131	119	107	96	85	75	66	57	49	41	33	26	19	12
45	154	140	127	115	104	93	83	73	64	56	48	40	32	25	18	12
46	149	136	123	111	101	90	81	71	63	54	46	39	32	25	18	12
47	144	131	119	108	98	88	78	70	61	53	45	38	31	24	18	11
48	139	127	116	105	95	85	76	68	60	52	44	37	30	24	17	11
49	135	123	112	102	92	83	74	66	58	51	43	36	30	23	17	11
50	131	120	109	99	90	81	73	65	57	49	42	35	29	23	17	11

Residual Nitrogen Times (Minutes)

Table 9-9. *Air Decompression Table.*
(DESCENT RATE 75 FPM—ASCENT RATE 30 FPM)

Bottom Time (min)	Time to First Stop (M:S)	Gas Mix	DECOMPRESSION STOPS (FSW) Stop times (min) include travel time, except first air and first O_2 stop 100	90	80	70	60	50	40	30	20	Total Ascent Time (M:S)	Chamber O_2 Periods	Repet Group
30 FSW														
371	1:00	AIR									0	1:00	0	Z
		AIR/O_2									**0**	1:00		
380	0:20	AIR									5	6:00	0.5	Z
		AIR/O_2									**1**	2:00		
In-Water Air/O_2 Decompression or $SurDO_2$ Recommended ----------														
420	0:20	AIR									22	23:00	0.5	Z
		AIR/O_2									**5**	6:00		
480	0:20	AIR									42	43:00	0.5	
		AIR/O_2									**9**	10:00		
540	0:20	AIR									71	72:00	1	
		AIR/O_2									**14**	15:00		
Exceptional Exposure: In-Water Air Decompression ---------- In-Water Air/O_2 Decompression or $SurDO_2$ Required ----------														
600	0:20	AIR									92	93:00	1	
		AIR/O_2									**19**	20:00		
660	0:20	AIR									120	121:00	1	
		AIR/O_2									**22**	23:00		
720	0:20	AIR									158	159:00	1	
		AIR/O_2									**27**	28:00		
35 FSW														
232	1:10	AIR									0	1:10	0	Z
		AIR/O_2									**0**	1:10		
240	0:30	AIR									4	5:10	0.5	Z
		AIR/O_2									**2**	3:10		
In-Water Air/O_2 Decompression or $SurDO_2$ Recommended ----------														
270	0:30	AIR									28	29:10	0.5	Z
		AIR/O_2									**7**	8:10		
300	0:30	AIR									53	54:10	0.5	Z
		AIR/O_2									**13**	14:10		
330	0:30	AIR									71	72:10	1	Z
		AIR/O_2									**18**	19:10		
360	0:30	AIR									88	89:10	1	
		AIR/O_2									**22**	23:10		
Exceptional Exposure: In-Water Air Decompression ---------- In-Water Air/O_2 Decompression or $SurDO_2$ Required ----------														
420	0:30	AIR									134	135:10	1.5	
		AIR/O_2									**29**	30:10		
480	0:30	AIR									173	174:10	1.5	
		AIR/O_2									**38**	44:10		
540	0:30	AIR									228	229:10	2	
		AIR/O_2									**45**	51:10		
600	0:30	AIR									277	278:10	2	
		AIR/O_2									**53**	59:10		
660	0:30	AIR									314	315:10	2.5	
		AIR/O_2									**63**	69:10		
720	0:30	AIR									342	343:10	3	
		AIR/O_2									**71**	82:10		

Table 9-9. *Air Decompression Table (Continued).*
(DESCENT RATE 75 FPM—ASCENT RATE 30 FPM)

Bottom Time (min)	Time to First Stop (M:S)	Gas Mix	DECOMPRESSION STOPS (FSW) Stop times (min) include travel time, except first air and first O_2 stop 100	90	80	70	60	50	40	30	20	Total Ascent Time (M:S)	Chamber O_2 Periods	Repet Group
40 FSW														
163	1:20	AIR									0	1:20	0	O
		AIR/O_2									**0**	1:20		
170	0:40	AIR									6	7:20	0.5	O
		AIR/O_2									**2**	3:20		
180	0:40	AIR									14	15:20	0.5	Z
		AIR/O_2									**5**	6:20		
In-Water Air/O_2 Decompression or SurDO_2 Recommended ----------														
190	0:40	AIR									21	22:20	0.5	Z
		AIR/O_2									**7**	8:20		
200	0:40	AIR									27	28:20	0.5	Z
		AIR/O_2									**9**	10:20		
210	0:40	AIR									39	40:20	0.5	Z
		AIR/O_2									**11**	12:20		
220	0:40	AIR									52	53:20	0.5	Z
		AIR/O_2									**12**	13:20		
230	0:40	AIR									64	65:20	1	Z
		AIR/O_2									**16**	17:20		
240	0:40	AIR									75	76:20	1	Z
		AIR/O_2									**19**	20:20		
Exceptional Exposure: In-Water Air Decompression ---------- In-Water Air/O_2 Decompression or SurDO_2 Required ----------														
270	0:40	AIR									101	102:20	1	Z
		AIR/O_2									**26**	27:20		
300	0:40	AIR									128	129:20	1.5	
		AIR/O_2									**33**	34:20		
330	0:40	AIR									160	161:20	1.5	
		AIR/O_2									**38**	44:20		
360	0:40	AIR									184	185:20	2	
		AIR/O_2									**44**	50:20		
420	0:40	AIR									248	249:20	2.5	
		AIR/O_2									**56**	62:20		
480	0:40	AIR									321	322:20	2.5	
		AIR/O_2									**68**	79:20		
Exceptional Exposure: In-Water Air/0_2 Decompression ---------- SurDO_2 Required----------														
540	0:40	AIR									372	373:20	3	
		AIR/O_2									**80**	91:20		
600	0:40	AIR									410	411:20	3.5	
		AIR/O_2									**93**	104:20		
660	0:40	AIR									439	440:20	4	
		AIR/O_2									**103**	119:20		
Exceptional Exposure: SurDO_2 ----------														
720	0:40	AIR									461	462:20	4.5	
		AIR/O_2									**112**	128:20		

Table 9-9. *Air Decompression Table (Continued).*
(DESCENT RATE 75 FPM—ASCENT RATE 30 FPM)

Bottom Time (min)	Time to First Stop (M:S)	Gas Mix	DECOMPRESSION STOPS (FSW) Stop times (min) include travel time, except first air and first O_2 stop 100	90	80	70	60	50	40	30	20	Total Ascent Time (M:S)	Chamber O_2 Periods	Repet Group
45 FSW														
125	1:30	AIR									0	1:30	0	N
		AIR/O_2									**0**	1:30		
130	0:50	AIR									2	3:30	0.5	O
		AIR/O_2									**1**	2:30		
140	0:50	AIR									14	15:30	0.5	O
		AIR/O_2									**5**	6:30		
In-Water Air/O_2 Decompression or SurDO_2 Recommended ----------														
150	0:50	AIR									25	26:30	0.5	Z
		AIR/O_2									**8**	9:30		
160	0:50	AIR									34	35:30	0.5	Z
		AIR/O_2									**11**	12:30		
170	0:50	AIR									41	42:30	1	Z
		AIR/O_2									**14**	15:30		
180	0:50	AIR									59	60:30	1	Z
		AIR/O_2									**17**	18:30		
190	0:50	AIR									75	76:30	1	Z
		AIR/O_2									**19**	20:30		
Exceptional Exposure: In-Water Air Decompression ---------- In-Water Air/O_2 Decompression or SurDO_2 Required ----------														
200	0:50	AIR									89	90:30	1	Z
		AIR/O_2									**23**	24:30		
210	0:50	AIR									101	102:30	1	Z
		AIR/O_2									**27**	28:30		
220	0:50	AIR									112	113:30	1.5	Z
		AIR/O_2									**30**	31:30		
230	0:50	AIR									121	122:30	1.5	Z
		AIR/O_2									**33**	34:30		
240	0:50	AIR									130	131:30	1.5	Z
		AIR/O_2									**37**	43:30		
270	0:50	AIR									173	174:30	2	
		AIR/O_2									**45**	51:30		
300	0:50	AIR									206	207:30	2	
		AIR/O_2									**51**	57:30		
330	0:50	AIR									243	244:30	2.5	
		AIR/O_2									**61**	67:30		
360	0:50	AIR									288	289:30	3	
		AIR/O_2									**69**	80:30		
Exceptional Exposure: In-Water Air/0_2 Decompression ---------- SurDO_2 Required----------														
420	0:50	AIR									373	374:30	3.5	
		AIR/O_2									**84**	95:30		
480	0:50	AIR									431	432:30	4	
		AIR/O_2									**101**	117:30		
Exceptional Exposure: SurDO_2 ----------														
540	0:50	AIR									473	474:30	4.5	
		AIR/O_2									**117**	133:30		

Table 9-9. *Air Decompression Table (Continued).*
(DESCENT RATE 75 FPM—ASCENT RATE 30 FPM)

Bottom Time (min)	Time to First Stop (M:S)	Gas Mix	DECOMPRESSION STOPS (FSW) Stop times (min) include travel time, except first air and first O_2 stop 100	90	80	70	60	50	40	30	20	Total Ascent Time (M:S)	Chamber O_2 Periods	Repet Group
50 FSW														
92	1:40	AIR									0	1:40	0	M
		AIR/O_2									**0**	1:40		
95	1:00	AIR									2	3:40	0.5	M
		AIR/O_2									**1**	2:40		
100	1:00	AIR									4	5:40	0.5	N
		AIR/O_2									**2**	3:40		
110	1:00	AIR									8	9:40	0.5	O
		AIR/O_2									**4**	5:40		
In-Water Air/O_2 Decompression or $SurDO_2$ Recommended ----------														
120	1:00	AIR									21	22:40	0.5	O
		AIR/O_2									**7**	8:40		
130	1:00	AIR									34	35:40	0.5	Z
		AIR/O_2									**12**	13:40		
140	1:00	AIR									45	46:40	1	Z
		AIR/O_2									**16**	17:40		
150	1:00	AIR									56	57:40	1	Z
		AIR/O_2									**19**	20:40		
160	1:00	AIR									78	79:40	1	Z
		AIR/O_2									**23**	24:40		
Exceptional Exposure: In-Water Air Decompression ---------- In-Water Air/O_2 Decompression or $SurDO_2$ Required ----------														
170	1:00	AIR									96	97:40	1	Z
		AIR/O_2									**26**	27:40		
180	1:00	AIR									111	112:40	1.5	Z
		AIR/O_2									**30**	31:40		
190	1:00	AIR									125	126:40	1.5	Z
		AIR/O_2									**35**	36:40		
200	1:00	AIR									136	137:40	1.5	Z
		AIR/O_2									**39**	45:40		
210	1:00	AIR									147	148:40	2	
		AIR/O_2									**43**	49:40		
220	1:00	AIR									166	167:40	2	
		AIR/O_2									**47**	53:40		
230	1:00	AIR									183	184:40	2	
		AIR/O_2									**50**	56:40		
240	1:00	AIR									198	199:40	2	
		AIR/O_2									**53**	59:40		
270	1:00	AIR									236	237:40	2.5	
		AIR/O_2									**62**	68:40		
300	1:00	AIR									285	286:40	3	
		AIR/O_2									**74**	85:40		
Exceptional Exposure: In-Water Air/O_2 Decompression ---------- $SurDO_2$ Required----------														
330	1:00	AIR									345	346:40	3.5	
		AIR/O_2									**83**	94:40		
360	1:00	AIR									393	394:40	3.5	
		AIR/O_2									**92**	103:40		
Exceptional Exposure: $SurDO_2$ ----------														
420	1:00	AIR									464	465:40	4.5	
		AIR/O_2									**113**	129:40		

Table 9-9. *Air Decompression Table (Continued).*
(DESCENT RATE 75 FPM—ASCENT RATE 30 FPM)

Bottom Time (min)	Time to First Stop (M:S)	Gas Mix	DECOMPRESSION STOPS (FSW) Stop times (min) include travel time, except first air and first O_2 stop 100	90	80	70	60	50	40	30	20	Total Ascent Time (M:S)	Chamber O_2 Periods	Repet Group
55 FSW														
74	1:50	AIR									0	1:50	0	L
		AIR/O_2									**0**	1:50		
75	1:10	AIR									1	2:50	0.5	L
		AIR/O_2									**1**	2:50		
80	1:10	AIR									4	5:50	0.5	M
		AIR/O_2									**2**	3:50		
90	1:10	AIR									10	11:50	0.5	N
		AIR/O_2									**5**	6:50		
In-Water Air/O_2 Decompression or SurDO$_2$ Recommended ----------														
100	1:10	AIR									17	18:50	0.5	O
		AIR/O_2									**8**	9:50		
110	1:10	AIR									34	35:50	0.5	O
		AIR/O_2									**12**	13:50		
120	1:10	AIR									48	49:50	1	Z
		AIR/O_2									**17**	18:50		
130	1:10	AIR									59	60:50	1	Z
		AIR/O_2									**22**	23:50		
140	1:10	AIR									84	85:50	1	Z
		AIR/O_2									**26**	27:50		
Exceptional Exposure: In-Water Air Decompression ---------- In-Water Air/O_2 Decompression or SurDO$_2$ Required ----------														
150	1:10	AIR									105	106:50	1.5	Z
		AIR/O_2									**30**	31:50		
160	1:10	AIR									123	124:50	1.5	Z
		AIR/O_2									**34**	35:50		
170	1:10	AIR									138	139:50	1.5	Z
		AIR/O_2									**40**	46:50		
180	1:10	AIR									151	152:50	2	Z
		AIR/O_2									**45**	51:50		
190	1:10	AIR									169	170:50	2	
		AIR/O_2									**50**	56:50		
200	1:10	AIR									190	191:50	2	
		AIR/O_2									**54**	60:50		
210	1:10	AIR									208	209:50	2.5	
		AIR/O_2									**58**	64:50		
220	1:10	AIR									224	225:50	2.5	
		AIR/O_2									**62**	68:50		
230	1:10	AIR									239	240:50	2.5	
		AIR/O_2									**66**	77:50		
240	1:10	AIR									254	255:50	3	
		AIR/O_2									**69**	80:50		
Exceptional Exposure: In-Water Air/0$_2$ Decompression ---------- SurDO$_2$ Required----------														
270	1:10	AIR									313	314:50	3.5	
		AIR/O_2									**83**	94:50		
300	1:10	AIR									380	381:50	3.5	
		AIR/O_2									**94**	105:50		
330	1:10	AIR									432	433:50	4	
		AIR/O_2									**106**	122:50		
Exceptional Exposure: SurDO$_2$ ----------														
360	1:10	AIR									474	475:50	4.5	
		AIR/O_2									**118**	134:50		

Table 9-9. *Air Decompression Table (Continued).*
(DESCENT RATE 75 FPM—ASCENT RATE 30 FPM)

Bottom Time (min)	Time to First Stop (M:S)	Gas Mix	DECOMPRESSION STOPS (FSW) Stop times (min) include travel time, except first air and first O_2 stop 100	90	80	70	60	50	40	30	20	Total Ascent Time (M:S)	Chamber O_2 Periods	Repet Group
60 FSW														
63	2:00	AIR									0	2:00	0	K
		AIR/O_2									**0**	2:00		
65	1:20	AIR									2	4:00	0.5	L
		AIR/O_2									**1**	3:00		
70	1:20	AIR									7	9:00	0.5	L
		AIR/O_2									**4**	6:00		
80	1:20	AIR									14	16:00	0.5	N
		AIR/O_2									**7**	9:00		
In-Water Air/O_2 Decompression or SurDO_2 Recommended ----------														
90	1:20	AIR									23	25:00	0.5	O
		AIR/O_2									**10**	12:00		
100	1:20	AIR									42	44:00	1	Z
		AIR/O_2									**15**	17:00		
110	1:20	AIR									57	59:00	1	Z
		AIR/O_2									**21**	23:00		
120	1:20	AIR									75	77:00	1	Z
		AIR/O_2									**26**	28:00		
Exceptional Exposure: In-Water Air Decompression ---------- In-Water Air/O_2 Decompression or SurDO_2 Required ----------														
130	1:20	AIR									102	104:00	1.5	Z
		AIR/O_2									**31**	33:00		
140	1:20	AIR									124	126:00	1.5	Z
		AIR/O_2									**35**	37:00		
150	1:20	AIR									143	145:00	2	Z
		AIR/O_2									**41**	48:00		
160	1:20	AIR									158	160:00	2	Z
		AIR/O_2									**48**	55:00		
170	1:20	AIR									178	180:00	2	
		AIR/O_2									**53**	60:00		
180	1:20	AIR									201	203:00	2.5	
		AIR/O_2									**59**	66:00		
190	1:20	AIR									222	224:00	2.5	
		AIR/O_2									**64**	71:00		
200	1:20	AIR									240	242:00	2.5	
		AIR/O_2									**68**	80:00		
210	1:20	AIR									256	258:00	3	
		AIR/O_2									**73**	85:00		
220	1:20	AIR									278	280:00	3	
		AIR/O_2									**77**	89:00		
Exceptional Exposure: In-Water Air/0_2 Decompression ---------- SurDO_2 Required----------														
230	1:20	AIR									300	302:00	3.5	
		AIR/O_2									**82**	94:00		
240	1:20	AIR									321	323:00	3.5	
		AIR/O_2									**88**	100:00		
270	1:20	AIR									398	400:00	4	
		AIR/O_2									**102**	119:00		
Exceptional Exposure: SurDO_2 ----------														
300	1:20	AIR									456	458:00	4.5	
		AIR/O_2									**115**	132:00		

Table 9-9. Air Decompression Table (Continued).
(DESCENT RATE 75 FPM—ASCENT RATE 30 FPM)

Bottom Time (min)	Time to First Stop (M:S)	Gas Mix	DECOMPRESSION STOPS (FSW) Stop times (min) include travel time, except first air and first O_2 stop 100	90	80	70	60	50	40	30	20	Total Ascent Time (M:S)	Chamber O_2 Periods	Repet Group
70 FSW														
48	2:20	AIR									0	2:20	0	K
		AIR/O_2									**0**	2:20		
50	1:40	AIR									2	4:20	0.5	K
		AIR/O_2									**1**	3:20		
55	1:40	AIR									9	11:20	0.5	L
		AIR/O_2									**5**	7:20		
60	1:40	AIR									14	16:20	0.5	M
		AIR/O_2									**8**	10:20		
In-Water Air/O_2 Decompression or $SurDO_2$ Recommended ----------														
70	1:40	AIR									24	26:20	0.5	N
		AIR/O_2									**13**	15:20		
80	1:40	AIR									44	46:20	1	O
		AIR/O_2									**17**	19:20		
90	1:40	AIR									64	66:20	1	Z
		AIR/O_2									**24**	26:20		
Exceptional Exposure: In-Water Air Decompression ---------- In-Water Air/O_2 Decompression or $SurDO_2$ Required ----------														
100	1:40	AIR									88	90:20	1.5	Z
		AIR/O_2									**31**	33:20		
110	1:40	AIR									120	122:20	1.5	Z
		AIR/O_2									**38**	45:20		
120	1:40	AIR									145	147:20	2	Z
		AIR/O_2									**44**	51:20		
130	1:40	AIR									167	169:20	2	Z
		AIR/O_2									**51**	58:20		
140	1:40	AIR									189	191:20	2.5	
		AIR/O_2									**59**	66:20		
150	1:40	AIR									219	221:20	2.5	
		AIR/O_2									**66**	78:20		
160	1:20	AIR								1	244	247:00	3	
		AIR/O_2								**1**	**72**	85:00		
Exceptional Exposure: In-Water $Air/0_2$ Decompression ---------- $SurDO_2$ Required----------														
170	1:20	AIR								2	265	269:00	3	
		AIR/O_2								**1**	**78**	91:00		
180	1:20	AIR								4	289	295:00	3.5	
		AIR/O_2								**2**	**83**	97:00		
190	1:20	AIR								5	316	323:00	3.5	
		AIR/O_2								**3**	**88**	103:00		
200	1:20	AIR								9	345	356:00	4	
		AIR/O_2								**5**	**93**	115:00		
210	1:20	AIR								13	378	393:00	4	
		AIR/O_2								**7**	**98**	122:00		
Exceptional Exposure: $SurDO_2$ ----------														
240	1:20	AIR								25	454	481:00	5	
		AIR/O_2								**13**	**110**	140:00		

Table 9-9. *Air Decompression Table (Continued).*
(DESCENT RATE 75 FPM—ASCENT RATE 30 FPM)

Bottom Time (min)	Time to First Stop (M:S)	Gas Mix	DECOMPRESSION STOPS (FSW) Stop times (min) include travel time, except first air and first O_2 stop 100	90	80	70	60	50	40	30	20	Total Ascent Time (M:S)	Chamber O_2 Periods	Repet Group
80 FSW														
39	2:40	AIR									0	2:40	0	J
		AIR/O_2									**0**	2:40		
40	2:00	AIR									1	3:40	0.5	J
		AIR/O_2									**1**	3:40		
45	2:00	AIR									10	12:40	0.5	K
		AIR/O_2									**5**	7:40		
In-Water Air/O_2 Decompression or SurfO_2 Recommended ----------														
50	2:00	AIR									17	19:40	0.5	M
		AIR/O_2									**9**	11:40		
55	2:00	AIR									24	26:40	0.5	M
		AIR/O_2									**13**	15:40		
60	2:00	AIR									30	32:40	1	N
		AIR/O_2									**16**	18:40		
70	2:00	AIR									54	56:40	1	O
		AIR/O_2									**22**	24:40		
80	2:00	AIR									77	79:40	1.5	Z
		AIR/O_2									**30**	32:40		
Exceptional Exposure: In-Water Air Decompression ---------- In-Water Air/O_2 Decompression or SurfO_2 Required ----------														
90	2:00	AIR									114	116:40	1.5	Z
		AIR/O_2									**39**	46:40		
100	1:40	AIR								1	147	150:20	2	Z
		AIR/O_2								**1**	**46**	54:20		
110	1:40	AIR								6	171	179:20	2	Z
		AIR/O_2								**3**	**51**	61:20		
120	1:40	AIR								10	200	212:20	2.5	
		AIR/O_2								**5**	**59**	71:20		
130	1:40	AIR								14	232	248:20	3	
		AIR/O_2								**7**	**67**	86:20		
Exceptional Exposure: In-Water Air/0_2 Decompression ---------- SurfO_2 Required----------														
140	1:40	AIR								17	258	277:20	3.5	
		AIR/O_2								**9**	**73**	94:20		
150	1:40	AIR								19	285	306:20	3.5	
		AIR/O_2								**10**	**80**	102:20		
160	1:40	AIR								21	318	341:20	4	
		AIR/O_2								**11**	**86**	114:20		
170	1:40	AIR								27	354	383:20	4	
		AIR/O_2								**14**	**90**	121:20		
Exceptional Exposure: SurfO_2 ----------														
180	1:40	AIR								33	391	426:20	4.5	
		AIR/O_2								**17**	**96**	130:20		
210	1:40	AIR								51	473	526:20	5	
		AIR/O_2								**26**	**110**	158:20		

Table 9-9. *Air Decompression Table (Continued).*
(DESCENT RATE 75 FPM—ASCENT RATE 30 FPM)

Bottom Time (min)	Time to First Stop (M:S)	Gas Mix	DECOMPRESSION STOPS (FSW) Stop times (min) include travel time, except first air and first O_2 stop 100	90	80	70	60	50	40	30	20	Total Ascent Time (M:S)	Chamber O_2 Periods	Repet Group
90 FSW														
33	3:00	AIR									0	3:00	0	J
		AIR/O_2									**0**	3:00		
35	2:20	AIR									4	7:00	0.5	J
		AIR/O_2									**2**	5:00		
40	2:20	AIR									14	17:00	0.5	L
		AIR/O_2									**7**	10:00		
In-Water Air/O_2 Decompression or SurDO_2 Recommended ----------														
45	2:20	AIR									23	26:00	0.5	M
		AIR/O_2									**12**	15:00		
50	2:20	AIR									31	34:00	1	N
		AIR/O_2									**17**	20:00		
55	2:20	AIR									39	42:00	1	O
		AIR/O_2									**21**	24:00		
60	2:20	AIR									56	59:00	1	O
		AIR/O_2									**24**	27:00		
70	2:20	AIR									83	86:00	1.5	Z
		AIR/O_2									**32**	35:00		
Exceptional Exposure: In-Water Air Decompression ---------- In-Water Air/O_2 Decompression or SurDO_2 Required ----------														
80	2:00	AIR								5	125	132:40	2	Z
		AIR/O_2								**3**	**40**	50:40		
90	2:00	AIR								13	158	173:40	2	Z
		AIR/O_2								**7**	**46**	60:40		
100	2:00	AIR								19	185	206:40	2.5	
		AIR/O_2								**10**	**53**	70:40		
110	2:00	AIR								25	224	251:40	3	
		AIR/O_2								**13**	**61**	86:40		
Exceptional Exposure: In-Water Air/0_2 Decompression ---------- SurDO_2 Required----------														
120	1:40	AIR							2	28	256	288:20	3.5	
		AIR/O_2							2	**14**	**70**	98:40		
130	1:40	AIR							5	28	291	326:20	3.5	
		AIR/O_2							5	**14**	**79**	110:40		
140	1:40	AIR							8	28	330	368:20	4	
		AIR/O_2							8	**14**	**87**	126:40		
Exceptional Exposure: SurDO_2 ----------														
150	1:40	AIR							11	34	378	425:20	4.5	
		AIR/O_2							11	**17**	**94**	139:40		
160	1:40	AIR							13	40	418	473:20	4.5	
		AIR/O_2							13	**20**	**101**	151:40		
170	1:40	AIR							15	45	451	513:20	5	
		AIR/O_2							15	**23**	**106**	166:40		
180	1:40	AIR							16	51	479	548:20	5.5	
		AIR/O_2							16	**26**	**112**	176:40		
240	1:40	AIR							42	68	592	704:20	7.5	
		AIR/O_2							42	**34**	**159**	267:40		

Table 9-9. *Air Decompression Table (Continued).*
(DESCENT RATE 75 FPM—ASCENT RATE 30 FPM)

Bottom Time (min)	Time to First Stop (M:S)	Gas Mix	DECOMPRESSION STOPS (FSW) Stop times (min) include travel time, except first air and first O_2 stop 100	90	80	70	60	50	40	30	20	Total Ascent Time (M:S)	Chamber O_2 Periods	Repet Group
100 FSW														
25	3:20	AIR									0	3:20	0	H
		AIR/O_2									**0**	3:20		
30	2:40	AIR									3	6:20	0.5	J
		AIR/O_2									**2**	5:20		
35	2:40	AIR									15	18:20	0.5	L
		AIR/O_2									**8**	11:20		
In-Water Air/O_2 Decompression or SurDO$_2$ Recommended ----------														
40	2:40	AIR									26	29:20	1	M
		AIR/O_2									**14**	17:20		
45	2:40	AIR									36	39:20	1	N
		AIR/O_2									**19**	22:20		
50	2:40	AIR									47	50:20	1	O
		AIR/O_2									**24**	27:20		
55	2:40	AIR									65	68:20	1.5	Z
		AIR/O_2									**28**	31:20		
60	2:40	AIR									81	84:20	1.5	Z
		AIR/O_2									**33**	36:20		
Exceptional Exposure: In-Water Air Decompression ---------- In-Water Air/O_2 Decompression or SurDO$_2$ Required ----------														
70	2:20	AIR								11	124	138:00	2	Z
		AIR/O_2								**6**	**39**	53:00		
80	2:20	AIR								21	160	184:00	2.5	Z
		AIR/O_2								**11**	**45**	64:00		
90	2:00	AIR							2	28	196	228:40	2.5	
		AIR/O_2							2	**14**	**53**	82:00		
Exceptional Exposure: In-Water Air/0_2 Decompression ---------- SurDO$_2$ Required----------														
100	2:00	AIR							9	28	241	280:40	3	
		AIR/O_2							9	**14**	**66**	102:00		
110	2:00	AIR							14	28	278	322:40	3.5	
		AIR/O_2							14	**14**	**76**	117:00		
120	2:00	AIR							19	28	324	373:40	4	
		AIR/O_2							19	**14**	**85**	136:00		
Exceptional Exposure: SurDO$_2$ ----------														
150	1:40	AIR						3	26	46	461	538:20	5	
		AIR/O_2						3	26	**23**	**109**	183:40		

Table 9-9. *Air Decompression Table (Continued).*
(DESCENT RATE 75 FPM—ASCENT RATE 30 FPM)

Bottom Time (min)	Time to First Stop (M:S)	Gas Mix	DECOMPRESSION STOPS (FSW) Stop times (min) include travel time, except first air and first O_2 stop 100	90	80	70	60	50	40	30	20	Total Ascent Time (M:S)	Chamber O_2 Periods	Repet Group
110 FSW														
20	3:40	AIR									0	3:40	0	H
		AIR/O_2									**0**	3:40		
25	3:00	AIR									5	8:40	0.5	I
		AIR/O_2									**3**	6:40		
30	3:00	AIR									14	17:40	0.5	K
		AIR/O_2									**7**	10:40		
In-Water Air/O_2 Decompression or SurDO_2 Recommended ----------														
35	3:00	AIR									27	30:40	1	M
		AIR/O_2									**14**	17:40		
40	3:00	AIR									39	42:40	1	N
		AIR/O_2									**20**	23:40		
45	3:00	AIR									50	53:40	1	O
		AIR/O_2									**26**	29:40		
50	3:00	AIR									71	74:40	1.5	Z
		AIR/O_2									**32**	35:40		
Exceptional Exposure: In-Water Air Decompression ---------- In-Water Air/O_2 Decompression or SurDO_2 Required ----------														
55	2:40	AIR								5	85	93:20	1.5	Z
		AIR/O_2								**3**	**33**	44:20		
60	2:40	AIR								13	111	127:20	2	Z
		AIR/O_2								**7**	**36**	51:20		
70	2:40	AIR								26	155	184:20	2.5	Z
		AIR/O_2								**14**	**42**	64:20		
Exceptional Exposure: In-Water Air/0_2 Decompression ---------- SurDO_2 Required----------														
80	2:20	AIR							9	28	200	240:00	2.5	
		AIR/O_2							9	**14**	**54**	90:20		
90	2:20	AIR							18	28	249	298:00	3.5	
		AIR/O_2							18	**14**	**68**	113:20		
100	2:20	AIR							25	28	295	351:00	3.5	
		AIR/O_2							25	**14**	**79**	131:20		
110	2:00	AIR						5	26	28	353	414:40	4	
		AIR/O_2						5	26	**14**	**91**	154:00		
Exceptional Exposure: SurDO_2 ----------														
120	2:00	AIR						10	26	35	413	486:40	4.5	
		AIR/O_2						10	26	**18**	**101**	173:00		
180	1:40	AIR					3	23	47	68	593	736:20	7.5	
		AIR/O_2					3	23	47	**34**	**159**	298:40		

Table 9-9. *Air Decompression Table (Continued).*
(DESCENT RATE 75 FPM—ASCENT RATE 30 FPM)

Bottom Time (min)	Time to First Stop (M:S)	Gas Mix	DECOMPRESSION STOPS (FSW) Stop times (min) include travel time, except first air and first O_2 stop 100	90	80	70	60	50	40	30	20	Total Ascent Time (M:S)	Chamber O_2 Periods	Repet Group
120 FSW														
15	4:00	AIR									0	4:00	0	F
		AIR/O_2									**0**	4:00		
20	3:20	AIR									4	8:00	0.5	H
		AIR/O_2									**2**	6:00		
25	3:20	AIR									9	13:00	0.5	J
		AIR/O_2									**5**	9:00		
In-Water Air/O_2 Decompression or $SurDO_2$ Recommended ----------														
30	3:20	AIR									24	28:00	0.5	L
		AIR/O_2									**13**	17:00		
35	3:20	AIR									38	42:00	1	N
		AIR/O_2									**20**	24:00		
40	3:00	AIR								2	49	54:40	1	O
		AIR/O_2								**1**	**26**	30:40		
45	3:00	AIR								3	71	77:40	1.5	Z
		AIR/O_2								**2**	**31**	36:40		
Exceptional Exposure: In-Water Air Decompression ---------- In-Water Air/O_2 Decompression or $SurDO_2$ Required ----------														
50	3:00	AIR								10	85	98:40	1.5	Z
		AIR/O_2								**5**	**33**	46:40		
55	3:00	AIR								19	116	138:40	2	Z
		AIR/O_2								**10**	**35**	53:40		
60	3:00	AIR								27	142	172:40	2	Z
		AIR/O_2								**14**	**39**	61:40		
70	2:40	AIR							13	28	190	234:20	2.5	
		AIR/O_2							13	**14**	**51**	86:40		
Exceptional Exposure: In-Water $Air/0_2$ Decompression ---------- $SurDO_2$ Required----------														
80	2:40	AIR							24	28	246	301:20	3	
		AIR/O_2							24	**14**	**67**	118:40		
90	2:20	AIR						7	26	28	303	367:00	3.5	
		AIR/O_2						7	26	**14**	**80**	140:20		
100	2:20	AIR						15	25	28	372	443:00	4	
		AIR/O_2						15	25	**14**	**95**	167:20		
Exceptional Exposure: $SurDO_2$ ----------														
110	2:20	AIR						21	25	38	433	520:00	5	
		AIR/O_2						21	25	**19**	**105**	188:20		
120	2:00	AIR					3	23	25	47	480	580:40	5.5	
		AIR/O_2					3	23	25	**24**	**113**	211:00		

Table 9-9. *Air Decompression Table (Continued).*
(DESCENT RATE 75 FPM—ASCENT RATE 30 FPM)

Bottom Time (min)	Time to First Stop (M:S)	Gas Mix	DECOMPRESSION STOPS (FSW) Stop times (min) include travel time, except first air and first O_2 stop 100	90	80	70	60	50	40	30	20	Total Ascent Time (M:S)	Chamber O_2 Periods	Repet Group
130 FSW														
12	4:20	AIR									0	4:20	0	F
		AIR/O_2									**0**	4:20		
15	3:40	AIR									3	7:20	0.5	G
		AIR/O_2									**2**	6:20		
20	3:40	AIR									8	12:20	0.5	I
		AIR/O_2									**5**	9:20		
In-Water Air/O_2 Decompression or SurDO_2 Recommended ----------														
25	3:40	AIR									17	21:20	0.5	K
		AIR/O_2									**9**	13:20		
30	3:20	AIR								2	32	38:00	1	M
		AIR/O_2								1	**17**	22:00		
35	3:20	AIR								5	44	53:00	1	O
		AIR/O_2								**3**	**23**	30:00		
40	3:20	AIR								6	66	76:00	1.5	Z
		AIR/O_2								**3**	**30**	37:00		
Exceptional Exposure: In-Water Air Decompression ---------- In-Water Air/O_2 Decompression or SurDO_2 Required ----------														
45	3:00	AIR							1	11	84	99:40	1.5	Z
		AIR/O_2							1	**6**	**33**	49:00		
50	3:00	AIR							2	20	118	143:40	2	Z
		AIR/O_2							2	**10**	**36**	57:00		
55	3:00	AIR							4	28	146	181:40	2	Z
		AIR/O_2							4	**14**	**40**	67:00		
60	3:00	AIR							12	28	170	213:40	2.5	Z
		AIR/O_2							12	**14**	**46**	81:00		
Exceptional Exposure: In-Water Air/0_2 Decompression ---------- SurDO_2 Required----------														
70	2:40	AIR						1	26	28	235	293:20	3	
		AIR/O_2						1	26	**14**	**63**	117:40		
80	2:40	AIR						12	26	28	297	366:20	3.5	
		AIR/O_2						12	26	**14**	**79**	144:40		
90	2:40	AIR						22	25	28	375	453:20	4	
		AIR/O_2						22	25	**14**	**95**	174:40		
Exceptional Exposure: SurDO_2 ----------														
100	2:20	AIR					6	23	26	38	444	540:00	5	
		AIR/O_2					6	23	26	**20**	**106**	204:20		
120	2:20	AIR					17	24	27	57	534	662:00	6	
		AIR/O_2					17	24	27	**29**	**130**	255:20		
180	2:00	AIR				13	21	45	57	94	658	890:40	9	
		AIR/O_2				13	21	45	57	**46**	**198**	418:00		

Table 9-9. *Air Decompression Table (Continued).*
(DESCENT RATE 75 FPM—ASCENT RATE 30 FPM)

Bottom Time (min)	Time to First Stop (M:S)	Gas Mix	DECOMPRESSION STOPS (FSW) Stop times (min) include travel time, except first air and first O_2 stop 100	90	80	70	60	50	40	30	20	Total Ascent Time (M:S)	Chamber O_2 Periods	Repet Group
140 FSW														
10	4:40	AIR									0	4:40	0	E
		AIR/O_2									**0**	4:40		
15	4:00	AIR									5	9:40	0.5	H
		AIR/O_2									**3**	7:40		
20	4:00	AIR									13	17:40	0.5	J
		AIR/O_2									**7**	11:40		
In-Water Air/O_2 Decompression or SurDO_2 Recommended ----------														
25	3:40	AIR								3	24	31:20	1	L
		AIR/O_2								**2**	**12**	18:20		
30	3:40	AIR								7	37	48:20	1	N
		AIR/O_2								**4**	**19**	27:20		
35	3:20	AIR							2	7	58	71:00	1.5	O
		AIR/O_2							2	**4**	**26**	36:20		
Exceptional Exposure: In-Water Air Decompression ---------- In-Water Air/O_2 Decompression or SurDO_2 Required ----------														
40	3:20	AIR							4	7	82	97:00	1.5	Z
		AIR/O_2							4	**4**	**33**	50:20		
45	3:20	AIR							5	18	114	141:00	2	Z
		AIR/O_2							5	**9**	**36**	59:20		
50	3:20	AIR							8	27	145	184:00	2	Z
		AIR/O_2							8	**14**	**39**	70:20		
55	3:00	AIR						1	15	29	171	219:40	2.5	Z
		AIR/O_2						1	15	**15**	**45**	85:00		
Exceptional Exposure: In-Water Air/0_2 Decompression ---------- SurDO_2 Required----------														
60	3:00	AIR						2	23	28	209	265:40	3	
		AIR/O_2						2	23	**14**	**56**	109:00		
70	3:00	AIR						14	25	29	276	347:40	3.5	
		AIR/O_2						14	25	**15**	**74**	142:00		
80	2:40	AIR					2	24	25	29	362	445:20	4	
		AIR/O_2					2	24	25	**15**	**91**	175:40		
Exceptional Exposure: SurDO_2 ----------														
90	2:40	AIR					12	23	26	38	443	545:20	5	
		AIR/O_2					12	23	26	**19**	**107**	210:40		

Table 9-9. *Air Decompression Table (Continued).*
(DESCENT RATE 75 FPM—ASCENT RATE 30 FPM)

Bottom Time (min)	Time to First Stop (M:S)	Gas Mix	DECOMPRESSION STOPS (FSW) Stop times (min) include travel time, except first air and first O_2 stop 100	90	80	70	60	50	40	30	20	Total Ascent Time (M:S)	Chamber O_2 Periods	Repet Group
150 FSW														
8	5:00	AIR									0	5:00	0	E
		AIR/O_2									**0**	5:00		
10	4:20	AIR									2	7:00	0.5	F
		AIR/O_2									**1**	6:00		
15	4:20	AIR									8	13:00	0.5	H
		AIR/O_2									**5**	10:00		
In-Water Air/O_2 Decompression or $SurDO_2$ Recommended ----------														
20	4:00	AIR								2	15	21:40	0.5	K
		AIR/O_2								1	**8**	13:40		
25	4:00	AIR								7	29	40:40	1	M
		AIR/O_2								**4**	**14**	22:40		
30	3:40	AIR							4	7	45	60:20	1.5	O
		AIR/O_2							4	**4**	**22**	34:40		
Exceptional Exposure: In-Water Air Decompression ---------- In-Water Air/O_2 Decompression or $SurDO_2$ Required ----------														
35	3:40	AIR							6	7	74	91:20	1.5	Z
		AIR/O_2							6	**4**	**30**	44:40		
40	3:20	AIR						2	6	14	106	132:00	2	Z
		AIR/O_2						2	6	**7**	**35**	59:20		
45	3:20	AIR						3	8	24	142	181:00	2	Z
		AIR/O_2						3	8	**12**	**40**	72:20		
50	3:20	AIR						4	14	28	170	220:00	2.5	Z
		AIR/O_2						4	14	**14**	**46**	87:20		
Exceptional Exposure: In-Water $Air/0_2$ Decompression ---------- $SurDO_2$ Required----------														
55	3:20	AIR						7	21	28	212	272:00	3	
		AIR/O_2						7	21	**14**	**57**	113:20		
60	3:20	AIR						11	26	28	248	317:00	3	
		AIR/O_2						11	26	**14**	**67**	132:20		
70	3:00	AIR					3	24	25	28	330	413:40	4	
		AIR/O_2					3	24	25	**14**	**85**	170:00		
Exceptional Exposure: $SurDO_2$ ----------														
80	3:00	AIR					15	23	26	35	430	532:40	4.5	
		AIR/O_2					15	23	26	**18**	**104**	205:00		
90	2:40	AIR				3	22	23	26	47	496	620:20	5.5	
		AIR/O_2				3	22	23	26	**24**	**118**	239:40		
120	2:20	AIR			3	20	22	23	50	75	608	804:00	8	
		AIR/O_2			3	20	22	23	50	**37**	**168**	356:20		
180	2:00	AIR		2	19	20	42	48	79	121	694	1027:40	10.5	
		AIR/O_2		2	19	20	42	48	79	**58**	**222**	538:00		

Table 9-9. *Air Decompression Table (Continued).*
(DESCENT RATE 75 FPM—ASCENT RATE 30 FPM)

Bottom Time (min)	Time to First Stop (M:S)	Gas Mix	DECOMPRESSION STOPS (FSW) Stop times (min) include travel time, except first air and first O_2 stop 100	90	80	70	60	50	40	30	20	Total Ascent Time (M:S)	Chamber O_2 Periods	Repet Group
160 FSW														
7	5:20	AIR									0	5:20	0	E
		AIR/O_2									**0**	5:20		
10	4:40	AIR									4	9:20	0.5	F
		AIR/O_2									**2**	7:20		
15	4:20	AIR								2	10	17:00	0.5	I
		AIR/O_2								**1**	**6**	12:00		
In-Water Air/O_2 Decompression or SurDO_2 Recommended ----------														
20	4:00	AIR							1	4	19	28:40	0.5	L
		AIR/O_2							1	**2**	**10**	18:00		
25	4:00	AIR							4	7	35	50:40	1	N
		AIR/O_2							4	**4**	**17**	30:00		
30	3:40	AIR						2	6	7	62	81:20	1.5	Z
		AIR/O_2						2	6	**4**	**26**	42:40		
Exceptional Exposure: In-Water Air Decompression ---------- In-Water Air/O_2 Decompression or SurDO_2 Required ----------														
35	3:40	AIR						4	6	8	89	111:20	1.5	Z
		AIR/O_2						4	6	**4**	**34**	57:40		
40	3:40	AIR						6	6	21	134	171:20	2	Z
		AIR/O_2						6	6	**11**	**38**	70:40		
45	3:20	AIR					2	5	11	28	166	216:00	2.5	Z
		AIR/O_2					2	5	11	**14**	**45**	86:20		
Exceptional Exposure: In-Water Air/0_2 Decompression ---------- SurDO_2 Required----------														
50	3:20	AIR					2	8	19	28	207	268:00	3	
		AIR/O_2					2	8	19	**15**	**55**	113:20		
55	3:20	AIR					3	11	26	28	248	320:00	3	
		AIR/O_2					3	11	26	**14**	**67**	135:20		
60	3:20	AIR					6	17	25	29	291	372:00	3.5	
		AIR/O_2					6	17	25	**15**	**77**	154:20		
Exceptional Exposure: SurDO_2 ----------														
70	3:20	AIR					15	23	26	29	399	496:00	4.5	
		AIR/O_2					15	23	26	**15**	**99**	197:20		
80	3:00	AIR				6	21	24	25	44	482	605:40	5.5	
		AIR/O_2				6	21	24	25	**23**	**114**	237:00		

Table 9-9. *Air Decompression Table (Continued).*
(DESCENT RATE 75 FPM—ASCENT RATE 30 FPM)

Bottom Time (min)	Time to First Stop (M:S)	Gas Mix	DECOMPRESSION STOPS (FSW) Stop times (min) include travel time, except first air and first O_2 stop 100	90	80	70	60	50	40	30	20	Total Ascent Time (M:S)	Chamber O_2 Periods	Repet Group
170 FSW														
6	5:40	AIR									0	5:40	0	D
		AIR/O_2									**0**	5:40		
10	5:00	AIR									6	11:40	0.5	G
		AIR/O_2									**3**	8:40		
In-Water Air/O_2 Decompression or $SurDO_2$ Recommended ----------														
15	4:40	AIR								3	13	21:20	0.5	J
		AIR/O_2								2	**6**	13:20		
20	4:20	AIR							3	6	24	38:00	1	M
		AIR/O_2							3	**3**	**12**	23:20		
25	4:00	AIR						1	7	7	41	60:40	1	O
		AIR/O_2						1	7	**4**	**20**	37:00		
Exceptional Exposure: In-Water Air Decompression ---------- In-Water Air/O_2 Decompression or $SurDO_2$ Required ----------														
30	4:00	AIR						5	7	7	77	100:40	1.5	Z
		AIR/O_2						5	7	**3**	**30**	50:00		
35	3:40	AIR					2	6	6	15	120	153:20	2	Z
		AIR/O_2					2	6	6	**8**	**37**	68:40		
40	3:40	AIR					4	6	9	25	158	206:20	2.5	Z
		AIR/O_2					4	6	9	**12**	**44**	84:40		
Exceptional Exposure: In-Water $Air/0_2$ Decompression ---------- $SurDO_2$ Required----------														
45	3:40	AIR					5	7	16	28	197	257:20	2.5	Z
		AIR/O_2					5	7	16	**14**	**53**	109:40		
50	3:20	AIR				1	5	11	23	28	244	316:00	3	
		AIR/O_2				1	5	11	23	**14**	**66**	134:20		
55	3:20	AIR				2	7	16	26	28	289	372:00	3.5	
		AIR/O_2				2	7	16	26	**14**	**77**	156:20		
60	3:20	AIR				2	11	21	26	28	344	436:00	4	
		AIR/O_2				2	11	21	26	**14**	**88**	181:20		
Exceptional Exposure: $SurDO_2$ ----------														
70	3:20	AIR				7	19	24	25	39	454	572:00	5	
		AIR/O_2				7	19	24	25	**20**	**109**	228:20		
80	3:20	AIR				17	22	23	26	53	525	670:00	6	
		AIR/O_2				17	22	23	26	**27**	**128**	267:20		
90	3:00	AIR			8	19	22	23	37	66	574	752:40	7	
		AIR/O_2			8	19	22	23	37	**33**	**148**	319:00		
120	2:40	AIR		9	19	20	22	42	60	94	659	928:20	9	
		AIR/O_2		9	19	20	22	42	60	**46**	**198**	454:40		
180	2:20	AIR	10	18	19	40	43	70	97	156	703	1159:00	11.5	
		AIR/O_2	10	18	19	40	43	70	97	**74**	**229**	648:00		

Table 9-9. *Air Decompression Table (Continued).*
(DESCENT RATE 75 FPM—ASCENT RATE 30 FPM)

Bottom Time (min)	Time to First Stop (M:S)	Gas Mix	DECOMPRESSION STOPS (FSW) Stop times (min) include travel time, except first air and first O_2 stop 100	90	80	70	60	50	40	30	20	Total Ascent Time (M:S)	Chamber O_2 Periods	Repet Group
180 FSW														
6	6:00	AIR									0	6:00	0	E
		AIR/O_2									**0**	6:00		
10	5:20	AIR									8	14:00	0.5	G
		AIR/O_2									**4**	10:00		
In-Water Air/O_2 Decompression or SurDO_2 Recommended ----------														
15	4:40	AIR							2	3	14	24:20	0.5	K
		AIR/O_2							2	**2**	**7**	16:40		
20	4:20	AIR						1	5	7	29	47:00	1	M
		AIR/O_2						1	5	**3**	**15**	29:20		
25	4:20	AIR						5	6	7	57	80:00	1.5	O
		AIR/O_2						5	6	**4**	**24**	44:20		
Exceptional Exposure: In-Water Air Decompression ---------- In-Water Air/O_2 Decompression or SurDO_2 Required ----------														
30	4:00	AIR					3	6	6	7	95	121:40	1.5	Z
		AIR/O_2					3	6	6	**4**	**34**	63:00		
35	3:40	AIR				1	5	6	6	22	144	188:20	2	Z
		AIR/O_2				1	5	6	6	**11**	**41**	79:40		
Exceptional Exposure: In-Water Air/0_2 Decompression ---------- SurDO_2 Required----------														
40	3:40	AIR				2	6	5	13	28	178	236:20	2.5	
		AIR/O_2				2	6	5	13	**14**	**48**	97:40		
45	3:40	AIR				4	5	10	20	28	235	306:20	3	
		AIR/O_2				4	5	10	20	**14**	**63**	130:40		
50	3:40	AIR				4	8	13	25	29	277	360:20	3.5	
		AIR/O_2				4	8	13	25	**15**	**75**	154:40		
55	3:40	AIR				5	11	19	26	28	336	429:20	4	
		AIR/O_2				5	11	19	26	**14**	**87**	181:40		
Exceptional Exposure: SurDO_2 ----------														
60	3:20	AIR			1	8	13	23	25	31	406	511:00	4.5	
		AIR/O_2			1	8	13	23	25	**16**	**100**	205:20		
70	3:20	AIR			4	12	21	24	25	48	499	637:00	5.5	
		AIR/O_2			4	12	21	24	25	**24**	**119**	253:20		

Table 9-9. *Air Decompression Table (Continued).*
(DESCENT RATE 75 FPM—ASCENT RATE 30 FPM)

Bottom Time (min)	Time to First Stop (M:S)	Gas Mix	DECOMPRESSION STOPS (FSW) Stop times (min) include travel time, except first air and first O_2 stop 100	90	80	70	60	50	40	30	20	Total Ascent Time (M:S)	Chamber O_2 Periods	Repet Group
190 FSW														
5	6:20	AIR									0	6:20	0	D
		AIR/O_2									**0**	6:20		
10	5:20	AIR								2	8	16:00	0.5	H
		AIR/O_2								1	**4**	11:00		
In-Water Air/O_2 Decompression or $SurDO_2$ Recommended ----------														
15	4:40	AIR						1	3	3	16	28:20	0.5	K
		AIR/O_2						1	3	**2**	**8**	19:40		
20	4:20	AIR					1	2	6	7	34	55:00	1	N
		AIR/O_2					1	2	6	**4**	**17**	35:20		
Exceptional Exposure: In-Water Air Decompression ---------- In-Water Air/O_2 Decompression or $SurDO_2$ Required ----------														
25	4:20	AIR					2	6	7	7	72	99:00	1.5	Z
		AIR/O_2					2	6	7	**3**	**28**	51:20		
30	4:00	AIR				1	6	5	7	13	122	158:40	2	Z
		AIR/O_2				1	6	5	7	**7**	**38**	74:00		
Exceptional Exposure: In-Water $Air/0_2$ Decompression ---------- $SurDO_2$ Required----------														
35	4:00	AIR				4	5	6	8	26	165	218:40	2.5	Z
		AIR/O_2				4	5	6	8	**13**	**45**	91:00		
40	3:40	AIR			1	5	5	8	17	28	217	285:20	3	
		AIR/O_2			1	5	5	8	17	**15**	**58**	123:40		
45	3:40	AIR			2	5	6	12	24	29	264	346:20	3.5	
		AIR/O_2			2	5	6	12	24	**15**	**71**	149:40		
50	3:40	AIR			3	5	10	17	26	28	324	417:20	4	
		AIR/O_2			3	5	10	17	26	**14**	**85**	179:40		
Exceptional Exposure: SurDO2 ----------														
55	3:40	AIR			4	8	10	24	25	30	397	502:20	4.5	
		AIR/O_2			4	8	10	24	25	**15**	**99**	204:40		
60	3:40	AIR			5	10	16	24	25	40	454	578:20	5	
		AIR/O_2			5	10	16	24	25	**20**	**109**	233:40		
90	3:20	AIR		11	19	20	21	28	51	83	626	863:00	8.5	
		AIR/O_2		11	19	20	21	28	51	**41**	**178**	408:20		
120	3:00	AIR	15	17	19	20	37	46	79	113	691	1040:40	10.5	
		AIR/O_2	15	17	19	20	37	46	79	**55**	**219**	551:00		

Table 9-9. *Air Decompression Table (Continued).*
(DESCENT RATE 75 FPM—ASCENT RATE 30 FPM)

Bottom Time (min)	Time to First Stop (M:S)	Gas Mix	DECOMPRESSION STOPS (FSW) Stop times (min) include travel time, except first air and first O_2 stop 100	90	80	70	60	50	40	30	20	Total Ascent Time (M:S)	Chamber O_2 Periods	Repet Group
200 FSW														
Exceptional Exposure														
5	6:40	AIR									0	6:40	0	E
		AIR/O_2									**0**	6:40		
10	5:40	AIR								3	8	17:20	0.5	H
		AIR/O_2								**2**	**4**	12:20		
15	5:00	AIR						2	3	5	19	34:40	0.5	L
		AIR/O_2						2	3	**3**	**9**	23:00		
20	4:40	AIR					2	4	6	7	43	67:20	1	O
		AIR/O_2					2	4	6	**4**	**20**	41:40		
25	4:20	AIR				1	5	6	6	7	85	115:00	1.5	Z
		AIR/O_2				1	5	6	6	**4**	**32**	64:20		
30	4:20	AIR				4	6	5	7	19	145	191:00	2	Z
		AIR/O_2				4	6	5	7	**10**	**42**	84:20		
35	4:00	AIR			2	5	5	6	13	28	188	251:40	2.5	
		AIR/O_2			2	5	5	6	13	**14**	**51**	106:00		
40	4:00	AIR			4	5	5	11	21	28	249	327:40	3.5	
		AIR/O_2			4	5	5	11	21	**14**	**68**	143:00		
45	3:40	AIR		1	4	5	10	14	25	28	306	397:20	3.5	
		AIR/O_2		1	4	5	10	14	25	**14**	**81**	168:40		
50	3:40	AIR		2	4	8	10	21	26	28	382	485:20	4.5	
		AIR/O_2		2	4	8	10	21	26	**14**	**97**	201:40		
210 FSW														
Exceptional Exposure														
4	7:00	AIR									0	7:00	0	D
		AIR/O_2									**0**	7:00		
5	6:20	AIR									2	9:00	0.5	E
		AIR/O_2									**1**	8:00		
10	5:40	AIR							2	3	9	20:20	0.5	I
		AIR/O_2							2	**2**	**4**	14:40		
15	5:00	AIR					1	3	3	6	24	42:40	1	M
		AIR/O_2					1	3	3	**3**	**12**	28:00		
20	4:40	AIR				1	3	5	6	7	57	84:20	1	O
		AIR/O_2				1	3	5	6	**4**	**23**	47:40		
25	4:40	AIR				3	6	5	7	8	110	144:20	2	Z
		AIR/O_2				3	6	5	7	**4**	**38**	73:40		
30	4:20	AIR			2	5	6	6	6	26	163	219:00	2.5	Z
		AIR/O_2			2	5	6	6	6	**13**	**45**	93:20		
35	4:00	AIR		1	4	5	6	7	18	28	223	296:40	3	
		AIR/O_2		1	4	5	6	7	18	**14**	**60**	130:00		
40	4:00	AIR		2	5	5	7	11	26	28	278	366:40	3.5	
		AIR/O_2		2	5	5	7	11	26	**14**	**76**	161:00		
45	4:00	AIR		4	4	6	11	18	26	28	355	456:40	4	
		AIR/O_2		4	4	6	11	18	26	**14**	**91**	194:00		
50	3:40	AIR	1	4	5	10	12	23	26	36	432	553:20	5	
		AIR/O_2	1	4	5	10	12	23	26	**18**	**105**	223:40		

Table 9-9. *Air Decompression Table (Continued).*
(DESCENT RATE 75 FPM—ASCENT RATE 30 FPM)

Bottom Time (min)	Time to First Stop (M:S)	Gas Mix	DECOMPRESSION STOPS (FSW) Stop times (min) include travel time, except first air and first O_2 stop 130	120	110	100	90	80	70	60	50	40	30	20	Total Ascent Time (M:S)	Chamber O_2 Periods	Repet Group
220 FSW																	
Exceptional Exposure ----------																	
4	7:20	AIR												0	7:20	0	E
		AIR/O_2												**0**	7:20		
5	6:40	AIR												3	10:20	0.5	E
		AIR/O_2												**2**	9:20		
10	6:00	AIR										3	4	10	23:40	0.5	J
		AIR/O_2										3	**2**	**5**	17:00		
15	5:20	AIR								3	2	4	7	28	50:00	1	N
		AIR/O_2								3	2	4	**4**	**14**	33:20		
20	5:00	AIR							2	4	6	6	7	70	100:40	1.5	Z
		AIR/O_2							2	4	6	6	**4**	**26**	54:00		
25	4:40	AIR						1	5	6	6	6	14	133	176:20	2	Z
		AIR/O_2						1	5	6	6	6	**7**	**41**	82:40		
30	4:20	AIR					1	4	5	6	6	10	28	183	248:00	2.5	
		AIR/O_2					1	4	5	6	6	10	**14**	**50**	106:20		
35	4:20	AIR					3	5	5	5	10	22	28	251	334:00	3.5	
		AIR/O_2					3	5	5	5	10	22	**14**	**68**	147:20		
40	4:00	AIR				1	4	5	5	9	15	26	28	319	416:40	4	
		AIR/O_2				1	4	5	5	9	15	26	**14**	**84**	183:00		
250 FSW																	
Exceptional Exposure ----------																	
4	7:40	AIR												4	12:20	0.5	F
		AIR/O_2												**2**	10:20		
5	7:40	AIR												7	15:20	0.5	G
		AIR/O_2												**4**	12:20		
10	6:20	AIR								2	2	4	3	15	33:00	0.5	L
		AIR/O_2								2	2	4	**2**	**7**	24:20		
15	5:40	AIR						2	2	3	4	6	7	53	83:20	1	O
		AIR/O_2						2	2	3	4	6	**4**	**22**	49:40		
20	5:20	AIR					2	2	4	6	6	6	11	125	168:00	2	Z
		AIR/O_2					2	2	4	6	6	6	**6**	**39**	82:20		
25	5:00	AIR				1	4	4	5	6	6	10	28	189	258:40	2.5	
		AIR/O_2				1	4	4	5	6	6	10	**14**	**51**	112:00		
30	4:40	AIR			1	4	4	4	5	6	9	25	28	267	358:20	3.5	
		AIR/O_2			1	4	4	4	5	6	9	25	**15**	**72**	160:40		
35	4:40	AIR			3	4	4	5	5	10	19	26	28	363	472:20	4	
		AIR/O_2			3	4	4	5	5	10	19	26	**14**	**93**	203:40		

Bottom Time (min)	Time to First Stop (M:S)	Gas Mix	DECOMPRESSION STOPS (FSW) Stop times (min) include travel time, except first air and first O_2 stop 130	120	110	100	90	80	70	60	50	40	30	20	Total Ascent Time (M:S)	Chamber O_2 Periods	Repet Group
300 FSW																	
Exceptional Exposure ----------																	
4	9:00	AIR											3	7	19:40	0.5	G
		AIR/O_2											**2**	**4**	15:40		
5	8:40	AIR										3	3	8	23:20	0.5	I
		AIR/O_2										3	**2**	**4**	18:40		
10	7:20	AIR						2	3	2	3	4	7	35	64:00	1	N
		AIR/O_2						2	3	2	3	4	**4**	**18**	44:20		
15	6:20	AIR			1	2	2	3	3	5	6	7	11	125	172:00	2	Z
		AIR/O_2			1	2	2	3	3	5	6	7	**6**	**39**	86:20		
20	6:00	AIR		2	2	2	4	5	5	5	6	16	28	219	300:40	3	
		AIR/O_2		2	2	2	4	5	5	5	6	16	**14**	**59**	137:00		
25	5:40	AIR	1	3	4	4	4	5	5	5	18	26	28	324	433:20	4	
		AIR/O_2	1	3	4	4	4	5	5	5	18	26	**14**	**85**	195:40		

ATTACHMENT 11
EQUIPMENT CHECKLISTS

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ATTACHMENT 11

GENERAL DIVE EQUIPMENT LOADOUT

PROJECT NAME: _____ **DATE:** _____

General Dive Equipment

Item	Quantity	Inspected for operation and Loaded
DIVE FLAG (CIVILIAN AND CODE ALPHA)		
LOST DIVER BUOY		
TENDING LINES AND HARNESSES		
HANDHELD GPS		
BUDDY LINES		
DIVE SYSTEM(S)		
AIR SUPPLY/ BOTTLES		
CELLULAR PHONE (ON AND CHARGED)		
VHF RADIO		
DRINKING WATER		
PERSONAL DIVE GEAR		
DIVE OPS WORK PLAN		
DIVE SAFE PRACTICES MANUAL		
U.S. NAVY DIVE MANUAL		
EMERGENCY CONTACT LIST (POSTED)		
REQUIRED LINES, BUOYS, ANCHORS		

ATTACHMENT 11

GENERAL DIVE EQUIPMENT LOADOUT

Medical Equipment

Item	Quantity	Inspected for operation and Loaded	
FIRST AID KIT/ TRAUMA KIT			
EMERGENCY OXYGEN SYSTEM		**PSIG**	**PSIG**
STRETCHER OR BACKBOARD			

Tools, UXO Related Equipment, Explosive Materials

Item	Quantity	Inspected for operation and Loaded

Loadout Checked (Name) _____ Signature _____

Diving Supervisor Name _____ Diving Supervisor Signature _____

ATTACHMENT 11

GENERAL DIVE EQUIPMENT LOADOUT

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ATTACHMENT 11

BOAT PRE-OPERATION CHECKLIST

Project Description:	Date:
Project Location:	Job#:

Step No.	Description	Check Completed (Initials)
1	**Inspect exterior of vessel** ☐ Inspect for visible damage ☐ Boat registration ☐ POL leaks ☐ Hull plugs in place ☐ Maintenance issues	
2	**Inspect propulsion system** ☐ a. Engine (propeller, oil, fuel level and extra fuel on board, hours since last maintenance, functional, and adequately secured to vessel) ☐ b. Steering system (functional, forward/reverse gears) ☐ c. Batteries (charged, water in cells, contacts clean)	
3	**Inspect all communication equipment** ☐ a. Perform VHF radio check with a base station ☐ b. Perform cellular phone check with a base station ☐ c. Perform dive communication check with radio and dive hats ☐ d. Have spare batteries charged and within reach of all comm. equip.	
4	**Inspect electrical systems and all other communication equipment** Ensure the following are on board and in work order ☐ a. Dive flags (Alpha and Recreational) and pole ☐ b. Sound signaling device (vessel horn, hand horn, whistle) ☐ c. Flares (rocket/parachute, hand held, smoke) ☐ d. Water dye canister, flash light, signaling mirror, EPIRB, and strobe lights for PFDs ☐ e. Deck and Navigation lighting (port, starboard, fore/aft, search, and cabin) ☐ f. Bilge pump	
5	**Inspect mooring systems** ☐ a. Anchor secured to line/chain and functional ☐ b. Line/chain in working order and ready for use ☐ c. Fenders secure and ready for use ☐ d. Extra line available for use	
6	**Ensure navigational equipment is functioning** ☐ a. GPS (locked on 4 satellites, correct datum, power source) ☐ b. Compass and binoculars ☐ c. Charts / maps	
7	**Place copies of the following in cabin near helm** ☐ a. Emergency procedures plan ☐ b. Safe diving practices and operations manual ☐ c. Air decompression tables	

ATTACHMENT 11

BOAT PRE-OPERATION CHECKLIST

Step No.	Description	Check Completed (Initials)
8	**Inspect lifesaving equipment** ☐ a. Ensure 1 PFD per person and 1 throw ring (USCG approved, in working order and properly fitted with strobe, whistle and knife attached) ☐ b. First aid kit (stocked, non-expired contents), First aid book, back board ☐ c. Fire extinguisher (charged, current inspection, accessible)	
9	**Inspect tool box** ☐ a. Spare parts for engine and other vessel systems ☐ b. Tools (clean and in working order) for repairing vessel systems and dive equipment	
10	**Alternate propulsion systems** ☐ a. Hand paddles (2) ☐ b. Spare outboard engine (complete, working, with spare fuel source)	
11	**Personal comfort equipment** ☐ a. Water ☐ b. Food ☐ c. Sunscreen/motion sickness medicine ☐ d. Clothing as required by conditions/locations (hard hat, sun glasses, ball cap, extreme weather, steel toed boots, change of clothes)	

NOTES:

1. File completed checklist in daily job log.
2. Record any maintenance issues in vessel log and report to Project Manager.
3. Complete dive boat safety checklist after completing this checklist.

ATTACHMENT 11

SCUBA CHECKLISTS

PROJECT NAME: _____ DATE: _____

SCUBA EQUIPMENT INSPECTION

Cylinders				FFMs/ Regulators/ Gauges		Buoyancy Compensators	
Primary		Emergency Bail-Out					
Pre-Dive	Post Dive	Pre-Dive	Post Dive	Pre-Dive	Post Dive	Pre-Dive	Post Dive
Serial # Inspect	Clean and Charge (PSIG)	Serial # Inspect	Clean and Charge (PSIG)	Serial # Inspect /Test	Clean and Inspect	Serial # Inspect /Test	Clean/Inspect

Notes:

1. Fill-in and initial each block prior to and after each dive. Place PSI level in block as indicated.
2. Ensure cylinders are gauged at minimum 90% capacity ***(2700 PSI)*** following charge. *(**NOTE**: Gauge after bottles are cool).*

Specific Pre-Dive Procedures:

FFM

- Inspect – Nose pad/ one-way/ comms/ purge/ ABV/ seal/ straps/test breathe

Specific Post Dive Procedures:

Cylinders

- Rinse cylinders with fresh water.
- Leak check cylinders during charging.

Masks / Regulators / Gauges

- Rinse with fresh water and sterilize regulator.
- Inspect mask, regulator and hoses.
- Rinse & inspect gauges.

Buoyancy Compensators

- Rinse with fresh water and clean BC.
- Inspect BC inflation and dump valves.
- Empty any water in BC, Inflate and leave overnight for drying and leak check

_____ _____

Diving Supervisor Name Diving Supervisor Signature

ATTACHMENT 11

SCUBA CHECKLISTS

PROJECT NAME: _____ DATE: _____

ALL ITEMS WILL BE CHECKED IN APPROPRIATE BLOCKS AS FOLLOWS:

1. **ALL PERSONNEL MUST WEAR SAFETY GLASSES WHEN WORKING WITH HP AIR**
2. **Initial for each completed and satisfactory check.**
3. **When completed, person completing the checks will sign as appropriate (blocks 1 thru 4) and then turn in to the Diving Supervisor for his checks, review and signature.**

Set Number	Diver Signature	Dive Supervisor Signature

Initial	Procedure	Remarks
Air Cylinders		
	Cylinders – inspect for current hydro and visual	
	O ring and valve – inspect condition	
	Pressure – adequate for days operations	
	Bail-Out Bottles - *Repeat above steps	
Buoyancy Compensator (BC)		
	Straps / Buckles / Harness – inspect condition and adjust for fit	
	Air bladder – leak check	
	Cylinder and bail-out – mount securely	
	Inflator fitting and hose – inspect condition	
	Dump valves – check for proper function	
Regulator(s)		
	Hoses / Connectors – inspect condition	
	1st and 2nd stages – inspect condition	
	Cylinder yoke assembly – secure	
	Bail-out regulator(s) – repeat above checks	
	Regulator assemblies – attach to cylinders	
	Inflation whip – attach to BC	
	Valves – open / leak check cylinder O ring	
	Pressure gauge – reading properly	
	Dive Computer – inspect, check batt, function	
	BC inflation – check proper function	
	Primary regulator / bail-out regulator - test	
	Fittings - Check for leaks	
	FFM – Nose pad/ one-way valves / comms/ pp/ ABV/ seal/straps	
Notes:		

ATTACHMENT 11

SCUBA CHECKLISTS

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ATTACHMENT 11

PRE-DIVE: SSA DIVE HELMET CHECKOFF SHEET

PROJECT NAME/NUMBER: _____ DATE: _____
TENDER/DIVER: _____

NOTE: ALL ITEMS WILL BE CHECKED IN APPROPRIATE BLOCKS AS FOLLOWS:

1. **An initial for each completed and satisfactory check.**
2. **An N/A for each item not applicable to the Dive Helmet being pre-dove.**
3. **An "R" for any repairs made. A brief description in the remarks section. If more space required use the "notes" section for continuation.**
4. **When completed, person completing the checks will sign as appropriate (blocks 1 thru 4) and then turn in to the Diving Supervisor for his checks, review and signature.**

Helmet/Mask Type	Serial No.	Checked By:	Signature	Dive Supe Signature
1.				
2.				
3.				
4.				

	Procedure	1	2	Remarks
1	Test non-return valve (suck and blow)			
2	Check helmet for damage / deterioration			
3	Check neck dam seal (lube if required)			
4	Check oral nasal mask			
5	Check side block assembly – ensure secure			
6	Check 2nd stage regulator			
7	Check inhalation diaphragm			
8	Check exhaust valve			
9	Check neck dam for damage			
10	Check neck dam assembly			
11	Check locking mechanism			
12	Check 1st stage assembly			
13	Check HP and LP hoses			
14	Check face plate secure and not damaged *(DO NOT use screwdriver)*			
15	Check harness assembly			
16	Check bailout PSIG *(2700 minimum)*			PSIG 1: / PSIG 2: / PSIG 3:
17	Check air spread OP's completed			
18	Check to ensure flow restrictor in place			
19	Stow flow restrictor plug in safe place			
20	Connect hoses			
21	Adjust dial-a-breath			
22	Check free-flow			
23	Check purge			
24	Check EGS valve			
25	Check communications OK			

Notes:

ATTACHMENT 11

POST-DIVE: SSA DIVE HELMET CHECKOFF SHEET

PROJECT NAME/NUMBER: _____ DATE: _____
TENDER/DIVER: _____

NOTE: ALL ITEMS WILL BE CHECKED IN APPROPRIATE BLOCKS AS FOLLOWS:

1. **An initial for each completed and satisfactory check.**
2. **An N/A for each item not applicable to the Dive Helmet being pre-dove.**
3. **An "R" for any repairs made. A brief description in the remarks section. If more space required use the "notes" section for continuation.**
4. **When completed, person completing the checks will sign as appropriate (blocks 1 or 2) and then turn in to the Diving Supervisor for his checks, review and signature.**

Helmet/Mask Type	Serial No.	Checked By:	Signature	Dive Supe Signature
1.				
2.				
3.				
4.				

	Procedure	1	2	Remarks
1	Secure system and emergency air			
2	Bleed and disconnect hoses			
3	Make sure flow restrictor remains on helmet when using dry suit inflator whip			
4	Install flow restrictor plug			
5	Disconnect comms: 2-wire or MM plug			
6	Cap helmet and umbilical fittings			
7	Check helmet for damage			
8	Check neck dam O-ring for damage (lube)			
9	Check neck dam assembly for damage			
10	Check locking mechanisms for damage			
11	Remove head liner			
12	Check oral nasal mask			
13	Check side block assembly - secured			
14	Check 2nd stage regulator			
15	Check inhalation diaphragm			
16	Check LP and HP hoses (1st stage)			
17	Check face plate secure and not damaged *(DO NOT use screwdriver)*			
18	Wash with soap and water. Then dry.			
19	Disinfect with antibacterial wipes			
20	Open all valves – back of ¼ turn			
21	Remove covers from ear speakers / comms pod			

Notes:

Number of dives:

ATTACHMENT 11

PRE-DIVE: SURFACE SUPPLIED LIGHTWEIGHT (FFM)

PROJECT NAME/NUMBER: _____ DATE: _____
TENDER/DIVER: _____

ALL ITEMS WILL BE CHECKED IN APPROPRIATE BLOCKS AS FOLLOWS:

1. **ALL PERSONNEL MUST WEAR SAFETY GLASSES WHEN WORKING WITH HP AIR**
2. **Initial for each completed and satisfactory check.**
3. **When completed, person completing the checks will sign as appropriate (blocks 1 THRU 3) and then turn in to the Diving Supervisor for his checks, review and signature.**

Mask/ Type	Serial No.	Diver Signature	Dive Supervisor Signature
1.			
2.			
3.			

Initial	Procedure	Remarks		
	Ensure HP Air Bottles secured; Check cylinder pressures; Record cylinder pressures	#1:	#2:	#3:
	Ensure ACS on solid surface and secured			
	Inspect ACS condition			
	Check Umbilical condition and secured			
	Ensure all ACS valves are SECURED (closed); regulator valve low pressure (*all the way counterclockwise*)			
	Attach HP whips to bottles			
	Open bottles slowly; record HP Supply Pressure	1 HP PSIG:	2 HP PSIG:	
	Attach Divers supply/ pneumo hoses/ comm wires and mic to ACS			
	Open 1 HP supply (slowly)			
	Set required OB pressure on ACS	OB PSIG:	* *Initial set @ 135 PSIG*	
	Check harness assembly			
	Check bailout bottle PSIG (90% @ min 2700)	PSIG DVR:	PSIG STBY:	
	Attach bailout first stage to pony bottle		* *Attach QD (first stage to KM block)*	
	Check KM Manifold Block (*Suck and blow*)			
	Blow down diver's umbilical's			
	Connect umbilical hose to KM blocks			
	Connect comms (Hi-use connector)		* *Secure dummy plugs/ tape connector*	
	Inspect Full Face Mask (FFM) - Nose pad/ one-way/ comms/ pp/ ABV/ seal / straps			
	Connect FFM to Block			
	Air to Masks			
	Check air to FFM; purge mask			
	Check comms – DV to console; DV to DV			
	Check pneumo for both umbilical's			
	Check all air spread OP's completed			

Notes:

ATTACHMENT 11

POST-DIVE: SURFACE SUPPLIED LIGHTWEIGHT (AGA)

PROJECT NAME/NUMBER: _____ DATE: _____
TENDER/DIVER: _____

ALL ITEMS WILL BE CHECKED IN APPROPRIATE BLOCKS AS FOLLOWS:

1. **ALL PERSONNEL MUST WEAR SAFETY GLASSES WHEN WORKING WITH HP AIR**
2. **Initial for each completed and satisfactory check.**
3. **When completed, person completing the checks will sign as appropriate (blocks 1 or 2) and then turn in to the Diving Supervisor for his checks, review and signature.**

Mask/ Type	Serial No.	Diver Signature	Dive Supervisor Signature
1.			
2.			
3.			

Initial	Procedure	Remarks
	Secure HP air; bleed down both HP whips and umbilical's	
	Disconnect FFM air / comms	
	Check FFM for damage/ post dive	
	Disinfect with antibacterial wipes	*Note: Contact time is 5 minutes.*
	Wash with soap and water. Then dry.	
	Bleed down EGS; Disconnect QD	
	Remove B/O first stage from pony	
	Bleed and disconnect hoses from KM block, inspect block and harness	
	Cap all fittings on block and umbilical	** Use dummy plugs/ tape connector.*
	Remove umbilicals from ACS/ stow	
	Cap all fittings on umbilical and ACS	
	Remove mic from ACS/ stow	
	Ensure all air system fittings capped and valves are secured; regulator valve backed out; ACS power OFF	
	Place ACS on charge or stow	

Notes: