DIVING SAFETY MANUAL

STATE OF CALIFORNIA
RESOURCES AGENCY
DEPARTMENT OF FISH AND WILDLIFE

April 2018

This Page Intentionally Blank

TABLE OF CONTENTS

VOLUME I

GENERAL POLICIES AND PROCEDURES

TABLE OF CONTENTS

VOLUME II

SPECIALIZED DIVING MODES

TABLE OF CONTENTS

VOLUME II

SPECIALIZED DIVING MODES

This Page Intentionally Blank

VOLUME I

GENERAL POLICIES AND PROCEDURES

Sections 1 through 5

April 2018

This Page Intentionally Blank

SECTION 1

GENERAL POLICY

1.1 THE SCIENTIFIC DIVING STANDARDS

1.1.1 Purpose

The purpose of the Scientific Diving Standards set forth in this *Manual* is to ensure that all Department diving is conducted in a manner that maximizes the protection of divers from accidental injury and/or illness, and to set forth standards for training and certification that will allow a working reciprocity between the Department and other AAUS Organizational Members. Fulfillment of the purposes will be consistent with the furtherance of research and safety.

This *Manual* sets minimal standards originally established by the American Academy of Underwater Sciences (AAUS) for recognized scientific diving programs, the organization for the conduct of these programs, and the basic policies and procedures for safety in scientific diving operations. It also establishes a framework for reciprocity between AAUS Organizational Members that adhere to these minimum standards.

These standards were developed and written by AAUS by compiling the policies set forth in the diving manuals of several university, private, and governmental scientific diving programs. These programs share a common heritage with the scientific diving program at the Scripps Institution of Oceanography (SIO). Adherence to the SIO standards has proven both feasible and effective in protecting the health and safety of scientific divers since 1954.

Specific purposes of this *Manual* include:

Setting safety standards to ensure that all diving is conducted in a safe manner;
Setting operational standards for rules, policies, and standards for certification, recertification, supervision, diving procedures, review of records, and necessary equipment;
Defining reciprocity to establish a safe working relationship between Department divers and divers from other AAUS Organizational Members.

1.1.2 Background and Authority

The Department of Fish and Wildlife (Department) will administer its Diving Safety Program (DSP) in a safe, efficient manner to attain its objectives. The DSP will also maintain adequate protection for its employees, property, and those for whom the

Department has a responsibility.

In 1982, the federal Occupational Health and Safety Administration (OSHA) exempted scientific diving from commercial diving regulations (29CFR1910, Subpart T) under certain conditions that are outlined below. The final guidelines for the exemption became effective in 1985 (Federal Register, Vol. 50, No.6, p.1046). OSHA recognizes the American Academy of Sciences as the scientific diving standard setting organization.

As an Organizational Member of the American Academy of Underwater Sciences (AAUS), the Department meets or exceeds their Scientific Diving Standards. The Department also adheres to OSHA standards: Title 46, Code of Federal Regulations, Chapter 1, Subchapter V, Part 197, Subpart B - Commercial Diving Operations; and to Cal/OSHA standards: Title 8, Subchapter 7, Group 26, Article 152, California Code of Regulations - Diving Operations.

This *Manual* prescribes the administration and safety rules for the Department's Diving Safety Program and the policy for implementing the Cal/OSHA requirements of Title 8, Article 152, California Code of Regulations. The relationship among the DSP, Department divers, and the Incident Command System (ICS) is also established.

Department projects and programs require diving operations to accomplish their goals and responsibilities. The use of employees as divers is essential to the efficient accomplishment of departmental operations.

1.1.3 Scientific Diving Definition

Scientific diving is defined (29 CFR 1910.402) as diving performed solely as a necessary part of a scientific, research, or educational activity by employees whose sole purpose for diving is to perform scientific research tasks.

These policies shall apply to all Department employees and volunteers, regardless of diving activity type, and to those persons authorized to dive with employees under the auspices of this diving program.

1.1.4 Scientific Diving Exemption

OSHA has granted an exemption for scientific diving from commercial diving regulations under the following guidelines (29 CFR Part 1910, Appendix B to Subpart T):
The Diving Control Board consists of a majority of active scientific divers and which has autonomous and absolute authority over the scientific diving program's operation. (For purposes of this *Manual* and the Department's Diving Safety Program, the use of Diving Safety Board (DSB) shall be deemed synonymous with Diving Control Board.)
The purpose of a project using scientific diving is the advancement of science; therefore, information and data resulting from the project are non-proprietary.

The tasks of a scientific diver are those of an observer and data gatherer. Construction and trouble-shooting tasks traditionally associated with commercial diving are not included within scientific diving.
Scientific divers, based on the nature of their activities, must use scientific expertise in studying the underwater environment and therefore, are scientists or scientists-in-training.

In addition, the scientific diving program shall contain at least the following elements:
A Diving Safety Manual which includes at a minimum: Procedures covering all diving operations specific to the program; including procedures for emergency care, recompression and evacuation; and the criteria for diver training and certification.
A Diving Safety Board which shall at a minimum have the authority to: approve and monitor diving projects, review and revise the diving safety manual, assure compliance with the manual, certify the depths to which a diver has been trained, take disciplinary action for unsafe practices, and assure adherence to the buddy system (a diver is accompanied by and is in continuous contact with another diver in the water) for scuba diving.

1.1.5 Public Safety Diving Definition

This is diving whose purpose is to provide search, rescue, or public safety diving services under the direction and control of the Department.

1.1.6 Public Safety Diving Exemption

The Occupational Health and Safety Administration (OSHA) has granted an exemption for public safety diving from commercial diving regulations under the guidelines of 29 CFR Part 1910.401(a)(2)(ii).

1.1.7 Review of Standards

As part of the DSP's annual report, any recommendations for modifications to these standards shall be submitted to AAUS for consideration.

1.2 OPERATIONAL CONTROL

1.2.1 Department of Fish and Wildlife Auspices Defined

For the purpose of these standards the auspices of the Department includes any scientific diving operation in which it is connected because of ownership of any equipment used, locations selected, or relationship with the individual(s) concerned. This includes all cases involving the operations of employees of the Department or

employees of auxiliary organizations, where such employees are acting within the scope of their employment, and the operations of other persons who are engaged in scientific diving for the Department or are diving as members of an organization recognized by the Department.

It is the Department's responsibility to adhere to the AAUS Standards for Scientific Diving Certification and Operation of Scientific Diving Programs. The administration of the diving program will reside with the Department's Diving Safety Board (DSB).

The policies herein shall be observed at all locations where scientific diving is conducted under Department auspices.

1.2.2 Scientific Diving Standards and the Department's Diving Safety Manual

The Department shall develop and maintain its Diving Safety Manual in order to provide for the development and implementation of policies and procedures that will enable it to meet requirements of local environments and conditions as well as to comply with the AAUS scientific diving standards. The Department's Diving Safety Manual shall include, but not be limited to:
Minimal policy and operational standards established by AAUS and contained herein in Volumes I and II.
Emergency evacuation and medical treatment procedures
Criteria for diver training and certification
Standards written or adopted by reference for each diving mode utilized which include the following:
Safety procedures for the diving operation
Responsibilities of the dive team members
Equipment use and maintenance procedures
Emergency procedures

1.2.3 Diving Safety Manager

Overall administration of the Department's diving activities shall be the responsibility of the Diving Safety Manager (DSM), appointed by the Director of the Department of Fish and Wildlife. The DSM will appoint the Diving Safety Board that assists and advises the Diving Safety Officer.

1.2.4 Diving Safety Officer

The Diving Safety Officer (DSO) is appointed by the Diving Safety Manager with the advice and counsel of the Diving Safety Board. The DSO serves as a member of the DSB. This person should have broad technical and scientific expertise in research related diving.

Qualifications

The DSO shall meet the following minimum qualifications:
Shall be trained as a scientific diver
Shall be a full member as defined by AAUS
Shall be an active Underwater Instructor from an internationally recognized certifying agency

Duties and Responsibilities
The DSO shall be responsible, through the DSB, to the Diving Safety Manager, for the conduct of the scientific diving program of the Department. The routine operational authority for this program, including the conduct of training and certification, approval of dive plans, maintenance of diving records, and ensuring compliance with this standard and all relevant policies of the Department, rests with the DSO.

The DSO may permit portions of this program to be carried out by a qualified delegate, although the DSO may not delegate responsibility for the safe conduct of the local diving program.

The DSO shall be guided in the performance of the required duties by the advice of the DSB, but operational responsibility for the conduct of the local diving program will be retained by the DSO.
The DSO shall suspend diving operations considered to be unsafe or unwise.

The Diving Safety Officer shall have full authority to take any action permitted or required by this Manual. The DSO shall ensure that all correspondence, diving files, and records are maintained; and will ensure that any required administrative duties are performed. The DSO shall act as a training coordinator for Department diving programs.

1.2.5 Diving Safety Board

The Diving Safety Board (DSB) membership shall consist of a majority of active scientific divers. Voting members shall include the DSO and the DSM or designee. Voting members should also include other representatives of the diving program such as qualified divers and members selected by procedures established by the Department. A chairperson and a secretary may be chosen from the membership of the DSB. The DSB shall consist of at least five active divers, certified to a depth of at least 100 feet with at least one year's regular diving experience with the Department. At least one voting member shall represent the Enforcement Branch.

The DSB's primary responsibility is to ensure a safe and efficient diving operation. The members shall serve as the Department's technical experts and shall assist the DSO in conducting dive training and safety programs.

The DSB must meet at least four times a year; meetings by teleconference may be used to meet this requirement.

New DSB members who are active divers shall become certified at least to the level of Assistant Instructor or Divemaster by an internationally recognized certifying organization. The cost of this certification will be a Department responsibility.

1.2.6 Duties and Responsibilities

The Diving Safety Board shall:
Approve and monitor diving projects
Review and revise the Diving Safety Manual
Assure compliance with the Diving Safety Manual
Certify the depths to which a diver has been trained
Initiate disciplinary action for unsafe practices
Assure adherence to the buddy system for scuba diving
Act as the official representative of the Department in matters concerning the scientific diving program
Act as a board of appeal to consider diver-related problems
Recommend the issue, reissue, or the revocation of diving certifications
Recommend changes in policy and amendments to AAUS and the Department's Diving Safety Manual as the need arises
Establish and/or approve training programs through which the applicants for certification can satisfy the requirements of the Department's Diving Safety Manual
Suspend diving programs that are considered to be unsafe or unwise
Establish criteria for equipment selection and use
Recommend new equipment or techniques
Establish and/or approve facilities for the inspection and maintenance of diving and associated equipment
Ensure that the Department's air station(s) meet air quality standards as described in Sections 3.4.2 and 3.6
Periodically review the Diving Safety Officer's performance and program
Sit as a board of investigation to inquire into the nature and cause of diving accidents or violations of the Department's Diving Safety Manual
Review the use of Department divers in ICS responses, and ensure that Department divers have received appropriate training for the tasks for which they are deployed

1.2.7 Instructional Personnel

Qualifications
All personnel involved in diving instruction under Department auspices shall be qualified for the type of instruction being given.

Selection
Instructional personnel shall be selected by the DSM, or his/her designee, who will solicit the advice of the DSB in conducting preliminary screening of applicants for instructional positions.

1.2.8 Lead Diver

Nothing in this section relieves an individual diver of their responsibility (Section 1.3).

For each dive, one individual shall be designated as the Lead Diver. The Lead Diver is responsible for dive planning and the diving operation in-situ. When designating a Lead Diver, level of experience and training relevant to the dive project will supersede rank/classification. The Lead Diver shall be at the dive location during the diving operation (See Section 2.2.2).

Duties and Responsibilities
The Lead Diver shall be responsible for:
Submitting a Department Diving Operations Plan for approval by the DSO
Coordination with other known activities in the vicinity that are likely to interfere with diving operations
Ensuring all dive team members possess current certification and are qualified for the type of diving operation
Planning dives in accordance with Section 2.2
Ensuring safety and emergency equipment is in working order and at the dive site
Briefing dive team members on:
Dive objectives
Unusual hazards or environmental conditions likely to affect the safety of the diving operation
Modifications to diving or emergency procedures necessitated by the specific diving operation
Determining that the team members have conducted a functional check of individual diving equipment and that the team member's current state of fitness is adequate before diving activities begin
Suspending diving operations if in their opinion conditions are not safe
Inquiring into the fitness of the dive team members upon completion of a day's diving
Reporting to the DSO and DSB any physical problems or adverse physiological effects including symptoms of pressure-related injuries that have been reported to them
On any dive during which Nitrox will be used by any team member, the Lead Diver should be authorized to use Nitrox, and hold appropriate authorizations required for the dive, as specified in AAUS Standards. See Section 7.4.1

1.2.9 Reciprocity and Visiting Scientific Divers

Two or more AAUS Organizational Members engaged jointly in diving activities, or engaged jointly in the use of diving resources, shall designate one of the participating Diving Safety Boards to govern the joint dive project.

A Scientific Diver from one Organizational Member shall apply for permission to dive under the auspices of another Organizational Member by submitting to the Diving Safety Officer of the host Organizational Member a document containing all the information described in Appendix 5, signed by the Diving Safety Officer or Chairperson

of the home Diving Safety Board.

A visiting scientific diver may be asked to demonstrate his/her knowledge and skills for the planned diving.

If the Department denies a visiting scientific diver permission to dive, the Department's Diving Safety Board shall notify the visiting scientific diver and that diver's Diving Safety Board with an explanation of all reasons for the denial.

1.2.10 Incident Command System (ICS)

The Department utilizes the Incident Command System (ICS) organizational structure for managing multi-agency and multi-jurisdictional emergency responses. Department employees shall use the ICS when responding to pollution, wildfire, public safety, or other incidents.

The Diving Safety Program shall participate in the ICS as the Dive Operations Branch of the Operations Section. Either the DSO, a member of the DSB, or a Lead Diver having training or experience with the technical aspects specific to the incident shall serve as the Branch Director, and shall report to the Operations Section Chief. The Dive Operations Branch Director shall be delegated full authority over the deployment of Department divers. Nothing herein shall override the "Individual Diver Responsibility" (Section 1.30).

1.2.11 Waiver of Requirements

The Diving Safety Board may grant a waiver for specific requirements of training, examinations, depth certification, and minimum activity to maintain certification.

1.3 INDIVIDUAL DIVER RESPONSIBILITY

Divers are responsible for their own behavior and safety.

It is each diver's responsibility and right to refuse to dive if, in the diver's judgment, conditions are unsafe or unfavorable, the diver's health is impaired, or if diving would violate the dictates of training, these policies, or other applicable regulations (See Section 2.3.4).

1.4 VIOLATION OF POLICIES BY DEPARTMENT DIVERS

Failure to comply with the policies of this *Manual* may be cause for the revocation or restriction of the diver's scientific diving authorization by action of the Diving Safety

Board. The Diving Safety Officer, or designee, may informally counsel a diver regarding a violation or, with the concurrence of the DSB, issue a Memo of Policy Violation to a diver with a copy to the diver's supervisor. Such actions will be documented pursuant to standard Department procedures (See Department Operations Manual, Section 12651). A diver may request a hearing with the DSB or submit written communication to document or clarify any incident, or to appeal any actions taken by the DSB or the DSO.

1.4.1 Informal Counsel

The preliminary response to minor violations of the standards of this *Manual* that do not pose an immediate threat to the safety of a diver or dive team will be an informal consultation between the DSO and the diver. Minor violations include, but are not limited to, late or incomplete logs, expired medical examination, insufficient dives for certification maintenance, or other non-compliance that is not an immediate threat to diver safety. This consultation will occur after the DSO has obtained the concurrence of the DSB as to the nature of the violation and the content of the consultation. The intent of the Informal Counsel is to communicate the non-compliance, determine the facts of the incident and/or violation, and provide the diver the opportunity to explain and/or correct the situation.

1.4.2 Memorandum of Policy Violation

If the DSO and DSB concur that the nature of a violation must be documented to minimize future liability to the Department, the DSO shall issue a Memorandum of Diving Safety Manual Policy Violation to the diver with a copy to the diver's supervisor. This memo will be permanently held in the DSP files. This memo will also be considered part of the supervisory record and subject to standard Department procedures for appeal and removal from that file. The DSO and DSB will not submit this memo as part of the employee's Personnel File.

1.4.3 Restriction or Revocation of Certification

Department diving certification and authorization may be restricted or revoked for cause by the DSO with the concurrence of the DSB. Violations of this *Manual*'s policy, or other governmental subdivisions not in conflict with this *Manual*, repeated policy violations, or violations that pose an immediate threat to the safety of a diver or dive team may be considered cause. The DSO shall inform the diver in writing of the reason(s) for restriction or revocation.

1.4.4 Appeal of Diving Safety Board or Diving Safety Officer Action

A Department diver subject to Informal Counseling may ask to discuss the incident in person with the full DSB or by written communication. A diver in receipt of a Memorandum of Policy Violation, or having a Restriction or Revocation of Diving

Certification may ask to appeal the action. The diver shall be given the opportunity to present a case in writing or in person to the DSB for reconsideration and/or recertification. Appeals shall be heard by the DSB within reasonable time to limit disruption of ongoing diving operations.

1.4.5 Recertification after Lapse or Revocation

A diver whose certification has lapsed or has been revoked may be recertified upon completion of the following requirements:
If the diver's certification has been revoked for cause, the cause of revocation must be corrected to the satisfaction of the DSB.
The diver's Regional Manager or Branch Chief must make written application to the DSO.
The diver must have a current physical examination on file with the DSO.
The diver must show evidence of current emergency care training as required (Section 4.3.2).
The diver must complete the standard annual Diver Recertification training and other skill evaluations as required by the DSB. This includes the possibility of required attendance at a Full Certification Course.

1.5 VIOLATION OF POLICIES BY DEPARTMENT OF FISH AND WILDLIFE

Failure to comply with the policies and procedures in this standard may be cause for the revocation or restriction of the Department of Fish and Wildlife's recognition by AAUS.

1.6 GENERAL DEFINITIONS

The following definitions apply to the types of diving covered in this *Manual*. For complete list of terms used in this *Manual*, see Appendix 4.

Dive. For purposes of record keeping and maintenance of certification, a "dive" consists of entry into water or a hyperbaric environment, an underwater activity using compressed gas, an exit, and a ten-minute (minimum) surface interval.

Diver. A Department scuba certified and authorized employee conducting a dive. A Department employee may not dive on Department time or use Department diving equipment unless certified and authorized by the DSO as a diver.

Law Enforcement/Public Safety Dive. Law Enforcement or Public Safety dives are those made in the course of enforcing regulations or laws or assisting in emergency response by, or under the direction of, a peace officer or emergency personnel.

Lead Diver. The Lead Diver is responsible for coordinating diving activities for the

diving operation. The Lead Diver is generally the most experienced diver on site and maintains the overall safety of the diving operation.

Light Maintenance Dive. A dive to perform routine or emergency maintenance on, repair, or installation of equipment to a vessel or structure, recover or salvage items other than those used in a scientific or Public Safety investigation (evidence recovery), or to conduct routine monitoring activities not part of a scientific or Public Safety investigation. These dives have special requirements (Section SECTION 12). The DSO must approve these dives.

Scientific Dive. A scientific dive is a dive to collect scientific data by or under the direction of a scientist.

Training Dive. Dives conducted to fulfill certification or instructional requirements, or to maintain proficiency. Training dives conducted outside Department auspices on Department time must be approved by the DSO.

1.7 RECORD MAINTENANCE

The Diving Safety Officer or his/her designee shall maintain permanent records for each certified diver. The file shall include evidence of certification level, log sheets, results of current physical examination, waiver, reports of disciplinary actions by the Diving Safety Board, and other pertinent information deemed necessary.

1.7.1 Availability of Records

Medical records shall be available to the attending physician of a diver or former diver when released in writing by the diver.

Records and documents required by this standard shall be retained for the following period:
Physician's written reports of medical examinations– 5 years.
Diving Safety Manual– current document only
Records of dive– 1 year, except 5 years where there has been an incident of pressure-related injury
Pressure-related injury assessment– 5 years
Equipment inspection and testing records– current entry or tag, or until equipment is withdrawn from service
Termination or Revocation of Active Diver Status– 5 years
Memorandum of Policy Violation– Permanent in Active Diver’s file may be removed from supervisory file per Department procedures

This Page Intentionally Blank

SECTION 2

POLICY FOR SCUBA USE (OPEN-CIRCUIT, COMPRESSED AIR)

2.1 INTRODUCTION

No person shall engage in any scuba diving operations under Department auspices unless he/she holds a current certification issued pursuant to the provisions of this *Manual*.

2.2 PRE-DIVE PROCEDURES

2.2.1 Dive Plans

Before conducting any diving operations under the auspices of the Department, the Lead Diver for a proposed operation must formulate a dive plan and submit it for approval. Dives should be planned around the competency of the least experienced diver. The dive plan should include the following:

Divers' qualifications and the type of certificate or certification held by each diver

Emergency Plan with the following information:

Name, telephone number, and relationship of person to be contacted for each diver in the event of an emergency

Nearest operational recompression chamber

Nearest accessible hospital

Available means of transport

Approximate number of proposed dives

Location(s) of proposed dives

Estimated depth(s) and bottom time(s) anticipated

Decompression status and repetitive dive plans, if required

Proposed work, equipment, and boats to be employed

Any hazardous conditions anticipated

2.2.2 Lead Diver

An appropriately qualified diver will be designated as the Lead Diver for each dive or series of dives. The Lead Diver is responsible for the diving operation. Level of experience and training in dealing with the task at hand will supersede rank/classification in selecting a Lead Diver. The Lead Diver shall be at the dive location during the diving operation. Refer to Section 1.2.8 for the duties of the Lead Diver. Nothing in this section alters each individual diver's responsibility (Section 1.3).

2.2.3 Pre-Dive Safety Checks

Diver's Responsibility:

Each scientific diver shall conduct a functional check of his/her diving equipment in the presence of the dive buddy or tender.

It is the diver's responsibility and duty to refuse to dive if, in his/her judgment, conditions are unfavorable or if he/she would be violating the precepts of his/her training, or this *Manual* (Section 1.3).

No dive team member shall be required to be exposed to hyperbaric conditions against his/her will, except when necessary to prevent or treat a pressure-related injury.
No dive team member shall be permitted to dive in conditions likely to adversely affect the safety and health of the diver or other dive members.

Equipment Evaluations:
Each diver shall ensure that his/her equipment is in proper working order and that the equipment is suitable for the type of diving operation.
Each diver shall have the capability of achieving and maintaining positive buoyancy.

Site Evaluation:
The environmental conditions at the site will be evaluated.

Contaminated Environments:
Any diver requested to dive in a known contaminated environment shall notify the DSO before proceeding. Dives conducted in petroleum contaminated water shall follow the procedures set forth in the Specialized Diving Modes section of this *Manual* (Section SECTION 6).

In the event a diver is exposed to environmental contamination in the course of a normal working dive, the diver shall immediately notify the DSO or DSB and consult a physician.

2.2.4 Diving Under the Influence of Drugs or Intoxicants

Alcoholic beverages will not be consumed eight hours before any dive. Divers will not use restricted or prescription drugs while diving without the specific consent of a physician.

2.2.5 Blood Donation

Divers should consult with a knowledgeable physician regarding time frames of donating blood prior to and after diving.

2.3 GENERAL DIVING PROCEDURES

2.3.1 Solo Diving Prohibition

All diving activities shall assure adherence to the buddy system for scuba diving (two comparably equipped divers in the water in constant communication). This buddy system is based on mutual assistance, especially in the case of an emergency. In the case of a tethered diver with direct communication to the surface, the buddy may be a fully suited diver, prepared to assist.

2.3.2 Buddy System

Buddy divers must maintain close continuous contact during each dive. Upon loss of contact, divers should check the surrounding area to re-establish contact. If contact is not made in a reasonable period, the divers shall surface and establish contact. The dive will be terminated when any team member runs low on breathing gas or approaches any other safe diving limitation.

Each buddy team will have an emergency evacuation and emergency medical plan and diving tables, or other planning method appropriate to the dive mode, available for immediate reference before and after each dive.

2.3.3 Depth Limits
Each Department diver shall be certified to a maximum depth by the DSO (Section 4.6). A diver shall not exceed his/her depth unless accompanied by a diver certified to a greater depth. Under these circumstances the diver may not exceed his/her depth limit by more than one step.
Dives to 130 feet deep must be in accordance with Sections 4.6.1 - 4.6.4.
Dives exceeding 130 feet deep must be in accordance with Sections 4.6.5 - 4.6.6.
Diving is not permitted beyond a depth of 190 feet.

2.3.4 Refusal to Dive
The decision to dive is that of each individual diver. A diver may refuse to dive, without fear of penalty, whenever the diver believes it is unsafe for them to make the dive (Section 1.3).

2.3.5 Safety of the Dive
The ultimate responsibility for safety rests with the individual diver. 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 or the policies of this *Manual* (Section 1.3).

2.3.6 Termination of the Dive
It is the responsibility of the diver to terminate the dive, without fear of penalty, whenever they feel it is unsafe to continue the dive, unless it compromises the safety of another diver already in the water (Section 1.30)

The dive will be terminated while there is still sufficient breathing gas to permit the diver to safely reach the surface, including any required decompression time, or to safely reach an additional air source at the decompression station.

2.3.7 Emergencies and Deviations from Policies
Any diver may deviate from the requirements of this *Manual* to the extent necessary to prevent or minimize a situation that is likely to cause death, serious physical harm, or major environmental damage. A written report of such actions must be submitted to the Diving Safety Board explaining the circumstances and justifications.

2.4 POST-DIVE PROCEDURES

2.4.1 Post-Dive Safety Checks
After completion of a dive, each diver shall report any physical problems, symptoms of decompression sickness, or equipment malfunctions.

When diving outside the no-decompression limits, the divers should remain awake for at

least 1 hour after diving, and in the company of a dive team member who is prepared to transport them to a decompression chamber if necessary.

2.4.2 Traveling (Ascending to Altitude >1000 feet) After Diving
Divers should observe the following minimum surface intervals before ascending to altitude greater than 1000 feet elevation. This includes ascent to altitude in aircraft or when driving to elevation or over mountain passes.
Following a single no-decompression dive: Minimum 12 hour pre-travel surface interval
Following multiple dives per day, or multiple days of diving: Minimum 18 hour pre-travel surface interval
Following decompression dives: Minimum 24 hour pre-travel surface interval

Before ascending to altitude (above 1000 feet) by land transport, divers should follow the appropriate pre-travel surface intervals unless the schedule used for planning the altitude dive accounted for the increased elevation.

2.5 EMERGENCY PROCEDURES

Each diving project, supervisor, or Lead Diver will develop emergency procedures which follow the standards of care of the community and must include procedures for emergency care, recompression and evacuation for each dive location.

It is essential that emergency procedures be pre-planned, communicated, and understood by all divers and surface support personnel to ensure appropriate medical treatment is initiated as soon as possible. Procedures include extrication, first aid treatment, evacuation, and Emergency Medical Services (EMS) response based on local resources. To facilitate these components, divers should use the Diving Emergency Management Procedures Form (Appendix 8).

2.6 RECORD KEEPING REQUIREMENTS

2.6.1 Personal Diving Log
Each certified diver shall log every dive made under the auspices of the Department of Fish and Wildlife's Diving Safety Program and is encouraged to log all other dives. The personal diving log shall be retained by the diver and will include at least the following:
Name of diver, buddy, and Lead Diver
Date, time, and location
Diving modes used
Diving gas used
General nature of diving activities
Approximate surface and underwater conditions
Maximum depths, bottom time, and surface interval time
Diving tables or computers used
Detailed report of any near or actual incidents

Personal Logs should be retained by each diver for at least one year.

2.6.2 Department Monthly Diving Log

Each diver shall submit a Department Monthly Diving Log on a form established by the DSB (Appendix 10). Monthly Diving Logs must report all Department dives, as well as any non-Department dives used to maintain required diving activity (Section 4.7). If no dives are made, a Monthly Diving Log showing "No Dives" will be submitted. Monthly Diving Logs will contain all the information listed in Section 2.6.1 as well as pay hours, if applicable.

Divers shall submit the Monthly Dive Log to the DSO at the end of each month. Logs not received by the tenth day of the following month will be considered delinquent. Divers not submitting logs in a timely manner are subject to de-certification.

The Department will maintain logs for a minimum of one calendar year, except five years where there has been an incident of pressure-related injury (Section 2.6.4).

2.6.3 Diving Pay

Divers shall be eligible for Diving Pay. Only those employment classifications identified by Department of Human Resources (CalHR) as eligible for the pay differential shall receive Diving Pay. Divers shall be paid only for dives occurring on state time.

A copy of the Monthly Diving Log must be attached to the Department of Fish and Wildlife Timesheet. Dive Pay Time from the Monthly Diving Log must be entered in the "Special Hours- Dive" box of the Timesheet. Timesheets including Diving Pay shall be retained in accordance with HR/Personnel document retention schedule.

2.6.4 Incident Reporting

All diving incidents requiring recompression treatment, or resulting in moderate or serious injury, or death shall be reported to the Department's Diving Safety Board and to AAUS. The Department's regular procedures for incident reporting, and those required by AAUS shall be followed. The reports will specify the circumstances of the incident and the extent of any injuries or illnesses.

If pressure-related injuries are suspected, or if symptoms are evident, the following shall be reported:
Diving Injury/Incident Report Form, Appendix 6, reported to Department's Diving Safety Board within 48 hours, unless prevented by the circumstances of the incident
AAUS Incident Report (www.aaus.org) submitted to AAUS during the annual reporting cycle. This summary report shall be reviewed and released by the Diving Safety Board.

Full, descriptive reports shall include:
Name, address, phone numbers of the principal parties involved
Summary of experience of divers involved
Location, description of dive site, and description of conditions that led up to incident
Description of symptoms, including depth and time of onset
Description and results of treatment
Disposition of case
Recommendations to avoid repetition of incident

In addition, the following shall be reported as applicable:
Minor injuries or potentially hazardous incidents should be reported to the DSO on the Department Report of Minor Injury form (Appendix 7).
The Department shall record and report occupational injuries and illnesses in accordance with requirements of the appropriate Labor Code section.

Submitting the above mentioned forms is in addition to any other Department requirements for reporting injury or accident.

Documents shall be retained by the Department, with the record of the dive, for a period of 5 years.

This Page Intentionally Blank

SECTION 3

DIVING EQUIPMENT

3.1 GENERAL POLICY

All equipment shall meet standards as determined by the Diving Safety Officer and the Diving Safety Board. All equipment shall be regularly examined by the person using it, and serviced according to Equipment Maintenance (Section 3.5) and manufacturer recommendations. Equipment subjected to extreme use or adverse conditions requires more frequent testing and maintenance.

Equipment shall be used in accordance with safe diving practices and within the manufacturers' specifications.

Exceptions to the required Department diver equipment may be granted upon request to and approval of the Diving Safety Officer.

The Department shall provide the following equipment to each certified diver.

3.2 REQUIRED PERSONAL EQUIPMENT

3.2.1 Scuba Regulator(s)

Regulators disapproved by the Diving Safety Officer and the Diving Safety Board shall not be used.

Each diver shall have and maintain at least one scuba regulator. Regulators will consist of a balanced first stage and a demand valve second stage. In addition, each diver shall have available an alternate breathing gas source. This may include an "octopus" second stage; a buoyancy compensator integrated second stage, or a redundant gas delivery system.

Scuba regulators shall be inspected and "bench-tested" prior to first use and every six months thereafter (Section 3.5).

Scuba regulators should be checked for leaks and free flow prior to each dive.

3.2.2 Scuba Cylinders

Each diver shall maintain a minimum of two single cylinders.

Scuba cylinders will be designed, constructed, and maintained in accordance with the applicable provisions of the Unfired Pressure Vessel Safety Orders.

Scuba cylinders must display markings indicating current inspection and testing per Section 3.5.

The use of Reserve Valves (J-Valves) on scuba cylinders is prohibited.

3.2.3 Backpack, Weighting System, and Flotation Device

Each diver shall have a backpack, weighting system, and a flotation device capable of achieving and maintaining positive buoyancy. These items may be integrated.

Backpacks without integrated flotation will have a quick release device designed to permit jettisoning with a single motion from either hand.

Weight belts and integrated weight systems used by divers will be capable of quick one-handed release.

Personal flotation systems, buoyancy compensators, dry suits, or other variable volume buoyancy compensation devices will be equipped with an exhaust valve.
These devices shall be functionally inspected and tested at intervals not to exceed six months (Section 3.5). Buoyancy compensator checks should include: manual oral inflation, power inflation, deflation with all manual valves and over-inflation release.

3.2.4 Sound Making Device
Each diver shall have a device capable of audibly signaling for assistance or attention at the surface.

3.2.5 Facemask
Facemasks will have tempered glass or shatterproof lenses.
Corrective lenses are approved.
Full face masks will be of a design that does not allow the build-up of excessive carbon dioxide.

3.2.6 Depth and Pressure Gauges
Each diver shall have an approved depth indicator, and a submersible cylinder pressure gauge. Capillary depth gauges are not approved.
Gauges shall be inspected and tested before first use and every 6 months thereafter (Sections 3.5).

3.2.7 Timing Device
Each diver shall have an underwater timing device capable of measuring and displaying dive (bottom) time and time of day.

3.2.8 Fins
Each diver shall have at least one pair of fins appropriate for the dive conditions.

3.2.9 Cutting Tool
Each diver shall have a cutting tool (e.g., knife, shears, wire cutters) as appropriate. A redundant cutting tool secured in an alternate location on the diver is required during night dives.

3.2.10 Snorkel
Each diver shall have one snorkel appropriate for breathing at the surface.

3.2.11 Compass
Each diver shall have one underwater compass.

3.2.12 Dive Light
Each diver shall have a functional underwater light for use on night or low visibility dives. A second, back-up, light is recommended.

3.2.13 Thermal Protective Suit
Each diver shall have a thermal protective suit (i.e., wetsuit or dry suit) appropriate for

the conditions.
Use of dry suits requires proof of formal training approved by the Diving Safety Officer (Section 6.1.1).

3.2.14 Method of Determination of Decompression Status: Dive Tables, Dive Computers
A set of dive tables, approved by the Diving Safety Board, must be available at the dive location.
Dive computers may be used in place of dive tables if the following guidelines are adhered to:
Makes and models of dive computers specifically disapproved by the Diving Safety Officer may not be used.
Each diver relying on a dive computer to plan dives and indicate or determine decompression status must have his/her own computer.
On any given dive, both divers in the buddy pair must follow the most conservative dive computer.
If the dive computer fails during the dive, the dive must be terminated and appropriate surfacing procedures should be initiated immediately.
A diver should not dive during the 24 hours preceding the activation of his/her dive computer if it is to be used for controlling subsequent dives.
Once a dive computer is in use, it must not be switched off until it indicates that complete out gassing has occurred or 18 hours have elapsed, whichever occurs first.
When using a dive computer, non-emergency ascents are to be at the rate specified for the make and model of the dive computer being used.
Ascent rates will not exceed 30 fsw/min in the last 60 fsw or the computer's recommended rate, whichever is slower.
Whenever practical, divers using a dive computer should make a stop between 10 and 20 feet for 3 - 5 minutes, especially for dives below 60 fsw. In addition, divers completing dives deeper than 100 feet should consider making a one minute safety stop on ascent at a depth equal to one half of the deepest depth of the dive.
Although decompression dives should be planned using U.S. Navy tables, divers should follow decompression procedures indicated on their computers if more conservative than the tables.
Repetitive deep dives should be conducted within the guidelines of dive tables or the most conservative computer used. The No Decompression Limits (NDL) shall not be exceeded unless the dives include planned decompression stops and conform to the decompression standards of this *Manual*.
The inclusion of a "deep stop", a safety stop, and long surface intervals are recommended for NDL dives.
Computers will not be used for diving in fresh water or at altitude, unless the dive computer specifically allows for such dives.
A time measuring device (diving watch) and suitable depth gauge must be worn in addition to a dive computer. A log of maximum depth, dive time, and surface intervals will be maintained as a backup.
AAUS recommendations on dive computers are available at www.aaus.org.

3.3 REQUIRED SUPPORT EQUIPMENT

3.3.1 Diving Flags
When diving in areas capable of supporting marine vessel traffic a rigid replica of the International code flag “A” or appropriate night signal shall be displayed as required by USCG Navigation Rule 27(e) for a vessel restricted in its ability to maneuver.
The additional use of a rigid recreational diving red and diagonal white stripe, “Diver Down” flag is recommended.
When diving from shore, or in shallow water in areas of vessel traffic, the “diver down flag” is a minimum requirement and will be prominently displayed.

3.3.2 Emergency Oxygen Delivery System
Emergency oxygen supply (such as a DAN Oxygen Unit) will be available.

3.3.3 First Aid Supplies
A first aid kit will be available.

3.4 AUXILIARY EQUIPMENT

3.4.1 Handheld Underwater Power Tools
Electrical tools and equipment used underwater will be specifically approved for this purpose. Electrical tools and equipment supplied with power from the surface will be de-energized before being placed into or retrieved from the water. Handheld power tools will not be supplied with power from the dive location until requested by the diver.

3.4.2 Compressor Systems– Department Controlled
Low-pressure compressors used to supply air to the diver if equipped with a volume tank will have a check valve on the inlet side, a relief valve, and a drain valve.
Compressed air systems over 500 psig will have slow-opening shut-off valves.
All air compressor intakes will be located away from areas containing exhaust or other contaminants.

3.4.3 Oxygen Systems
Equipment used with oxygen or mixtures containing over 40% by volume oxygen will be designed and maintained for oxygen service. See Section 7, Nitrox Diving Guidelines.
Components exposed to oxygen or mixtures containing over 40% by volume oxygen will be cleaned of flammable materials before being placed into service.
Oxygen systems over 125 psig will have slow-opening shut-off valves.

3.4.4 Breathing Masks and Helmets
Full Face Masks will be of a modern design that does not allow for the buildup of excessive carbon dioxide. Breathing masks and helmets shall have:
A non-return valve at the attachment point between helmet or mask and hose, which shall close readily and positively
An exhaust valve
A minimum ventilation rate capable of maintaining the diver at the depth to which he/she is diving

3.5 EQUIPMENT MAINTENANCE

All equipment is to be maintained in safe operating condition. Divers shall inspect all tools, equipment, and operational systems used in diving operations to ensure they are appropriate and in proper working order prior to diving.

Schedules of Maintenance

Equipment	Required Testing/Maintenance Schedule*
Scuba regulators	Test each 6 months
Scuba cylinders	Visual inspection each12 months Hydrostatic test each 5 years
Pressure gauges	Test each 6 months
Buoyancy compensators	Test each 6 months
Depth gauges	Test each 6 months
Dive computers	Test each 6 months
Breathing gas analyzers	Calibrated each dive Calibrated to known source 6 months
Emergency Oxygen Delivery Systems	Per manufacturers specifications Cylinders hydrostatically tested each 5 years

*Interval should not exceed manufacturer's specifications

Scuba Regulators
Scuba regulators will be "bench-tested" every 6 months and perform in accordance with manufacturers standards. Regulators should be overhauled by a qualified technician on a schedule as determined by the manufacturer.

Scuba Cylinders and Valves
Scuba cylinders:
Will be visually inspected (external and internal) at intervals not to exceed 12 months.
Will be functionally tested (with valves) at intervals not to exceed 12 months.
Shall be hydrostatically tested every 5 years in accordance with Department of Transportation (DOT) standards
Cylinder valve burst discs will be replaced as necessary. At a minimum, discs should be replaced at the time of cylinder hydrostatic testing.
Scuba cylinders dedicated to the use of nitrox or oxygen shall be marked with proper cylinder bands and contents tags.

Submersible (Cylinder) Pressure Gauge
Submersible pressure gauges will be tested or calibrated every 6 months or when there is reasonable cause to believe a discrepancy exists.

Buoyancy Compensators
Buoyancy compensation devices must be functionally tested at intervals not to exceed 6 months.

Depth Gauges
Each depth gauge will be tested or calibrated every 6 months or when there is reasonable cause to believe a discrepancy exists.

Dive Computers
Each computer will be tested or calibrated every 6 months or when there is reasonable cause to believe a discrepancy exists. Maintenance will be performed in accordance with the manufacturer's specifications.

Breathing Gas Analyzers
Breathing gas analyzers will be calibrated with air before each use.
They will be calibrated with a known gas mixture every 6 months or as per manufacturer's recommendation.
Sensor replacement and servicing should follow manufacturer's schedule and recommendations.

Emergency Oxygen Delivery Systems
Regulators: Assemblies will be serviced as recommended by the manufacturer. Regulators subject to recall or believed to be contaminated will immediately be removed from service.

Oxygen gas cylinders: Will be purged and refilled every two years, and shall be hydrostatically tested every five years (DOT requirement).

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

Regulators (including alternate gas sources)
Submersible cylinder pressure gauges
Depth gauges
Scuba cylinders
Cylinder valves
Diving helmets
Submersible breathing masks
Compressors
Gas control panels
Air storage cylinders
Air filtration systems
Analytical instruments
Buoyancy control devices
Dry suits
Emergency oxygen delivery systems

3.5.2 Compressor Operation and Air Test Records
Gas analyses and air tests shall be performed on each Department-controlled breathing air compressor at regular intervals of no more than 100 hours of operation or 6 months, whichever occurs first. The results of these tests shall be entered and maintained in a

logbook.

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

3.6 AIR QUALITY STANDARDS

Breathing air for scuba shall meet the following specifications as set forth by the Compressed Gas Association (CGA Pamphlet G-7.1).

CGA Grade E	
Component	**Maximum**
Oxygen	20 - 22%/v
Carbon Monoxide	10 PPM/v
Carbon Dioxide	1000 PPM/v
Condensed Hydrocarbons	5 mg/m3
Condensed Hydrocarbons as Methane	25 PPM/v
Water Vapor ppm	(2)
Objectionable Odors	None

Breathing air used conjunction with scuba apparatus in extreme cold can result in moisture to condensation and freezing causing the breathing apparatus to malfunction. Here, a dew point not to exceed -50°F (63 ppm v/v) or 10 degrees lower than the coldest temperature expected in the area is required.

This Page Intentionally Blank

SECTION 4

DIVER CERTIFICATION

4.1 CERTIFICATION

Certification in the Department's diving program is limited to paid and volunteer employees of the Department. Employees of other state agencies may be admitted to the certification course at the discretion of the DSM with concurrence of the DSB. A statement of training, but no Department certification will be issued to them. The DSO will notify their agency of their successful/unsuccessful completion of the course.

4.1.1 General Policy

No person shall engage in scientific diving unless that person is authorized by the Department pursuant to the provisions of this *Manual*. Only a person diving under the auspices of the Department while subscribing to the practices of AAUS is eligible for a scientific diver certification. The purpose of the certification standards is to ensure that all diving for the Department is conducted in a safe manner.

4.2 CERTIFICATION TYPES

4.2.1 Department Scientific Diver Certification

This is the required certification for employees and volunteers to dive under Department auspices in support of a Department scientific, research, or educational activity. This is a revocable permit to dive only while current, in good standing, and for the purposes intended.

Following certification, the diver's supervisor shall authorize the necessary time to maintain certification and will budget the monies for diving pay, equipment, travel, medical examination and other maintenance of certification requirements (Section 4.7).

4.2.2 Restricted Certification (Temporary Diver Permit)

A Restricted Certification is a temporary diver permit that may be available to individuals with demonstrated training and experience in a program equivalent to the Department's Diving Safety Program. A supervisor may request that an employee may be considered for a Restricted Diver Certification if such a certification is in the interest of the Department.

A Restricted Certification is valid for a limited time, as determined by the Diving Safety Officer. This temporary permit is not to be construed as a mechanism to circumvent the standard procedure for Department Diver Certification set forth in this *Manual*. A Restricted Certified diver may participate on Department dives, subject to the following conditions. A Restricted Certified diver:

May dive only on the sponsoring project's diving operations, under the supervision of that project's Department certified divers

May not be a Lead Diver

May only accompany another diver of the same or greater depth certification.

May only dive to 60 feet. The Restricted Diver may receive a 100-foot certification based on need, after application to the DSB. Such an application shall include records of a minimum of 12 dives completed with a Department diver holding at least a 100-foot certification (Section 4.6).
Shall attend the next regularly scheduled Department Certification Course. In the event that attendance is not possible, as determined by the DSB, the Restricted Certification may be extended to the subsequent Certification Course offering.
The Restricted Diver will abide by all policies in this *Manual*.

Application for Restricted Certification
Request for Restricted Diver Certification and submission of supporting documentation does not guarantee issuance of certification. A diver candidate may be considered for Restricted Certification after submitting the application materials for Department Diver Certification, Section 4.3.2 to the DSO. In addition, the Restricted Diver Candidate must provide:

A request from a diving project supervisor for consideration of Restricted Certification
A statement from the diving project supervisor or Lead Diver describing the diving environment and duties the Restricted Diver shall be required to perform (environments, depths, and skills required).
A verification of training from a responsible person documenting the training, qualifications, and experience of the candidate (i.e., university, commercial diving, military, or other scientific organization). The verification of training shall include including the name and contact information of the responsible person.

Restricted Certification Procedure
The Restricted Diver Candidate shall be evaluated to the qualification standards of the Department Diver Certification Course, Section **Error! Reference source not found.**.
The candidate shall be evaluated for certification to a depth of 60 feet.

The DSO or his/her designee shall evaluate the diver and verify that he/she possesses skills and knowledge substantially similar to those stated in Sections 4.3.

All DSB expenses associated with the Restricted Certification process, including per-diem, will be the responsibility of the project requesting the certification.

Issuance of Restricted Certification
The permit may be granted upon successful completion of the requirements listed in Section 4.3 and following a demonstration of diving proficiency. Upon the candidate's successful completion of the evaluation, the DSB will recommend and the DSO may issue a Restricted Certification, with expiration date.

Temporary permits shall be restricted to the sponsoring project's diving operations and shall comply with all other policies and standards of this *Manual*, including medical requirements.

Certain requirements of this section may be waived by the Diving Safety Officer with concurrence of the Diving Safety Board if the candidate has demonstrated proficiency in diving and can contribute measurably to a planned dive or project.

4.2.3 Diver-In-Training Permit
This is a permit to dive, usable only while it is current and for the purpose intended. It is granted only to Diver Candidates during attendance at the Certification Course. This permit signifies that a diver has completed and been certified to at least an entry-level diver through an internationally recognized certifying agency or another scientific diving program, and has the knowledge skills and experience necessary to continue training as a Department diver under supervision, as approved by the DSO.

4.3 REQUIREMENTS FOR DEPARTMENT DIVER CERTIFICATION
Only a person diving under Department auspices is eligible for Department Certification.

Submission of application materials and attendance at the Certification Course does not guarantee issuance of certification. The applicant must demonstrate to the Diving Safety Officer and members of the DSB that he/she is a sufficiently skilled and proficient diver capable of proper judgement. The signature of the Diving Safety Officer or designee may acknowledge successful demonstration of a qualification skill, however, successful demonstration of skills not does guarantee issuance of certification.

Any applicant who does not possess the judgment necessary to maximize the safety of themselves and their partner during diving operations may be denied Department diving privileges.

4.3.1 Prerequisite Training and Experience
Entry-level diver training and other prerequisites for the Department Diver Certification Course are not offered by the Diving Safety Program. Documented proof of the following minimum training is required prior to acceptance in the Department Diver Certification Course:
Entry-level scuba certification (e.g., Open Water, Scuba Diver, etc.) issued by an internationally recognized training agency
Rescue Diver Certification issued by an internationally recognized training agency
Adult Cardio-Pulmonary Resuscitation (CPR)
Emergency Oxygen Administration
First Aid for Diving accidents

Documented proof of the following minimum diving activity:
12 dives in the last 12 months; entry-level training not included

4.3.2 Application Materials
Each applicant for Department Diver Certification shall submit the following documents to the Diving Safety Officer at least two weeks prior to any diver certification course:

Application Form

The Application Form is completed by the candidate, signed by the candidate's supervisor, and by the Regional Manager/ Division Chief/ Assistant Chief.

Medical Evaluation Forms
The applicant shall be examined and certified by a licensed physician to be medically qualified for diving before proceeding with the training as described in Section **Error! Reference source not found.** (Section SECTION 5 and Appendices 1 through 3).

Swim Test
Applicants must demonstrate swimming aptitude according to the requirements of Section 4.4.7.

Written Exam
Applicants must submit and pass a written examination per Section 4.4.5

Proof of Prerequisite and Relevant Training and Experience
Applicants shall submit proof of:
Completion and certification in prerequisite training listed in Section 4.3.1
Completion and certification in any additional relevant training
Dive experience consisting of at least 12 open water dives in the previous 12 months

4.4 TRAINING AND EVALUATION

The Department Diver Certification Course consists of several days of lectures, workshops, field work, and intensive in-water skills evaluation of increasingly technical requirements under the supervision of the Diving Safety Officer and at least one other member of the Diving Safety Board. During the course, there will be no more than three Diver Candidates per DSB member.

The Diving Safety Board must be satisfied that the candidate is able to satisfactorily perform diving operations and exercise good judgement by observing candidate performance in an appropriate series of qualifying tests.

4.4.1 Theoretical Training

The Diver Candidate must complete theoretical aspects and practical training for a minimum cumulative time of 100 hours. Theoretical aspects will include principles and activities appropriate to the intended area of scientific study.

4.4.2 Required Topics (include, but not limited to):

Diving Emergency Care Training
Cardio-Pulmonary Resuscitation (CPR)
Standard or Basic First Aid
Recognition of DCS and AGE
Accident Management
Field Neurological Exam
Oxygen Administration
Dive Rescue

Dive Physics
Dive Physiology
Dive Environments
Decompression Theory and its Application
AAUS Scientific Diving Regulations and History
Scientific Dive Planning
Coordination with other Agencies
Appropriate Governmental Regulations
Scientific Method
Data Gathering Techniques (Only Items specific to area of study are required)
Estimating abundance using transects and quadrats
Mapping
Coring
Photography
Tagging
Collecting
Animal Handling
Archaeology
Common Biota
Organism Identification
Behavior
Ecology
Site Selection, Location, and Re-location
Specialized Equipment for data gathering
Hazardous Materials (Hazmat)
High Pressure Cylinders
Chemical Hygiene, Laboratory Safety (Use of Chemicals)

Suggested Topics (include, but are not limited to):
Specific Dive Modes (methods of gas delivery)
Open Circuit
Hookah
Surface Supplied diving
Small Boat Operation
Rebreathers
Closed Circuit
Semi-closed Circuit
Specialized Breathing Gas
Nitrox
Mixed Gas

Specialized Environments and Conditions
Blue Water Diving
Ice and Polar Diving (Cold Water Diving)
Zero Visibility Diving
Polluted Water Diving

Saturation Diving
Decompression Diving
Overhead Environments
Aquarium Diving
Night Diving
Kelp Diving
Strong Current Diving (Live-boating)
Potential Entanglement

Specialized Diving Equipment
Full face mask
Dry Suit
Communications

4.4.3 Practical Training
Practical training must include a checkout dive, with evaluation of the skills listed in Section 4.4.4 (Open Water Evaluation), with the DSO or qualified DSB member followed by at least 11 ocean or open water dives in a variety of dive sites and diving conditions, for a minimum cumulative bottom time of 6 hours. Dives following the checkout dive must be supervised by a qualified DSB member with experience in the type of diving planned, with the knowledge and permission of the DSO.

4.4.4 Open Water Evaluation
The Diver Candidate must satisfy Diving Safety Board members of their ability to perform at least the following skills in open water:

Surface dive to a depth of at least 15 feet in open water without scuba
Water entry and exit with full equipment from shore, dock, and vessel
Clear facemask and regulator underwater
Swim 400 yards in full scuba gear in the ocean, but not breathing from the scuba unit
Maneuver efficiently in an underwater environment while maintaining neutral buoyancy
Simulated emergency swimming assent
Simulated emergency buoyant assent
Navigate underwater accurately
Swim at a constant stated depth while maintaining a compass course
Air sharing, including both buddy breathing and the use of alternate air source, as both donor and recipient, with and without a facemask
Alternate between snorkel and scuba while kicking
Common underwater hand signs and signals
Simulated diver recovery and in-water mouth-to-mouth resuscitation
Rescue and transport, as a diver, a passive simulated victim of an accident
Remove and replace equipment while submerged
Diving ability that is acceptable to the Instructor
Free diving ability and proficiency with use of fins, use of mask, and use of snorkel
Tow a diver in diving gear 500 feet at the surface
Bail Out: With fins, mask, weighting system, and scuba unit (cylinder valve closed;

regulator uncharged) in hands, and other diving gear on, jump off a floating platform. After submerging, don remaining gear under water
Ditch-and-Don: Remove mask, snorkel, and scuba unit in 15 feet of water. Close cylinder valve, purge system, and make a controlled free ascent to the surface. Return to the gear on the bottom and put it on. Then make a normal ascent to the surface. In addition, an extended ditch and don, where the diver swims 15 feet across the bottom before donning gear, must be performed
Ability to act as a Lead Diver by planning two dives, securing necessary safety and project equipment, briefing divers, completing the dive safely, and debriefing divers
Night dive(s) to familiarize candidate with night diving situations
Judgment adequate for safe diving
Perform other skills as required by the DSB

A portion of the certification course may be devoted to accomplishing tasks which might be required during routine assignments (biological and geological transects, underwater collecting, equipment maintenance, underwater search and recovery, etc.).

Hazardous diving conditions will be simulated, including but not limited to: loss of air; loss of equipment; entanglement in kelp and lines; limited visibility, etc., to simulate conditions, which might arise during a working dive.

4.4.5 Written Examination
Prior to any open water training, each Diver Candidate must successfully complete a comprehensive written examination as prescribed by the DSB. The examination shall demonstrate knowledge of at least the following:

Function, care, use, and maintenance of diving equipment
Physics and physiology of diving
Diving policies and precautions
Near-shore currents and waves
Dangerous marine animals
Emergency procedures, including buoyant ascent and ascent by air sharing
Currently accepted decompression procedures
Demonstrate the proper use of dive tables
Underwater communications
Aspects of freshwater and altitude diving
Hazards of breath-hold diving and ascents
Planning and supervision of diving operations
Diving hazards
Causes, symptoms, treatment, and prevention of the following: near-drowning, air embolism, carbon dioxide excess, squeezes, oxygen poisoning, nitrogen narcosis, exhaustion and panic, respiratory fatigue, motion sickness, decompression sickness, hypothermia, and hypoxia/anoxia

4.4.6 Equipment Examination
Each Diver Candidate will be subject to an examination/ inspection of diving equipment.

The following gear will be evaluated by the DSO or designee for functionality and suitability for scientific diving in California ocean conditions:

Personal diving equipment
Task-specific equipment

4.4.7 Swimming Skills Evaluation
In a swimming pool or similar confined water conditions, each Diver Candidate must complete the following skills. Evaluations must be proctored by a DSB member or designee at least two weeks prior to a scheduled Certification Course. All skills are to be performed during a single water session. Mask or swim goggles are permissible, but no other swim aids are allowed. Where exposure protection is needed, the swimmer must be appropriately weighted to allow for neutral buoyancy.

Swim 400 yards, in less than 12 minutes
Swim 25 yards continuously underwater, without surfacing
Surface dive to a depth of 15 feet
Recover a 15-pound weight from a depth of 15 feet
Transport a passive person of equal or greater size a distance of 25 yards in the water
Tread water/survival swim, for 10 minutes; or for 2 minutes without the use of hands

Demonstration of other skills may be requested at the discretion of the DSB member or designee.

4.5 ISSUANCE OF CERTIFICATION
Upon successful completion of the Certification Course and the written examination, the Diving Safety Board members present may recommend, and the Diving Safety Officer may certify the candidate as a Department diver to a depth of 60 feet.

4.6 DEPTH CERTIFICATIONS
Depth certifications are progressive, and are granted following demonstrated proficiency to that depth. Divers shall not exceed their certified depth unless:
Supervised a buddy holding a greater depth certification, *and*
Their depth certification is exceeded by no more than one step.

A Department diver may be certified to the next depth level after successfully completing the required number of supervised dives for that level. Dives shall be planned and executed under the close supervision of a diver certified to at least that depth, and with the knowledge and permission of the Diving Safety Board.

4.6.1 Certification to 30 Foot Depth
This is the initial certification level granted to Divers-in-Training during attendance at the Certification Course, approved upon the successful completion of training listed in Section 4.3. It will be revoked if the Certification Course is not successfully completed.

4.6.2 Certification to 60 Foot Depth

A diver holding a 30-foot certificate may be certified to a depth of 60 feet after completing 12 logged dives to depths between 31 and 60 feet, for a minimum total bottom time of 4 hours. A diver holding a 60-foot or greater certification must closely accompany the diver.

4.6.3 Certification to 100 Foot Depth
A diver holding a 60-foot certificate may be certified to a depth of 100 feet after completing 12 logged dives to depths between 61 and 100 feet, for a minimum total bottom time of 2 hours. A diver holding a 100-foot or greater certification must closely accompany the diver.

4.6.4 Certification to 130 Foot Depth
A diver holding a 100-foot certificate may be certified to a depth of 130 feet after completing 4 logged dives to depths between 101 and 130 feet, for a minimum total bottom time of 1 hour. A diver with a 130-foot or greater certification must closely accompany the diver.

The diver must be monitored for obvious signs of gas narcosis. The diver shall also carry and demonstrate the safe use of a fully redundant gas supply. This certification will be issued by the DSO based upon job requirements and justification of need.

4.6.5 Certification to 165 Foot Depth

Dives deeper than 130 feet are to be planned and performed as staged decompression dives. This is a specialized diving mode requiring additional prerequisites, training, and equipment (SectionSECTION 6). Requests for certification deeper than 130 feet will be considered for approval by the DSB based upon job requirements and justification of need.

A diver holding a 130-foot certificate may be certified to a depth of 165 feet after successfully completing 4 logged dives to depths between 131 and 165 feet. The diver must also demonstrate knowledge of the special problems of deep diving and of special safety requirements (SectionSECTION 6).

4.6.6 Certification to 190 Foot Depth
A diver holding a 165-foot certificate may be certified to a depth of 190 feet after successfully completing 4 logged dives to depths between 166 and 190 feet. The diver must also demonstrate knowledge of the special problems of deep diving and of special safety requirements (SectionSECTION 6).

4.6.7 Certification beyond 190 Foot Depth
Diving on normoxic air is not permitted beyond a depth of 190 feet. The Department does not currently certify divers beyond a depth of 190 feet.

4.7 MAINTENANCE OF CERTIFICATION
Department divers must meet the following requirements each calendar year in order to maintain certification. Failure to meet these requirements is cause for revocation of

restriction of Diver Certification, or lowering of depth of certification.

4.7.1 Minimum Dive Activity
Divers must log a minimum of 20 dives each calendar year.
Divers certified to use nitrox should log at least 1 nitrox dive each calendar year (Section 7.2).
Divers certified to use rebreathers must log at least 10 rebreather dives each calendar year (Section 14.7).
At least one dive must be logged near the maximum depth of the diver's certification during each 6 month period. Divers certified to 165 feet or deeper may satisfy these requirements with dives to 130 feet or deeper.
Failure to meet the minimum activity levels may be cause for restriction or revocation of certification.

Requalification of Depth Certification
Once the requirements of Department Diver Certification (Section 4.3) and subsequent Depth Certifications (Section 4.6) have been met, divers whose Depth Certification has lapsed due to inactivity may be re-qualified by procedures adopted by the Department's Diving Safety Board.

4.7.2 Annual Diver Recertification
Each diver must attend an annual Recertification Course (Section 4.8).

4.7.3 Medical Re-Examination
All divers shall pass a medical examination at the intervals specified in Section 5.1.2. After each major illness or injury, as described in Section SECTION 5, a diver shall receive clearance to return to diving from a physician before resuming dive activities. The medical examination requirement cannot be waived for any diver.

4.7.4 Emergency Care Training
Divers must provide proof of current training in the following:
Adult Cardio-Pulmonary Resuscitation (CPR)
Emergency Oxygen Administration
First Aid for Diving accidents

4.7.5 Record Keeping Requirements
Divers must maintain required logs and maintenance records (Sections 2.6.1, 2.6.2, and 3.5.1). Monthly Dive Logs must be submitted to the DSO in a timely manner (Section 2.6.2).

4.8 ANNUAL DIVER RECERTIFICATION

Certified divers must attend a Recertification Course each calendar year. Course content will include:
DSP administrative review and update
Emergency care skills refresher or recertification, as required
Swimming Skills Evaluation (Section 4.4.7)

Swim 400 yards in full dive gear in the ocean breathing from snorkel
Supervised check-out and proficiency dives, and/or training in diving techniques
Other topics at the discretion of the DSB

4.9 CONSEQUENCES OF POLICY VIOLATION

Lapse of certification or failure to abide by any of the requirements in this *Manual* may result in informal counsel with the Diving Safety Officer, issuance of a Memorandum of Policy Violation, or restriction or revocation of certification (Section 1.4). Section 1.4 also describes the process for appeal and the requirements for recertification after a lapse or revocation.

SECTION 5

MEDICAL STANDARDS

5.1 MEDICAL REQUIREMENTS

5.1.1 General

Current certified divers and applicants for Department diver certification shall be declared by an examining physician to be fit to engage in diving activities, or diving activities as limited or restricted in the medical evaluation report. A current and valid copy of this report shall be on file with the DSO.

All medical evaluations required by this standard shall be performed by, or under the direction of, a licensed physician. The physician may be of the diver's choice, preferably one trained in diving/undersea medicine.

The diver should be free of any chronic disabling disease and free of any conditions considered absolute contraindications to diving (Appendix 1). The medical examination requirement cannot be waived for any diver.

5.1.2 Schedule of Medical Evaluations

Prior to candidacy for Department Diver Certification, each diver shall pass an initial diving physical examination. Each diver shall then pass a physical re-examination on the following schedule:
Divers 39 years old and younger- every three (3) years.
Divers 40 years old and older- every two (2) years.

Results of the examination must be submitted to the DSO on forms provided by the Department, including a certificate signed by a physician stating the diver is physically qualified for scuba diving (Appendices 1, 2, and 3). The Department will pay reasonable physical examination costs.

Divers may be granted a maximum 90 day grace period for delinquent re-examinations.

Following any major injury or illness or any condition requiring hospital care, clearance to return to diving must be obtained from a physician. If the injury or illness was pressure related, then the clearance to return to diving must come from a physician trained in diving medicine.

5.1.3 Information Provided to Examining Physician

The Diver shall provide a copy of the medical evaluation requirements of this standard to the examining physician (Appendices 1, 2, and 3).

5.1.4 Content of Medical Evaluations

Medical examinations conducted initially and at the intervals specified in Section 5.1.2 will consist of the following:
Completed Applicant Agreement for Release of Medical Information to the Diving Safety

Officer and the DSB (Appendix 2B)
Completed Diving Medical History Form (Appendix 3)
Completed Diving Physical Examination Form (Appendix 2)

5.1.5 Conditions Which May Disqualify Candidates from Diving
The conditions listed in Appendix 1 (Diving Medical Exam Overview for the Examining Physician) may disqualify candidates from diving and should be considered by the examining physician.

5.1.6 Laboratory Requirements for Diving Medical Examination
The examinations and laboratory tests listed in Appendix 2 (Medical Evaluation of Fitness for Scuba Diving Report) are required for initial and subsequent medical examinations. Additional requirements are indicated for divers age forty and over.

5.1.7 Physician's Written Report
After any medical examination relating to an individual's fitness to dive, the Department shall obtain a written report prepared by the examining physician, which will contain the examining physician's opinion of the individual's fitness to dive, including any recommended restrictions or limitations (Appendix 2). This report shall be reviewed by the DSO.

The Department shall make a copy of the physician's written report available to the individual.

VOLUME II

SPECIALIZED DIVING MODES

Sections 6 through 14

SECTION 6

SPECIALIZED DIVING MODES

6.1 GENERAL

6.1.1 Specialized Diving Modes Defined

The following diving modes or environments are considered specialized and require additional diver training and evaluation, and additional dive planning, preparation, and support:

Deeper than 130 feet
Requiring staged decompression
Incorporating breathing gas mixtures other than air
Involving delivery systems other than self-contained, open circuit systems (scuba)
Restricted overhead environment (cavern, cave, tunnel, ice, or shipwreck penetration)
Blue water (open ocean, with bottom depth deeper than the diver's certified depth)
Dry suit
Altitudes above 1,000 feet
Swiftwater
Tended or tethered
Black water or extremely low visibility
Light maintenance
Petroleum contaminated water
Any other particularly hazardous environments

6.1.2 Prior Approval and Additional Training Required

Approval for additional training for and use of specialized diving modes is required from the DSO. The DSO may establish procedures and requirements for the training and use of specialized diving modes beyond those listed in these sections.

SECTION 7

NITROX DIVING GUIDELINES

7.1 GENERAL

The following guidelines address the use of nitrox by scientific divers under Department auspices. Nitrox is defined for these guidelines as breathing mixtures composed predominately of nitrogen and oxygen, where the oxygen content is greater than 20.9 percent.

7.1.1 Prerequisites

(a) Eligibility

Only a certified diver (Section 4.1) diving under Department auspices is eligible for authorization to use nitrox. After completion, review, and acceptance of application materials, training and qualification as per these guidelines, an applicant will be

authorized to use nitrox within his/her depth authorization (Section 4.6), and within safe nitrox operating depths.

Application and Documentation
Application and documentation for authorization to use nitrox should include a copy of course certification and a completed Diving with Nitrox Form (Appendix 9) sent to the DSO to be placed in the diver's file.

7.2 Requirements for Authorization to Use Nitrox
Submission of documents and participation in aptitude examinations does not automatically result in authorization to use nitrox. The applicant must convince the DSO and members of the DSB that he/she is sufficiently skilled and proficient. The signature of the DSO on the authorization form will acknowledge authorization. After completion of training and evaluation, authorization to use nitrox may be denied to any diver who does not demonstrate to the satisfaction of the DSO or DSB the appropriate judgment or proficiency to ensure the safety of the diver and dive buddy.

Prior to authorization to use nitrox, the following minimum requirements should be met:

(a) Training
The diver must complete additional theoretical and practical training beyond the Scientific Diver certification level, to the satisfaction of the DSO and DSB.

(b) Examinations
Each diver should demonstrate proficiency in skills and theory in written, oral, and practical examinations covering:
Written examinations covering the information presented in the classroom training session(s) (i.e., gas theory, oxygen toxicity, and partial pressure determination).
Practical examinations covering the information presented in the practical training session(s) (i.e., gas analysis and documentation procedures).
Open water checkout dives, to appropriate depths, to demonstrate the application of theoretical and practical skills learned.

(c) Minimum Activity to Maintain Authorization
The diver should log at least one (1) nitrox dive per year. Failure to meet the minimum activity level may be cause for restriction or revocation of nitrox authorization.

7.3 Nitrox Training Guidelines
Training in these guidelines should be in addition to training for Diver-In-Training authorization (Section 4.2.3). It may be included as part of training to satisfy the Scientific Diver training requirements (Section 4.3).

(a) Classroom Instruction
Topics should include, but are not limited to: review of previous training; physical gas laws pertaining to nitrox; partial pressure calculations and limits; equivalent air depth (EAD) concept and calculations; oxygen physiology and oxygen toxicity; calculation of

oxygen exposure and maximum safe operating depth (MOD); determination of decompression schedules (both by EAD method using approved air dive tables, and using approved nitrox dive tables); dive planning and emergency procedures; mixing procedures and calculations; gas analysis; personnel requirements; equipment marking and maintenance requirements; dive station requirements.

The DSB may choose to limit standard nitrox diver training to procedures applicable to diving, and subsequently reserve training such as nitrox production methods, oxygen cleaning, and dive station topics to divers requiring specialized authorization in these areas.

(b) Practical Training

The practical training portion will consist of a review of skills as stated for scuba (Section 5.32.5), with additional training as follows:

Oxygen analysis of nitrox mixtures
Determination of MOD, oxygen partial pressure exposure, and oxygen toxicity time limits for various nitrox mixtures at various depths
Determination of nitrogen-based dive limits status by EAD method using air dive tables, and/or using nitrox dive tables, as approved by the DSB
Nitrox dive computer use may be included, as approved by the DSB

(c) Written Examination (based on classroom instruction and practical training)

Before authorization, the trainee should successfully pass a written examination demonstrating knowledge of at least the following:

Function, care, use, and maintenance of equipment cleaned for nitrox use
Physical and physiological considerations of nitrox diving (e.g., O2 and CO2 toxicity)
Diving policies and procedures as related to nitrox diving, either scuba or surface-supplied (depending on intended mode)
Given the proper information, calculation of:
Equivalent air depth (EAD) for a given fO2 and actual depth
pO2 exposure for a given fO2 and depth
Optimal nitrox mixture for a given pO2 exposure limit and planned depth
Maximum operational depth (MOD) for a given mix and pO2 exposure limit
For nitrox production purposes, percentages/psi of oxygen present in a given mixture, and psi of each gas required to produce a pO2 by partial pressure mixing
Decompression Dive table and dive computer selection and usage
Nitrox production methods and considerations
Oxygen analysis
Nitrox operational requirements (Section 7.23), dive planning, and dive station components

(d) Open Water Dives

A minimum of two supervised open water dives using nitrox should be required for

authorization. The mode used in the dives should correspond to the intended application (i.e., scuba or surface-supplied). If the MOD for the mix being used can be exceeded at the training location, direct, in-water supervision is required.

(e) Surface-Supplied Nitrox Training

All training as applied to surface-supplied diving (practical, classroom, and open water) will follow the Department's surface-supplied diving standards, including additions listed in Section 7.60.

7.4 Scientific Nitrox Diving Policies

7.4.1 Dive Personnel Requirements

Nitrox Diver-In-Training - A Diver-In-Training, who has completed the requirements of Section 4.2.3 (Diver-In-Training Permit) and the nitrox training and authorization requirements, may be authorized by the DSO to use nitrox during training dives under the direct supervision a Scientific Diver who also holds a nitrox authorization. Dive depths should be restricted to those specified in the diver's authorization.

Scientific Diver - A Scientific Diver, who has completed the requirements of Section 4.3 (Department Diver Certification) and the nitrox training and authorization requirements, may be authorized by the DSO to use nitrox. Depth authorization to use nitrox should be the same as those specified in the diver's authorization, and within safe nitrox operating depths, as described in Section 5.61.

Lead Diver - On any dive during which nitrox will be used by any team member, the Lead Diver should be authorized to use nitrox, and hold appropriate authorizations required for the dive, as specified in this *Manual*. Lead Diver authorization for nitrox dives by the DSO and/or DSB should occur as part of the dive plan approval process.

In addition to responsibilities listed in Section 1.27, the Lead Diver should:
As part of the dive planning process, verify that all divers using nitrox on a dive are properly qualified and authorized;
As part of the pre-dive procedures, confirm with each diver the nitrox mixture the diver is using. Also establish dive team maximum depth and time limits according to the shortest time limit or shallowest depth limit among the team members.
The Lead Diver should also reduce the maximum allowable pO2 exposure limit for the dive team if on-site conditions so indicate (Section 7.4.2).

7.4.2 Nitrox Diving Parameters

(a) Oxygen Exposure Limits

The inspired oxygen partial pressure experienced at depth should not exceed 1.6 ATA. All dives performed using nitrox breathing mixtures should comply with the current *NOAA Diving Manual* "Oxygen Partial Pressure Limits for 'Normal' Exposures"

The maximum allowable exposure limit should be reduced in cases where cold or strenuous dive conditions, or extended exposure times are expected. The DSB should consider this in the review of any dive plan application, which proposes to use nitrox.

The Lead Diver should also review on-site conditions and reduce the allowable pO_2 exposure limits if conditions indicate.

If using the equivalent air depth (EAD) method the maximum depth of a dive should be based on the oxygen partial pressure for the specific nitrox breathing mix to be used.

(b) Bottom Time Limits

Maximum bottom time should be based on the depth of the dive and the nitrox mixture being used. Bottom time for a single dive should not exceed the NOAA maximum allowable "Single Exposure Limit" for a given oxygen partial pressure, as listed in the current NOAA Diving Manual.

(c) Dive Tables and Gases

A set of DSB approved nitrox dive tables should be available at the dive site. When using the equivalent air depth (EAD) method, dives should be conducted using air dive tables approved by the DSB. If nitrox is used to increase the safety margin of air-based dive tables, the MOD and oxygen exposure and time limits for the nitrox mixture being dived should not be exceeded.

Breathing mixtures used while performing in-water decompression, or for bail-out purposes, should contain the same or greater oxygen content as that being used during the dive, within the confines of depth limitations and oxygen partial pressure limits.

Department divers using nitrox shall not exceed their ACTUAL depth certification unless accompanied by a diver with a deeper certification as provided in the Department Diving Safety Manual.

When diving with nitrox at elevations greater than 1000 feet, divers should calculate profiles based on altitude adjustments first then augment with the nitrox EAD.

(d) Nitrox Dive Computers

Dive computers may be used to compute decompression status during nitrox dives. Manufacturers' guidelines and operations instructions should be followed. Use of nitrox dive computers should comply with dive computer guidelines included in the AAUS Standards. nitrox dive computer users should demonstrate a clear understanding of the display, operations, and manipulation of the unit being used for nitrox diving prior to using the computer, to the satisfaction of the DSO or designee. For more information, see http://www.aaus.org.

If nitrox is used to increase the safety margin of an air-based dive computer, the MOD and oxygen exposure and time limits for the nitrox mixture being dived should not be exceeded.

Dive computers capable of pO2 limit and fO2 adjustment should be checked by the diver prior to the start each dive to assure compatibility with the mix being used.

(e) Repetitive Diving

Repetitive dives using nitrox mixtures should be performed in compliance with procedures required of the specific dive tables used. Residual nitrogen time should be based on the EAD for the specific nitrox mixture to be used on the repetitive dive, and not that of the previous dive.

The total cumulative exposure (bottom time) to a partial pressure of oxygen in a given 24 hour period should not exceed the current NOAA Diving Manual 24-hour Oxygen Partial Pressure Limits for "Normal" Exposures. When repetitive dives expose divers to different oxygen partial pressures from dive to dive, divers should account for accumulated oxygen exposure from previous dives when determining acceptable exposures for repetitive dives. Both acute (CNS) and chronic (pulmonary) oxygen toxicity concerns should be addressed.

7.4.3 Oxygen Parameters

(a) Authorized Mixtures

Mixtures meeting the criteria outlined in Section 7.24 may be used for nitrox diving operations, upon approval of the DSB.

(b) Purity

Oxygen used for mixing nitrox-breathing gas should meet the purity levels for "Medical Grade" (U.S.P.) or "Aviator Grade" standards.

In addition to the AAUS Air Purity Guidelines (Section 3.60), the following standard should be met for breathing air that is either:
Placed in contact with oxygen concentrations greater than 40%.
Used in nitrox production by the partial pressure mixing method with gas mixtures containing greater than 40% oxygen as the enriching agent.

Air Purity: CGA Grade E (Section 3.60)	
Component	**Maximum**
Condensed Hydrocarbons	5mg/m3
Hydrocarbon Contaminants	No greater than 0.1 mg/m3

7.4.4 Gas Mixing and Analysis

(a) Personnel Requirements

Individuals responsible for producing and/or analyzing nitrox mixtures should be knowledgeable and experienced in all aspects of the technique. Only those individuals approved by the DSO and/or DSB should be responsible for mixing and/or analyzing nitrox mixtures.

(b) Production Methods

It is the responsibility of the DSB to approve the specific nitrox production method used.

7.4.5 Analysis Verification by User
It is the responsibility of each diver to analyze the oxygen content of their scuba cylinder prior to the dive and acknowledge in writing the following information for each cylinder: fO2, MOD, cylinder pressure, date of analysis, and user's name.
Individual dive log reporting forms should report fO2 of nitrox used, if different than 21%.

7.5 Nitrox Diving Equipment
All of the designated equipment and stated requirements regarding scuba equipment required in the Department's Diving Safety Manual and AAUS standards should apply to nitrox scuba operations. Additional minimal equipment necessary for nitrox diving operations include labeled, dedicated scuba cylinders and oxygen analyzers

7.5.1 Oxygen Cleaning and Maintenance Requirements
Requirements for Oxygen Service
All equipment, which during the dive or cylinder filling process is exposed to concentrations greater than 40% oxygen at pressures above 150 psi, should be cleaned and maintained for oxygen service.

Equipment used with oxygen or mixtures containing over 40% by volume oxygen shall be designed and maintained for oxygen service. Oxygen systems over 125 psig shall have slow-opening shut-off valves. This should include the following equipment: scuba cylinders, cylinder valves, scuba and other regulators, cylinder pressure gauges, hoses, diver support equipment, compressors, and fill station components and plumbing.

7.5.2 Scuba Cylinder Identification Marking
Scuba cylinders to be used with nitrox mixtures should have the following identification documentation affixed to the cylinder:

Cylinders should be marked "NITROX", or "EANx", or "Enriched Air".
Nitrox identification color-coding should include a 4-inch wide green band around the cylinder, starting immediately below the shoulder curvature. If the cylinder is not yellow, the green band should be bordered above and below by a 1-inch yellow band.
The alternate marking of a yellow cylinder by painting the cylinder crown green and printing the word "NITROX" parallel to the length of the cylinder in green print is acceptable.
Other markings, which identify the cylinder as containing gas mixes other than Air, may be used as the approval of the DSB.
A contents label should be affixed, to include the current fO2, date of analysis, and MOD.
The cylinder should be labeled to indicate whether the cylinder is prepared for oxygen or nitrox mixtures containing greater than 40% oxygen.

Regulators
Regulators to be used with nitrox mixtures containing greater than 40% oxygen should be cleaned and maintained for oxygen service, and marked in an identifying manner.

Other Support Equipment
An oxygen analyzer is required which is capable of determining the oxygen content in the scuba cylinder. Two analyzers are recommended to reduce the likelihood of errors due to a faulty analyzer. The analyzer should be capable of reading a scale of 0 to 100% oxygen, within 1% accuracy.

All diver and support equipment should be suitable for the fO2 being used.

The Compressor/filtration system must produce oil-free air.

An oil-lubricated compressor placed in service for a nitrox system should be checked for oil and hydrocarbon contamination at least quarterly.

All Fill Station Components of a nitrox fill station that will contact nitrox mixtures containing greater than 40% oxygen should be cleaned and maintained for oxygen service. This includes cylinders, whips, gauges, valves, and connecting lines.

SECTION 8

STAGED DECOMPRESSION DIVING

8.1 General
Staged decompression diving will be defined as any diving during which the diver cannot perform a direct ascent to the surface without performing a mandatory decompression stop to allow the release of inert gas from the diver's body.

The following procedures shall be observed when conducting planned decompression stops.

8.1.1 Dives Shallower than 130 Feet
Staged Decompression dives performed shallower than 130 feet shall only be made with prior approval of the Diving Safety Officer. They must also meet the requirements of this section.

8.1.2 Dives Deeper than 130 Feet
Divers must be able to justify operational necessity for dives deeper than 130 feet.

All dives greater than 130 feet will be considered staged decompression diving. The training, equipment and operational requirements for staged decompression diving (Sections 7.31-7.33) must be followed. Before the dives occur, the diver must show appropriate competence to work at depth in a hyperbaric chamber test.

8.1.3 Dives Deeper than 150 Feet
Dives deeper than 150 feet will be considered on an individual basis. Due to the training and gear requirements of dives deeper than 150 feet, however, an explanation of why alternative resources (such as contracted commercial divers) are not being used

must be submitted to and approved by the DSO.

8.2 Minimum Experience and Training Requirements
Prerequisites:
Scientific Diver qualification according to Section 5.00
Minimum of 100 logged dives
Demonstration of the ability to safely plan and conduct dives deeper than 100 feet
Nitrox certification/authorization is recommended

Training shall be appropriate for the conditions in which dive operations are to be conducted

Minimum Training shall include the following:
A minimum of 6 hours of classroom training to ensure theoretical knowledge to include: physics and physiology of decompression; decompression planning and procedures; gas management; equipment configurations; decompression method, emergency procedures.
It is recommended that at least one training session be conducted in a pool or sheltered water setting, to cover equipment handling and familiarization, swimming and buoyancy control, to estimate gas consumption rates, and to practice emergency procedures.
A minimum of six open-water training dives simulating/requiring decompression shall be conducted, emphasizing planning and execution of required decompression dives, and including practice of emergency procedures.
Progression to greater depths shall be by 4-dive increments at depth intervals as specified in Section 5.40.
No training dives requiring decompression shall be conducted until the diver has demonstrated acceptable skills under simulated conditions.

The following are the minimum skills the diver must demonstrate proficiently during dives simulating and requiring decompression:
Buoyancy control
Proper ascent rate
Proper depth control
Equipment manipulation
Stage/decompression bottle use as pertinent to planned diving operation
Buddy skills
Gas management
Time management
Task loading
Emergency skills

Divers shall demonstrate to the satisfaction of the DSO or the DSO’s designee proficiency in planning and executing required decompression dives appropriate to the conditions in which diving operations are to be conducted.

Divers shall document training in staged decompression diving appropriate for the

conditions in which dive operations are to be conducted. Such documentation shall be to the satisfaction of the DSO. Training shall be conducted by agencies or Instructors approved by the DSO.

Upon completion of training, the diver shall be authorized to conduct required decompression dives with DSO approval.

8.3 Minimum Equipment Requirements
Cylinder, valve, regulator, and pressure gauge systems for primary (bottom) gas supplies will be configured in a redundant manner that allows continuous breathing gas delivery in the event of failure of any one component of the system.

Cylinders will be of such volume and configuration adequate for planned diving operations.

One of the second stages on the primary gas supply will be configured with a hose of adequate length to facilitate effective emergency gas sharing in the intended environment.

Additional dive equipment shall include:

Diver signaling and location devices adequate for the planned diving operations and environment

Lines, line reels, lift bags and floats as necessary to hold a diver at required decompression stop depths

Compass

Snorkel is optional at the DSB's discretion, as determined by the conditions and environment

Redundancy in the following components is desirable and may be required at the discretion of the DSO:

Dive Computers or Decompression Calculation Devices
Dive Timing Devices
Depth Gauges
Buoyancy Control Devices
Cutting Devices
Lift Bags and Line Reels

8.4 Minimum Operational Requirements
Approval of dive plan applications to conduct required decompression dives shall be on a case-by-case basis.

The maximum pO_2 to be used for planning required decompression dives is 1.6. It is recommended that a pO_2 of less than 1.6 be used during bottom exposure.

Divers' gas supplies will be adequate to meet planned operational requirements and foreseeable emergency situations. Plans will call for a "Rule of Thirds" where one third of the bottom gas supply is held in reserve.

Decompression dives may be planned using dive tables, dive computers, and/or PC software approved by the DSO/DSB.

Breathing gases used while performing in-water decompression will contain the same or greater oxygen content as that used during the bottom phase of the dive.

Emergency procedures approved by the DSO for loss of gas supply, equipment malfunction, unexpected conditions, or dive team separation must be developed and included in the application. Divers shall review emergency procedures prior to each diving day.

If breathing gas mixtures other than air are used for required decompression, their use will be in accordance with those policies set forth in the appropriate sections of this *Manual*.

The maximum depth for required decompression using air as the bottom gas will be 190 feet.

Use of additional nitrox and/or high fO_2 decompression mixtures as travel and decompression gases to decrease decompression obligations is encouraged. However additional training and equipment may be required.

Use of alternate inert gas mixtures (commonly referred to as mixed gases) to limit narcosis is encouraged for depths greater than 150 feet providing the diver has sufficient training in their use. (Currently, no Department divers are authorized to use alternate inert gas mixtures).

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

SECTION 9

RESTRICTED OVERHEAD ENVIRONMENTS

9.1 General

Restricted overhead environments include any diving environment in which a direct ascent to the surface is impeded by a physical barrier including; caves, caverns, ice, and shipwreck penetration. It does not include underwater arches, lava tubes, opened

shipwrecks or kelp forests, in which:
Two divers can easily swim abreast
There is no significant danger of entrapment or entanglement
Loss of visibility due to siltation is unlikely

9.2 Training Requirements
Divers shall document training in restricted overhead environment diving appropriate for the conditions in which dive operations are to be conducted.

Divers shall demonstrate to the satisfaction of the DSO or a designee, proficiency in planning and executing dives in a restricted overhead environment appropriate to the conditions in which diving operations are to be conducted.

9.3 Equipment Requirements
Divers shall employ a continuous guideline from a point outside the restricted overhead environment to their position.

Divers shall use redundant breathing gas systems while in restricted overhead environments. Redundant breathing gas delivery systems will be designed such that no single component failure can prevent access by the diver to an appropriate breathing gas supply.

An alternate second stage will be included with a hose of adequate length to facilitate emergency gas sharing while swimming in a single file formation.

Each diver shall carry a minimum of three lights.

The DSO may require redundancy in other equipment systems to ensure dive team safety, including:

Dive Computers or Decompression Calculation Devices
Dive Timing Devices
Depth gauges
Buoyancy Control Devices

9.4 Operational Requirements
Divers shall immediately exit a restricted overhead environment when a light source or a required piece of equipment fails or malfunctions.

Divers shall begin exiting the overhead environment when any member of the dive team reaches two-thirds of his/her starting primary breathing gas supply (“the Rule of Thirds”).

Where an enclosed or confined space is not large enough for two divers, a diver shall be stationed at the underwater point of entry, an orientation line shall be used, and an emergency breathing gas supply will be available at the point of entry.

Emergency procedures for loss of gas supply, equipment malfunction, team separation, unexpected diving conditions and loss of visibility must be developed. The divers must review emergency procedures prior to each dive.

9.5 Additional Requirement for Ice and Polar Diving
Divers planning to dive under ice or in polar conditions should use the following: "Guidelines for Conduct of Research Diving", National Science Foundation, Division of Polar Programs, 1990.

SECTION 10

BLUE WATER DIVING

10.1 General

Blue water diving is defined as diving conducted in any body of water in which there is no physical bottom within diving depth ranges. According to AAUS this is water "generally greater than 200 feet deep". It requires special training and the use of multiple-tethered diving techniques. The following policies have been derived from, Blue water Diving Guidelines (Heine, J.N., Ed., 1986. California Sea Grant College Program Publication No. T-CSGCP-014). Exceptions to this may be made on a case-by-case basis, if a risk of diver entanglement with other structures exists, or when there are other means of physical control. Procedures for diver control and communication must be developed to the satisfaction of the DSO.

10.2 Training Requirements

The diver shall complete practical training in blue water diving techniques, and demonstrate proficiency to the satisfaction of the DSO or a designee. This training shall include:

Blue water diving equipment deployment
Entry procedures
Buoyancy control and awareness
Diver communication
Out-of-air procedures
Dangerous marine life defensive techniques
Exit procedures
Entanglement procedures
Emergency communication and protocols

10.3 Equipment Requirements

Divers shall employ a down-line and counterweighted trapeze line system in order to maintain diver contact and depth control.

The total weight in water of the down-line and tether array will be no greater than 10 pounds.

All diver tether attachments will be made with connectors that can be quickly released by the diver while the line is under a tension at least equivalent to the weight of the entire array.

Attachments must be to either the diver's buoyancy compensator, or to a separate harness, but not to the diver's weight belt.

10.4 Operational Requirements

A safety diver shall be stationed at the trapeze attachment point. This diver's functions are monitoring and controlling the dive team, and monitoring the diving environment for potential hazards. This diver shall be authorized to terminate diving operations for any

or all members of the dive team.

A lookout/boat operator shall be stationed aboard any vessel from which blue water diving is conducted as long as divers are in the water.

SECTION 11
SURFACE-SUPPLIED AND HOOKAH DIVING

11.1 General
Surface-supplied dives will comply with all scuba diving procedures in this *Manual*. This includes applicable policies listed elsewhere in this chapter (Staged Decompression, Nitrox, etc.). Surface-supplied will not be conducted at depths greater than 190 feet.

Divers using the surface-supplied mode shall be equipped with a diver-carried independent reserve breathing gas supply.

Divers using the surface-supplied mode shall maintain voice communication with the surface tender.

Each surface-supplied diver shall be tended by a separate dive team member while in the water.

In the case of a tethered diver with direct communication to the surface, the buddy may be a fully suited diver on the surface, prepared to assist.

11.2 Training Requirements
Divers shall satisfy the DSO that they possess the required training, skills, and knowledge to conduct surface-supplied operations.

Equipment Requirements
Specific equipment requirements will be reviewed and defined by the DSO on a case-by-case basis. Equipment maintenance, repair, and record keeping will comply with the requirements of *this Manual*.

11.3 Operational Requirements
While in the water, each diver shall be assisted by a separate trained tender.

The surface-supplied breathing gas supply must be sufficient to support all surface-supplied divers in the water for the duration of the planned dive, including decompression, as well as providing for emergencies.

During operations when only one surface-supplied diver is in the water, there must be a fully equipped standby diver in attendance at the dive location.

SECTION 12

LIGHT MAINTENANCE DIVING

12.1 Operational Requirements

Job Hazard Analysis (JHA) - Before undertaking any underwater task, a Job Hazard Analysis (JHA) shall be performed. The purpose of the Job Hazard Analysis is to identify hazards associated with each step of a job, and to develop solutions that will either eliminate or guard against the hazard. Required portions of the JHA are:

Sequence of Basic Job Steps
Potential Hazards
Safe Procedures and Protection
Responsibility Assignments
Personnel Assignments
Underwater Hazards including, but not limited to:
Potential for diver fouling or entrapment
Differential pressure hazards including but not limited to underwater discharges, dredging, major intakes, pumps, sluices, suctions or valve culverts
Hazardous energy situations including but not limited to active cathodic protection, high intensity sonar, propellers, pumps, vessels, or any mechanical apparatus whose inadvertent operation would be hazardous to the diver (All such devices shall be deactivated and their controls tagged prior to the commencement of the diving operation.)
Diving in contaminated liquid, including but not limited to chemical, microbiological, or radiological contamination or any thermal or toxic threat to the diver
Limited access or penetration situations such as entering a pipe, tunnel, wreck, or similarly enclosed or confining structure (other than a habitat).These situations shall require an underwater tender at the point of entry and that divers are equipped with an appropriate diver-carried reserve gas breathing supply
Operations involving explosives

The JHA should be reviewed and updated periodically whenever new equipment or procedures are introduced into the work site. This is especially true if an accident has occurred previously.

Decompression Chambers are required for any Light Maintenance dive in excess of 80 fsw or requiring stage decompression. On site chambers must have a minimum capability of compression to 6 ATA (equivalent to 165 fsw).

Stand-by Divers, when assigned, will be on deck, suitably equipped, and ready to dive.

A Diver-Carried Reserve Breathing Supply must be provided when diving deeper than 60 fsw, on dives requiring decompression regardless of depth, when direct ascent to the surface is not available, or when bell diving, except where heavy gear is worn.

A diver-carried reserve breathing gas supply shall supply a physiologically appropriate mixture for the depths involved.

Diver-carried reserve breathing gas supplies must provide a positive indication to the diver that his reserve has been actuated. Such an indication can be the requirement for the diver to open a valve, a visual signal or other appropriate methods.

The diver-carried reserve breathing gas supply shall be of sufficient duration for use until the diver can reach the surface, reach another source of breathing media or be reached by the standby diver equipped with another source of breathing media.

In all cases the activation of a diver-carried reserve breathing gas supply shall cause the dive to be aborted. The reason for activation of the diver's reserve must be ascertained and corrected prior to continued use of the involved equipment.

Two-way Audio Communications between the diver and tender shall be used on Light Maintenance dives. Audio-communication is not required for scuba operations, where the team may use either safety line pull signals when diving tethered, or an in-water buddy team.

ANSI approved Personal Protective Equipment shall be worn when required. These items include but are not limited to: protective head gear, protective foot-wear, protective eye-wear, personal flotation devices, hearing protection, harness with approved double locking elastic lanyard, and respiratory equipment.

SECTION 13

PETROLEUM CONTAMINATED WATER DIVES

All diving operations in a petroleum contaminated environment will be conducted as part of the standard Incident Command System (Section 1.2.10), incorporating a Diving Operations function at an organizational level appropriate to the incident size. Refer to the *Oil Spill Field Operations Guide*, *ICS-OS-420-1*. This is not a guideline for diving in biologically or chemically hazardous conditions. Refer also to the *Oil Spill Area Diving Guidance Document.*

13.1 Operational Requirements

Prior to conducting the dive the following shall be obtained and/or completed:

The type of pollutant and the Material Safety Data Sheet (MSDS)
Ensure that active discharge (under pressure) has stopped; the source controlled
Identification of the chemical hazards and precautions, see MSDS
Determine who controls vessel operations and the operation of any suspect vessel and/or equipment (valves, screens, gates or other mechanical hazards)
Completion of the Site Safety Plan and the Medical Plan
Notify the appropriate Department Industrial Hygienist

Based on the above information the Lead Diver will submit a dive plan to the Incident Command for approval and incorporation into the Incident Action Plan. The following

points should be considered in the dive plan:

Response vessel operations
Ensure that all in/under water equipment on the subject vessel or location are secured (shut off/down). For a commercial vessel or vessel subject to pilotage have the Master or Watch Officer fly the alpha code flag and note so in the ships log. For storm drain discharges have the operator “Lock out and Tag” all automatic or manually activated pumps, gates and valves
Contaminated diver procedures
Dive purpose and activities
Known hazards and procedures to avoid contamination

When enforcement (LED) is conducting covert or otherwise secret operations exceptions to the above may be made providing that:

A dive plan is still formulated and encompasses the above listed hazards and safety considerations.

Personal or public safety must not be jeopardized to perform the operation.

When an Incident Command System is not in place (such as during a Natural Resource Damage Assessment) it must be activated prior to diving.

SECTION 14

REBREATHERS

14.1 General
This section contains standards and requirements for the use of rebreathers by Department divers. It considers training, equipment, and operational and additional safety protocols.
Application of these Rebreather Standards is in addition to pertinent requirements of all other sections of this *Manual*, Volumes I and II.
The DSB reserves the authority to review each application of this and all specialized diving modes on a case-by-case basis, and include any further requirements deemed necessary beyond those listed here.
No diver shall conduct operations using rebreathers without prior review and approval of the DSB.
In all cases, trainers shall be qualified for the type of instruction to be provided. Training shall be conducted by agencies or instructors approved by DSO and DSB.
Definition
A rebreather is any device that recycles some or all of the exhaled gas in the breathing loop and returns it to the diver. Rebreathers maintain levels of oxygen and carbon dioxide that support life by metered injection of oxygen and chemical removal of carbon dioxide. These characteristics fundamentally distinguish rebreathers from open-circuit life support systems, in that the breathing gas composition is dynamic rather than fixed.

14.2 Approved Rebreathers

Type

Currently, Oxygen Closed-Circuit Rebreathers are the only type authorized for use by the Department. An oxygen rebreather recycles breathing gas, consisting of pure oxygen, replenishing the oxygen metabolized by the diver. Oxygen rebreathers are generally the least complicated design but are limited in depth of use due to the physiological limits associated with oxygen toxicity.

Semi-Closed Circuit, and Closed-Circuit Mixed Gas rebreather types are not approved for Department diving at this time, with the exception of use for field evaluation with prior permission of the DSO.

Models

The following models of Oxygen Closed-Circuit Rebreathers are currently approved for marine mammal capture activities, associated training, and proficiency dives:

Make	Model	Manufacturer
Drager	LAR V	Drager, Inc.
Aqualung	FROGS	Aqualung Int'l.

Other closed circuit diving equipment may be used for field evaluation dives with the prior permission of the DSO.

14.3 Equipment Requirements

General

Only those models of rebreathers specifically approved by DSB shall be used

Rebreathers should meet the quality control/quality assurance protocols of the International Organization for Standardization (ISO) requirements: ISO 9004:2009 or the most current version, AND successful completion of CE (Conformité Européenne) or DSB approved third party testing

Rebreather modifications (including consumables and operational limits) that deviate from or are not covered by manufacturer documentation should be discussed with the manufacturer and approved by the DSB prior to implementation

Individual Equipment Requirements- O2CCR **X = include, IA = If Applicable**	
DSB approved rebreather make and model	X
Bottom timer, and depth gauge	X
Dive computer (separate from rebreather unit)	
Approved dive tables	
SMB (surface marker buoy) and line reel or spool with sufficient line to	IA
Access to an oxygen analyzer	X

Cutting implement	X
BCD capable of floating a diver with a flooded loop and/or dry suit at the surface	X
Bailout gas supply of sufficient volume for planned diving activities	X
Approved CO2 absorbent and other consumables	X

14.4 Equipment Maintenance Requirements

Rebreathers shall be maintained in accordance with manufacturer specifications. A maintenance log will be kept and will include at minimum:
Dates of service
Service performed
Individuals or company performing the service
Field repairs and replacement of components covered in rebreather diver training is not annual maintenance and may be performed by the rebreather diver in accordance with DSB policy.

If the rebreather is to be serviced and maintained by the diver, the diver must demonstrate to the DSO or a designee proficiency in proper system maintenance, including full breathing loop disassembly and cleaning (mouthpiece, check-valves, hoses, counterlung, absorbent canister, etc.), and other tasks required by specific rebreather models.

14.5 Operational Requirements

General
Planned oxygen partial pressure exposure shall not exceed 1.6 ata. This limits the depth of 100% oxygen rebreathers to 19.6 feet.
CNS and Oxygen Tolerance Units (OTUs) should be tracked for each diver. Exposure limits should be established by the DSB

Equipment
All rebreather divers shall have at their disposal an alternate means to return to the surface in the event of a catastrophic, unrecoverable breathing loop failure (e.g., a sufficient open-circuit gas supply).
CO2 scrubber media will be kept in a cool, dry location in a sealed container until required for use. Use and reuse of should be per manufacture recommendations or as defined by the DSB
User replaceable consumable rebreather components should be replaced per manufacture recommendations or as defined by the DSB
Rebreather equipment will be used and maintained in accordance with manufacturer specifications including pre- and post-dive procedures and operational limits (e.g., depth, water temperature, etc.).

Dive Plan
In addition to standard dive plan components, at a minimum all dive plans that include the use of rebreathers must include:
Information about the specific rebreather model(s) to be used

Type of CO2 absorbent material
Composition and volume(s) of supply gasses
Bailout procedures
Other specific details as required by the DSB
Identification of possible systems interference by underwater tools or tasks
Mitigation for rebreather use under conditions where heavy physical exertion is anticipated

Additional Policies
The DSB or their designee will establish policies for:
Use of checklists related to rebreather operations
Pre- and post-dive equipment checks to be conducted by divers
Disinfection of rebreathers to be used by divers
Pre-breathing of rebreathers used by divers
Use of mixed mode and mixed rebreather platform dive teams under DFW auspices. If mixed mode and/or mixed platform dive teams are permitted, at minimum, divers must be cross-briefed on basic system operations for establishing positive buoyancy, closing a rebreather diver's breathing loop, and procedures for gas sharing
Implementing workup dives within the program; Pre-operation workup dives, including review and practice of emergency recognition and response skills, and management of task loading are required for operations defined by the DSB as beyond the scope of normal operating conditions.
Reauthorization for the use of rebreathers if minimum proficiency requirements are not met
Reestablishment of authorization to use rebreathers must require more than just performing a dive on a particular make or model of rebreather
At minimum demonstrated skills included in the required training elements for the level of rebreather operation must be performed and reevaluated.

14.6 Training Guidelines
Prerequisites for Rebreather Candidates
Active Department Diver status, with 60 foot depth certification
Completion of minimum 100 open-water dives on open circuit SCUBA. The DSB may require additional dive experience.
Nitrox training for use of breathing mixtures containing 100% oxygen is required

Training, General
Divers must satisfactorily complete a rebreather-training program authorized by the manufacturer or equivalent training approved by the DSO or a designee.
Specific training requirements for each rebreather model shall be defined by the DSB on a case-by-case basis. Training shall include factory-recommended requirements, but may exceed this.
Successful completion of training does not in itself authorize the rebreather candidate to use rebreathers. In addition to pre-dive, dive, and post-dive operational procedures, the candidate must demonstrate to the DSB or its designee that he/ she possesses the proper judgment and discipline to safely conduct rebreather diving in the context of

planned operations.
Post-training supervised dives are required before the rebreather candidate is authorized to use rebreather for research dives.

Instructional Guidelines
Who may teach: Individuals authorized as an O2 Rebreather Instructor by the DSB; in all cases, the individual authorized must have operational experience on the rebreather platform being taught, and where applicable the individual being authorized should be authorized as an instructor by the respective rebreather manufacturer or their designee.
The training area for O2 Rebreathers should not exceed 20 fsw in depth
Maximum Student/Instructor Ratio: 4 to 1. This ratio is to be reduced as required by environmental conditions or operational constraints
Upon completion of practical training, the rebreather candidate must demonstrate proficiency in pre-dive, dive, and post-dive operational procedures for the particular model of rebreather to be used
Supervised dives target activities associated with the planned science diving application. Supervisor for these dives is the DSO or designee, experienced with the make/model rebreather being used

Oxygen CCR Training Requirements
Rebreather candidates must demonstrate to the DSO or designee an understanding of oxygen rebreather concepts and demonstration of practical proficiency, including, but not limited to:

Topic Requirements **Entry Level Training- O2CCR** X = include, ISE = If So Equipped	
Academic	
History of technology	X
Medical & physiological aspects of:	
Oxygen toxicity	X
Chemical burns & caustic cocktail	X
Hypoxia	X
Hypercapnia	X
Arterial gas embolism	X
Middle Ear Oxygen Absorption Syndrome	X
Hygienic concerns	X
Nitrogen absorption & decompression sickness	
CO2 retention	X
Hyperoxia-induced myopia	X
System design, assembly, and operation, including:	
Layout and design	X
Oxygen control systems	X
Diluent control systems	
Use of checklists	X
Complete assembly and disassembly of the unit	X

Canister design & proper packing and handling of chemical absorbent	X
Decompression management and applicable tracking methods	
Oxygen and high pressure gas handling and safety	X
Fire triangle	X
Filling of cylinders	X
Pre-dive testing & trouble shooting	X
Post-dive break-down and maintenance	X
Trouble shooting and manufacturer authorized field repairs	X
Required maintenance and intervals	X
Manufacturer supported additional items (ADV, temp stick, CO2 monitor, etc.)	ISE
Dive planning:	
Operational planning	X
Gas requirements	X
Oxygen exposure and management	X
Gas density calculations	
Oxygen metabolizing calculations	X
Scrubber limitations	X
Mixed mode diving (buddies using different dive modes)	X
Mixed platform diving (buddies using different rebreather platforms)	X
Problem Recognition & Emergency Procedures:	
Applicable open circuit emergency procedures for common gear elements	X
Loss of electronics	ISE
Partially flooded loop	X
Fully flooded loop	X
Cell warnings	
Battery warnings	ISE
High O2 warning	ISE
Low O2 warning	ISE
High CO2 warning	ISE
Recognizing issues as indicated by onboard scrubber monitors	ISE
Recognizing hypercapnia signs and symptoms in self or others	X
Excluded O2 cell(s)	ISE
Loss of Heads Up Display (HUD)	ISE
Loss of buoyancy	X
Diluent manual add button not functioning	
O2 manual add button not functioning	ISE
Exhausted oxygen supply	X
Exhausted diluent supply	
Lost or exhausted bailout	ISE
Handset not functioning	ISE
Solenoid stuck open	ISE
Solenoid stuck closed	ISE
ADV stuck open	ISE
ADV stuck closed	ISE
Isolator valve(s) not functioning	ISE

Oxygen sensor validation	ISE
CO2 sensor validation	IA
Gas sharing	X
Diver assist and diver rescue	X
Other problem recognition and emergency procedures specific to the particular unit, environment, or diving conditions	X
Practical Training and Evaluations (demonstrated minimum):	
Use of checklists	X
Carbon dioxide absorbent canister packing	X
Supply gas cylinder analysis and pressure check	X
Test of one-way valves	X
System assembly and breathing loop leak testing	X
Oxygen control system calibration	ISE
Proper pre-breathe procedure	X
In-water bubble check	X
Proper buoyancy control during descent, dive operations, and ascent	X
System monitoring & control during descent, dive operations, and ascent	X
Proper interpretation and operation of system instrumentation	X
Proper buddy contact and communication	X
Use of a line reel or spool to deploy an SMB from planned dive depth and while controlling buoyancy in the water column	X
Proper management of line reel or spool, and SMB during ascents and safety or required stops	X
Unit removal and replacement on the surface	X
Bailout and emergency procedures for self and buddy, including:	
System malfunction recognition and solution	X
Manual system control	ISE
Flooded breathing loop recovery	IA
Absorbent canister failure	X
Alternate bailout options	X
Manipulation of onboard and offboard cylinder valves	X
Manipulation of bailout cylinders (removal, replacement, passing and receiving while maintaining buoyancy control)	ISE
Manipulation of quick disconnects, isolator valves, and manual controls specific to the unit and gear configuration	ISE
Proper system maintenance, including:	
Breathing loop disassembly and disinfection	X
Oxygen sensor replacement	ISE
Battery removal and replacement or recharging	ISE
Other tasks as required by specific rebreather models	X
Written Evaluation	X
Supervised Rebreather Dives (see below)	X

Oxygen CCR Underwater Requirements (Minimum)

Pool/Confined Water	Openwater	Supervised Dives

1 Dive, 90 – 120 minutes	4 dives, 120 minutes cumulative	2 Dives, 120 minutes cumulative

Rebreather Crossover Training
Crossover training to a new rebreather platform requires a minimum of 4 training dives for a minimum cumulative dive time of 240 min.

14.7 Maintenance of Certification
Rebreather proficiency must be maintained by periodic performance and evaluation of rebreather skills. For divers certified to use rebreathers:
At least 10 rebreather dives shall be made each calendar year (Section 4.7.1).

APPENDICES

Appendix 1 through 12

This Page Intentionally Blank

APPENDIX 1
DIVING MEDICAL EXAM OVERVIEW FOR THE EXAMINING PHYSICIAN

To the Examining Physician:

This person, _____, requires a medical examination to assess their fitness for certification as a Scientific Diver for the California Department of Fish and Wildlife. Their answers on the *Diving Medical History Form* (attached) may indicate potential health or safety risks as noted. Your evaluation is requested on the attached *Scuba Diving Fitness Medical Evaluation Report*. If you have questions about diving medicine, you may wish to consult one of the references on the attached list or contact a physician with expertise in diving medicine, below. Please contact the undersigned Diving Safety Officer if you have any questions or concerns about diving medicine or the California Department of Fish and Wildlife standards. Thank you for your assistance.

_____ _____
Diving Safety Officer Date

_____ _____
Printed Name Phone Number

Scuba and other modes of compressed-gas diving can be strenuous and hazardous. A special risk is present if the middle ear, sinuses, or lung segments do not readily equalize air pressure changes. The most common cause of distress is Eustachian insufficiency. Recent deaths in the scientific diving community have been attributed to cardiovascular disease. Most fatalities involve deficiencies in prudence, judgment, emotional stability, or physical fitness. Please consult the following list of conditions that usually restrict candidates from diving.

CONDITIONS WHICH MAY DISQUALIFY CANDIDATES FROM DIVING
(Adapted from Bove, 1998. Bracketed numbers are pages in Bove.)

1. Abnormalities of the tympanic membrane, such as perforation, presence of a monomeric membrane, or inability to autoinflate the middle ears. [5 ,7, 8, 9]
2. Vertigo including Meniere's Disease. [13]
3. Stapedectomy or middle ear reconstructive surgery. [11]
4. Recent ocular surgery. [15, 18, 19]
5. Psychiatric disorders including claustrophobia, suicidal ideation, psychosis, anxiety states, untreated depression. [20 - 23]
6. Substance abuse, including alcohol. [24 - 25]
7. Episodic loss of consciousness. [1, 26, 27]
8. History of seizure. [27, 28]
9. History of stroke or a fixed neurological deficit. [29, 30]
10. Recurring neurological disorders, including transient ischemic attacks. [29, 30]
11. History of intracranial aneurysm, other vascular malformation or intracranial hemorrhage. [31]
12. History of neurological decompression illness with residual deficit. [29, 30]
13. Head injury with sequelae. [26, 27]
14. Hematological disorders including coagulopathies. [41, 42]
15. Evidence of coronary artery disease or high risk for coronary artery disease. [33 - 35]
16. Atrial septal defects. [39]
17. Significant valvular heart disease - isolated mitral valve prolapse is not disqualifying. [38]

18. Significant cardiac rhythm or conduction abnormalities. [36 - 37]
19. Implanted cardiac pacemakers and cardiac defibrillators (ICD). [39, 40]
20. Inadequate exercise tolerance. [34]
21. Severe hypertension. [35]
22. History of spontaneous or traumatic pneumothorax. [45]
23. Asthma. [42 - 44]
24. Chronic pulmonary disease, including radiographic evidence of pulmonary blebs, bullae, or cysts. [45,46]
25. Diabetes mellitus. [46 - 47]
26. Pregnancy. [56]

SELECTED REFERENCES IN DIVING MEDICINE

Most are available from Best Publishing Company, Flagstaff, AZ; the Divers Alert Network (DAN), Durham, NC; or the Undersea and Hyperbaric Medical Association (UHMS), Bethesda, MD.

- ACC/AHA Guidelines for Exercise Testing. A report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines (Committee on Exercise Testing). Gibbons RJ, et al. 1997. Journal of the American College of Cardiology. 30:260-311. http://www.acc.org/clinical/guidelines/exercise/exercise.pdf
- Alert Diver Magazine; Articles on diving medicine http://www.diversalertnetwork.org/medical/articles/index.asp
- "Are Asthmatics Fit to Dive? " Elliott DH, ed. 1996 Undersea and Hyperbaric Medical Society, Kensington, MD.
- "Assessment of Cardiovascular Risk by Use of Multiple-Risk-Factor Assessment Equations." Grundy et. al. 1999. AHA/ACC Scientific Statement. http://www.acc.org/clinical/consensus/risk/risk1999.pdf
- DIVING MEDICINE, Fourth Edition, 2004 A. Bove and J. Davis. W.B. Saunders Company, Philadelphia
- DIVING AND SUBAQUATIC MEDICINE, Fourth Edition, 2002. C. Edmonds, C. Lowery, J. Pennefather and R. Walker. Arnold (Hodder Headline Group), London
- MEDICAL EXAMINATION OF SPORT SCUBA DIVERS, 1998. Alfred Bove, M.D., Ph.D. (ed.). Medical Seminars, Inc. San Antonio, TX
- NOAA DIVING MANUAL, NOAA. Superintendent of Documents, U.S. Government Printing Office, Washington, D.C.
- U.S. NAVY DIVING MANUAL. Superintendent of Documents, U.S. Government Printing Office, Washington, D.C.

PHYSICIANS WITH EXPERTISE IN DIVING MEDICINE

A referral to a physician with expertise in diving medicine be obtained from:

- DAN's referral network www.diversalertnetwork.org/medical
- The Undersea and Hyperbaric Medical Society www.uhms.org/resources

APPENDIX 2
MEDICAL EVALUATION OF FITNESS FOR SCUBA DIVING REPORT

_____ _____
Name of Applicant (Print or Type) Date (Mo/Day/Year)

To The Examining Physician: Scientific divers require periodic scuba diving medical examinations to assess their fitness to engage in diving with self-contained underwater breathing apparatus (scuba). Their answers on the *Diving Medical History Form* may indicate potential health or safety risks as noted. Scuba diving is an activity that puts unusual stress on the individual in several ways. Your evaluation is requested on this *Medical Evaluation Form*. Your opinion on the applicant's medical fitness is requested. Scuba diving requires heavy exertion. The diver must be free of cardiovascular and respiratory disease (see references, following page). An absolute requirement is the ability of the lungs, middle ears and sinuses to equalize pressure. Any condition that risks the loss of consciousness should disqualify the applicant. Please proceed in accordance with the AAUS Medical Standards (Sec. 6.00). If you have questions about diving medicine, please consult with the Undersea Hyperbaric Medical Society or Divers Alert Network.

REQUIRED TESTS/ EXAMS: Please *initial* where the following were completed.

☐ **Initial Exam**	☐ **Re-Exam** Every 3 yrs <age 40; Every 2 yrs 40+	**Required Test/ Exam**
_____	_____	**Medical History**
_____	_____	**Complete Physical Exam** with emphasis on neurological and otological components
_____	_____	**Hematocrit or Hemoglobin**
_____	_____	**Urinalysis**
_____	_____	**Any further tests** deemed necessary by the physician
_____		**Chest X-Ray**
_____		**Spirometry**
		Additional testing for over age 40
_____	_____	**Resting EKG** (Exercise stress testing may be indicated based on Risk-Factor Assessment)
_____	_____	**Assessment of Coronary Artery Disease** using Multiple-Risk-Factor Assessment (age, lipid profile, blood pressure, diabetic screening, smoker)

PHYSICIAN'S STATEMENT:

_____ Individual **IS** medically qualified to dive for: _____ 2 years (age 40+) _____ 3 years (age <40)

_____ Individual **IS NOT** medically qualified to dive: _____ Permanently _____ Temporarily

I have evaluated the above-mentioned individual according to the American Academy of Underwater Sciences medical standards and required tests for scientific diving (Section 6.00 and Appendix 1) and, in my opinion find no medical conditions that may be disqualifying for participation in scuba diving. I have discussed with the patient any medical condition(s) that would not disqualify him/her from diving but which may seriously compromise subsequent health. The patient understands the nature of the hazards and the risks involved in diving with these conditions.

Signature _____ , M.D. or D.O. **Date** _____

Name (Print or Type) **Address**

My familiarity with applicant is: _____With this exam only _____Regular Physician for _____ years

My familiarity with diving medicine is: _____

APPENDIX 2B
MEDICAL EVALUATION OF FITNESS FOR SCUBA DIVING REPORT

APPLICANT'S RELEASE OF MEDICAL INFORMATION FORM

_____
Name of Applicant (Print or Type)

I authorize the release of this information and all medical information subsequently acquired in association with my diving to the California Department of Fish and Wildlife Diving Safety Officer and Diving Safety Board or their designee at

(place) _____ on (date)_____.

Signature of Applicant _____ Date _____.

APPENDIX 3
DIVING MEDICAL HISTORY FORM

– ***To be completed by the Diver Applicant***
– ***Return one copy to the examining physician.***

LAST NAME	FIRST NAME	SEX	DATE
POSITION	SCUBA ☐	LAND-BASED RESPIRATOR ☐	
WEIGHT	HEIGHT	AGE	DOB

To the Applicant:

Scuba diving places considerable physical and mental demands on the diver. Diving with certain medical conditions may put you, and others coming to your aid, at risk. Therefore, certain medical and physical requirements must be met before beginning a diving or training program, and periodically thereafter to continue diving. Your accurate answers to the questions are more important, in many instances, in determining your fitness to dive than what the physician may see, hear or feel as part of the diving medical exam.

This form shall be kept confidential by the examining physician. If you believe any question amounts to an invasion of your privacy, you may elect to omit an answer, provided that you shall subsequently discuss that matter with your own physician who must then indicate, in writing, that you have done so and that no health hazard exists.

Should your responses indicate a condition which may make diving hazardous, you are asked to review the matter with your physician. In such instances, their written authorization will be required in order for further consideration to be given to your application or continuance with your current diving authorization. If your physician concludes that diving would involve undue risk for you, remember that they are concerned only with your well-being and safety.

Please indicate whether or not the following apply to you.

		Y	N	Comments
Section 1. General				
1	Presently being treated by a physician			
2	Taking any medication regularly (even non-prescription)			
3	Have you ever had an adverse reaction to medication?			
4	Had a major operation			
5	Been rejected or restricted from sports			
6	Been addicted to drugs			
7	Alcoholism			
8	Diabetes			
9	Do you smoke?			
10	Wear dental plate or prosthesis			

		Y	N	Comments
11	Recent dental procedures			
12	Bleeding disorders			
13	Frequent sour stomachs, nervous stomachs or vomiting spells			
14	Wear glasses or contact lenses			
15	Eye surgery (e.g. radial keratotomy)			
16	Participate in regular exercise? If yes, describe.			
17	Date of last tetanus shot			
18	Are you pregnant?			
19	Do you suffer from menstrual problems?			

Section 2. Ears				
20	Have you ever had perforated ear drums?			
21	Hay fever			
22	Frequent sinus trouble, frequent drainage from the nose, post-nasal drip, or stuffy nose			
23	Frequent earaches or ear infections			
24	Drainage from the ears			
25	Difficulty with your ears in airplanes or on mountains			
26	Ear surgery			
27	Ringing in your ears			
28	Frequent dizzy spells			
29	Hearing problems			
30	Trouble equalizing pressure in your ears			

Section 3. Lungs				
31	Asthma			
32	Used an asthma inhaler medication in the past 12 months			
33	Wheezing attacks			
34	Chronic or recurrent cough			
35	Frequently raise sputum			
36	Pleurisy			
37	Collapsed lung (pneumothorax)			
38	Lung cysts			
39	Pneumonia			
40	Tuberculosis			
41	Shortness of breath			
42	Lung problem or abnormality			

		Y	N	Comments
43	Spit blood			
44	Breathing difficulty after eating particular foods/ after exposure to particular pollens or animals			
45	Wheezing with exercise or breathing cold air			
46	Abnormal chest X-ray			
47	Are you subject to bronchitis			
48	Chest injuries, surgeries			
Section 4. Heart				
49	Rheumatic fever			
50	Scarlet fever			
51	Heart murmur			
52	Large heart			
53	High blood pressure			
54	Low blood pressure			
55	Angina (heart pains or pressure in the chest)			
56	Heart attack			
57	Recurrent or persistent swelling of the legs			
58	Pounding, rapid heartbeat or palpitations			
59	Easily fatigued or short of breath			
60	Abnormal EKG			
61	Abnormal heart anatomy or patent foramen ovale			
62	Heart failure, stroke			
Section 5. Neurologic				
63	Convulsions, seizures, or epilepsy			
64	Paralysis			
65	Fainting spells or dizziness			
66	Motion sickness or sea/air sickness			
67	Headaches (frequent and severe)			
68	Head injury causing unconsciousness			
Section 6. Psychiatric				
69	Claustrophobia			
70	Nervous tension or emotional problems			
71	Anxiety spells or hyperventilation			
72	Take tranquilizers			
73	Mental disorder or nervous breakdown			

		Y	N	Comments
Section 7. Orthopedic				
74	Joint problems, dislocations or arthritis			
75	Back trouble or back injuries			
76	Ruptured or slipped disk			
77	Limiting physical handicaps			
78	Muscle cramps			
79	Varicose veins			
80	Amputations			

Section 8. Diving				
81	Subcutaneous emphysema (air under the skin)			
82	Air embolism after diving			
83	Decompression sickness			
84	Any problems related to diving?			

Section 9. Family History				
85	Is there a family history of high cholesterol?			
86	Is there a family history of heart disease or stroke?			
87	Is there a family history of diabetes?			
88	Is there a family history of asthma?			
89	Have you ever had any other medical problems not listed? If so, please list or describe below.			

Please explain any “yes” answers to the above questions. Attach additional pages if necessary.

_____
_____
_____
_____
_____
_____
_____
_____

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

APPLICANT SIGNATURE	DATE

APPENDIX 4
DEFINITION OF TERMS

Air sharing - Sharing of an air supply between divers.

ATA(s) - “Atmospheres Absolute”, Total pressure exerted on an object, by a gas or mixture of gases, at a specific depth or elevation, including normal atmospheric pressure.

Bottom Time - The total elapsed time measured in minutes from the time when the diver leaves the surface in descent to the time the diver returns to the surface in ascent. This includes safety stops and ascent time. This is also what a computer or watch will record for the dive profile.

Breath-hold 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 member of the dive team.

Buddy System -Two comparably equipped SCUBA divers in the water in constant communication.

Buoyant Ascent - An ascent made using some form of positive buoyancy.

Burst Pressure - Pressure at which a pressure containment device would fail structurally.

Certified Diver - A diver who holds a recognized valid certification from the Department or another AAUS Organizational Member.

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 or decompression chamber.

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

Deep Stop - An additional decompression stop added to a deep dive profile at approximately half the maximum depth of the dive. Deep stops are theorized to have beneficial effects on off gassing gradients.

Dive - An entry, a descent into the water, an underwater activity using compressed gas, a return to the surface an exit, and a minimum ten minute surface interval.

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

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

Dive Site - Physical location of a diver during a dive.

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

Diver - An individual in the water who uses apparatus, including snorkel, which supplies breathing gas at ambient pressure. A Department employee may not dive on Department time or use Department diving equipment unless certified by the DSO as a diver.

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

Diver-Carried Reserve Breathing Gas - A diver-carried independent supply of air or mixed gas (as appropriate) sufficient under standard operating conditions to allow the diver to reach the surface, or another source of breathing gas, or to be reached by another diver. Also known as a redundant gas supply.

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

Diving Safety Board (DSB) - Group of individuals who act as the official representative of the membership organization in matters concerning the scientific diving program (Section 1.24). Synonymous with Diving Control Board.

Diving Safety Officer (DSO) - Individual responsible for the safe conduct of the scientific diving program of the membership organization (Section 1.20).

EAD – See Equivalent Air Depth below.

Emergency Ascent - An ascent made under emergency conditions where the diver exceeds the normal ascent rate.

Enriched Air Nitrox (EANx) - A name for a breathing mixture of air and oxygen when the percent of oxygen exceeds 21%. This term is considered synonymous with the term “Nitrox” (Section 7.20).

Equivalent Air Depth (EAD) - Depth at which air will have the same nitrogen partial pressure as the nitrox mixture being used. This number, expressed in units of feet seawater or saltwater, will always be less than the actual depth for any enriched air mixture.

fN_2 - Fraction of nitrogen in a gas mixture, expressed as either a decimal or percentage, by volume.

fO_2 - Fraction of oxygen in a gas mixture, expressed as either a decimal or percentage, by volume.

FFW – Feet of freshwater, or equivalent static head.

FSW - Feet of seawater, or equivalent static head.

Hookah Diving - A type of shallow water surface-supplied diving where there is no voice communication with the surface.

Hyperbaric Chamber - See decompression chamber.

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

Law Enforcement/Public Safety Dive - Law enforcement or public safety dives are those made in the course of enforcing regulations or laws or assisting in emergency response by, or under the direction of, a peace officer or emergency personnel.

Lead Diver - Certified scientific diver with experience and training to conduct the diving operation. The Lead Diver is responsible for coordinating diving activities for the diving operation. The Lead Diver is generally the most experienced diver on site and maintains the overall safety of the diving operation.

Light Maintenance Dive - Light Maintenance Dives are those made to perform routine or emergency maintenance on, repair, or installation of equipment to a vessel or structure, recover or salvage items other than those used in a scientific or public safety investigation (evidence recovery), or to conduct routine monitoring activities at a hazardous material investigation that is not part of a scientific or public safety investigation.

Maximum Working Pressure - Maximum pressure to which a pressure vessel may be exposed under standard operating conditions.

Organizational Member - An organization which is a current member of AAUS, and which has a program, which adheres to the standards of AAUS as, set forth in the AAUS Standards for Scientific Diving Certification and Operation of Scientific Diving Programs.

Maximum Operating Depth (MOD) - The maximum allowable working depth for a given breathing gas. Usually determined as the depth at which the pO_2 for a given gas mixture reaches a predetermined maximum.

Mixed Gas - A breathing gas other than air. Generally used to refer to combinations of oxygen with varying levels of inert gasses used to increase the maximum operating depth.

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

MSW - Meters of seawater or equivalent static head.

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

NOAA Diving Manual - Refers to the NOAA Diving Manual, Diving for Science and Technology, 2001 edition. National Oceanic and Atmospheric Administration, Office of Undersea Research, US Department of Commerce.

No-Decompression limits - Depth-time limits of the “no-decompression limits and repetitive dive group designations table for no-decompression air dives” of the U.S. Navy Diving Manual or equivalent limits.

Normal Ascent - An ascent made with an adequate air supply at a rate of 60 feet per minute or less.

Oxygen Clean - All combustible contaminants have been removed.

Oxygen Compatible - A gas delivery system that has components (o-rings, valve seats, diaphragms, etc.) that are compatible with oxygen at a stated pressure and temperature.

Oxygen Service - A gas delivery system that is both oxygen clean and oxygen compatible.

Oxygen Toxicity - Any adverse reaction of the central nervous system (“acute” or “CNS” oxygen toxicity) or lungs (“chronic”, “whole-body”, or “pulmonary” oxygen toxicity) brought on by exposure to an increased (above atmospheric levels) partial pressure of oxygen.

Oxygen Toxicity Unit (OTU) - 1 minute of breathing 100% oxygen at sea level. Since it has been observed that most people can tolerate 24 hours of breathing pure oxygen without trouble, the accepted allowable dose is 1440 OTU's (1 OTU per min x 60 min/hr x 24 hr/ day) per day

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.

Pressure Vessel - See cylinder.

pN_2 - Inspired partial pressure of nitrogen, usually expressed in units of atmospheres absolute.

pO_2 - Inspired partial pressure of oxygen, usually expressed in units of atmospheres absolute.

Psi - Unit of pressure, “pounds per square inch.

Psig - Unit of pressure measured by a gauge, “pounds per square inch gauge.

Recompression Chamber - see decompression chamber.

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

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

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

Surface Supplied Diving - A diving mode in which the diver in the water is supplied from the dive location with compressed gas for breathing.

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

Training Dive - Training dives are those in which divers participate in order to fulfill certification or instructional requirements. They are also conducted to maintain proficiency. Training dives conducted outside Department auspices on Department time must be approved by the DSO.

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

Working Pressure - Normal pressure at which the system is designed to operate.

This Page Intentionally Blank

APPENDIX 5
REQUEST FOR DIVING RECIPROCITY FORM
VERIFICATION OF DIVER TRAINING AND EXPERIENCE

DATE OF REQUEST	DSO RECIPIENT	PHONE	EMAIL
HOST ORGANIZATION	**HOST INVESTIGATOR**	**PHONE**	**EMAIL**

The California Department of Fish & Wildlife (DFW) diver listed below has completed all the requirements and has demonstrated the necessary competencies for certification in the DFW Diving Safety Program. DFW is an AAUS Organizational Member and meets or exceeds all AAUS training requirements.

The host organization has the right to approve or deny this request and may require, at a minimum, a checkout dive with the Diving Safety Officer (DSO) or designee of the host organization. If the request is denied, the host organization should notify the CDFW DSO of the reason for the denial.

DFW DIVER	POSITION	PHONE	EMAIL

CERTIFICATIONS AND QUALIFICATIONS

DIVER TRAINING	DATE	DIVING ACTIVITY		CERTS. / QUALS.	EXP. DATE
Original diving auth.		Total career dives		CPR ( )	
Written sci. diving exam		Dives in last 12 mos.		O2 Admin. ( )	
24 h Recert & check-out		Last logged dive ____ ft		First Aid ( )	
Depth cert. ____ ft				Diving medical exam	
				Equipment inspection	

SPECIALTY CERTIFICATIONS

☐	Dry Suit	☐	Blue Water	☐	Decompression	☐	Rescue	☐	Lifesaving	☐	FSO
☐	Dive Computer	☐	Altitude	☐	Mixed Gas	☐	Dive Accident Mgt.	☐	Divemaster	☐	Other:
☐	Night	☐	Ice/Polar	☐	Closed Circuit	☐	Chamber Crew	☐	Instructor	☐	Other:
☐	Cave	☐	Nitrox	☐	Saturation	☐	EMT	☐	Small Boat/MOCC	☐	Other:

ADDITIONAL

RESTRICTIONS TO DIVING? ☐ Yes ☐ No	IF YES, PLEASE EXPLAIN:
GENERAL COMMENTS:	

EMERGENCY CONTACT	RELATIONSHIP	BEST PHONE
ADDRESS		**ALTERNATE PHONE**

VERIFICATION

The above individual is currently a certified scientific diver with the California Department of Fish & Wildlife, an Organizational Member in good standing with AAUS. If you have any questions about this diver or the information provided, please contact me.

DSO SIGNATURE	PRINTED NAME	DATE
	David Osorio	

(Valid until December 31 of year issued, or certification expiration)

CDFW Diving Safety Program
20 Lower Ragsdale Drive, Suite 100
Monterey, CA 93940

Phone: 831-649-7195
Fax: 831-649-2917
david.osorio@wildlife.ca.gov

This Page Intentionally Blank

APPENDIX 6
DIVING INJURY/INCIDENT REPORT FORM

Required Incident Reporting: All diving incidents requiring recompression treatment, or resulting in moderate or serious injury, or death shall be reported the DSB. The report will specify the circumstances of the incident and the extent of any injuries or illnesses. This form is confidential and for statistics purposes only.

Check the appropriate space(s) & complete the form:

___Simple Illness	___Referred to Physician	___Serious injury
___Barotrauma	___Hyperbaric Treatment	___Near Drowning
___Hyperoxic	___Hypercapnea	___Fatality
Workers' Compensation Claim Yes___ No___		___Other:_____

Descriptive Report (use additional sheets if necessary) Date of Incident: _____/_____/_____
Month/Day/Year

Circumstances and the extent of the injuries or illnesses:

Treatment provided and results:

Recommendations to avoid repetition of incident:

Name & Title of Person Submitting Report:_____
(Please print)

Signature_____Date_____/___/_____

Mailing Address_____

Telephone/FAX _____e-mail _____

This Page Intentionally Blank

APPENDIX 7
DEPARTMENT REPORT OF MINOR INJURY

Name SSN Date of Birth Sex (M/F)

Region/Division/Branch/Office

Address of Region/Division/Branch/Office

Location Where Injury Occurred

Classification Date of Injury Time of Injury Date Injury Reported

Describe the Injury and How it Occurred (include part of body affected)

Treatment

Comments

Signature of Injured Signature of Supervisor

Dated Dated

INSTRUCTIONS:

The supervisor will complete this form when an employee reports an injury, but did not lose time and did not see a doctor.

This form can be used to help complete the 3067 if an employee eventually loses time or decides to see a doctor for this injury.

The Supervisor will retain this form for a minimum of five years (this form may be attached to the 3067 if one is completed).

FG-PERS-300

This Page Intentionally Blank

APPENDIX 8
DIVING EMERGENCY MANAGEMENT PROCEDURES FORM

Introduction
A diving accident victim could be any person who has been breathing air underwater regardless of depth. It is essential that emergency procedures are pre-planned and that medical treatment is initiated as soon as possible.

General Procedures
Depending on and according to the nature of the diving accident:

1. Make appropriate contact with victim or rescue as required.
2. Establish (A)irway, (B)reathing, (C)irculation as required.
3. Stabilize the victim
4. Administer 100% oxygen, if appropriate (in cases of Decompression Illness, or Near Drowning).
5. Call local Emergency Medical System (EMS) for transport to nearest medical treatment facility. Explain the circumstances of the dive incident to the evacuation teams, medics and physicians. Do not assume that they understand why 100% oxygen may be required for the diving accident victim or that recompression treatment may be necessary.
6. Call appropriate Diving Accident Coordinator for contact with diving physician and decompression chamber, etc.
7. Notify DSO or designee according to the Emergency Action Plan.
8. Complete and submit Incident Report Form (www.aaus.org) to the DSB of the organization and to AAUS (Section 2.70 Required Incident Reporting).

List of Emergency Contact Numbers Appropriate For Dive Location

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

Available Procedures

- Emergency care
- Recompression
- Evacuation

Emergency Plan Content

- Name, telephone number, and relationship of person to be contacted for each diver in the event of an emergency.
- Nearest operational decompression chamber.
- Nearest accessible hospital.
- Available means of transport.

This Page Intentionally Blank

APPENDIX 9
DIVING WITH NITROX FORM

Please submit this form with a copy of your nitrox certification(s).

I certify that I have read the Diving Safety Program NITROX guidelines, and that I agree to abide by them. I understand that there are potential risks associated with the use of NITROX that may be greater than those of normal air.

Name: _____

Signature: _____

Date of NITROX Certification: _____

Certifying Agency: _____

Date: _____ DSB Certification Check: _____ EAN>40: _____

This Page Intentionally Blank

APPENDIX 10

CALIFORNIA DEPARTMENT OF FISH & WILDLIFE MONTHLY DIVING LOG

Diver: ____________________ **Month:** ______ **Year:** ______ Certified Depth: ________

Phone: ____________ Physical: ____________ Dive to cert.depth: ________ CPR: ______ Oxygen: ______ Haz mat: ______

Equipment Checks

Regulator(s): ______ Tank Press. Gauge: ______ Depth Gauge: ______ Computer(C)/Tables(T) Used (Specify): ____________

Dives this year:

Jan ____ Feb ____ Mar ____ Apr ____ May ____ Jun ____ Jul ____ Aug ____ Sep ____ Oct ____ Nov ____ Dec ____

			Dive Times		Bottom	Max	Saf Stop			Number of Dives					Dive	Suit	Pay	Codes (No. X type				
Day	Accompanied By	Location	IN	OUT	Time	Depth	(D/T)	FO2	C/T	0-30	31-60	61-100	100-130	>130	time	In/Out	Time	1	2	3	4	5
																			0	0	0	0	0	0	0	0	0	0	0	0	0

L.I.	Last 4 of SSN	Year (yy)	Month (mm)

Purpose Codes

1. Scientific
2. Law Enforcement
3. Training
4. Recreational
5. Light Commercial

1. A separate report must be filed for equipment fallures, accidents, or potentiall dangerous experiences. Did any occur? Yes ____ No ____
2. Fill in personal data, date, and totals and submit this form to the Diving Safety Officer each month.
3. Submit this report in duplicate with your monthly time sheet whether or not dives were made.
4. Divers must have a minimum of 10 in water scuba dives per each calendar 6 month period (January - June & July - December).

This Page Intentionally Blank

This Page Intentionally Blank

APPENDIX 11
SELECTED REFERENCES

Diving Protocol and Standards

American Academy of Underwater Sciences. 2003. *Standards for Scientific Diving.* American Academy of Underwater Sciences: Nahant, Massachusetts. 59 pp.

Federal Register. 1984. OSHA Commercial Diving Operations. 29 CFR 1910, subpart T. *In:* United States Code of Federal Regulations. pp. 752-763.

Joiner, J.T., ed. 2001. *NOAA Diving Manual* (4th Ed.). Best Publishing Company: Flagstaff, Arizona. 700 pp.

National Association of Underwater Instructors. 2004. *NAUI Advanced Scuba Diver*. NAUI Better Business Forms Printing Solutions: Tampa, Florida. 181 pp.

National Association of Underwater Instructors. 2004. *NAUI Nitrox Diver*. NAUI Better Business Forms Printing Solutions: Tampa, Florida. 103 pp.

National Association of Underwater Instructors. 2004. *NAUI Scuba Diver*. NAUI Better Business Forms Printing Solutions: Tampa, Florida. 234 pp.

Professional Association of Diving Instructors. 2003. *The Encyclopedia of Recreational Diving* (2nd Ed.). PADI: Santa Ana, California. 303 pp.

U.S. Department of the Navy. 1999. *U.S. Navy Diving Manual, Revision 4*. NAVSEA 0910-LP-708-8000. Naval Sea Systems Command: Arlington, Virginia.

American Academy of Underwater Sciences. www.aaus.org
Policies and standards of practice for the scientific diving community

NOAA Dive Program. www.ndc.noaa.gov
Administration and operations information for the National Oceanic and Atmospheric Administration diving program

U.S. Department of Labor, OSHA Standards. www.osha.gov/SLTC/commercialdiving
Federal standards for commercial diving and various links

Boating and Navigation

British Sub-Aqua Club. 1986. *Seamanship for Divers*. Random House: London. 159 pp.

International Maritime Organization. 1999. *International Aeronautical and Maritime Search and Rescue (IAMSAR) Manual*, IMO-I962E. International Maritime Organization and the International Civil Aviation Organization. 620 pp.

Maloney, E.S. 2003. *Chapman Piloting & Seamanship* (64th Ed.). Hearst Books: New York, New York. 928 pp.

U.S. Naval Oceanographic Office. 2004. *Glossary of Oceanographic Terms.* University Press of the Pacific. 224 pp.

United States Coast Guard Auxiliary. 2002. *Boating Skills and Seamanship* (12th Ed.). United States Coast Guard Auxiliary: Washington, D.C. 166 pp.

United States Coast Guard. 2003. *USCG Navigation Rules, International-Inland.* COMDTINST M16672.2E. US Department of Homeland Security, United States Coast Guard. 240 pp.

California Department of Boating and Waterways. www.dbw.ca.gov
Safety education for recreational boaters

U.S. Coast Guard Navigation Center. www.navcen.uscg.gov/mwv/navrules/navrules
Coastal and inland navigation rules and related boating links

United States Power Squadrons. www.usps.org
Educational organization with offerings in seamanship, navigation and related subjects

Dive Accident Management

Divers Alert Network. 2002. *DAN Basic Life Support for Dive Professionals*. Emergency Medical Training International, Inc./ Divers Alert Network: Durham, North Carolina. 80 pp.

Divers Alert Network. 2004. DAN Report on Decompression Illness, Diving Fatalities and Project Dive Exploration: 2004 Edition (Based on 2002 Data). Divers Alert Network: Durham, North Carolina. 152 pp.

Lippman, J. 2001. *Oxygen First Aid for Divers*. Divers Alert Network: Durham, NC. 144 pp.

National Association of Underwater Instructors. 2000. *NAUI Scuba Rescue Diver.* NAUI Better Business Forms Printing Solutions: Tampa, Florida. 193 pp.

Rutkowski, D. 1994. *Diving Accident Management Manual: Hyperbaric and Undersea Medicine* (4th Ed.). Best Publishing Co.: Flagstaff, Arizona. 22 pp.

Somers, L.H. 1986. *Diver Education Series: The First Responder.* Michigan Sea Grant College Program, University of Michigan: Ann Arbor, Michigan. 50 pp.

Work, K. 1991. *MedDive: In Field Emergency Treatment of Diving Injuries for the Dive Professional.* Dive Rescue International: Fort Collins, Colorado. 123 pp.

Yapor, W.Y. 2002. *On-site management of scuba diving and boating emergencies*. Publishing Co.: Flagstaff, Arizona. 262 pp.

Equipment Maintenance

Compressed Gas Association. 1987. Suggestions for the Care of High-Pressure Air Cylinders for Underwater Breathing, CGA P-5. Compressed Gas Association: Chantilly, Virginia.

Compressed Gas Association. 2001. Standards for Visual Inspection of Steel Compressed Gas Cylinders, CGA C-6. Compressed Gas Association: Chantilly, Virginia.

High, W.L. 1986. “Cylinder codes.” NDA News (Mar./Apr.). NAUI Diving Association: Montclair, California.

High, W.L. 2001. *Inspecting Cylinders- SCUBA and SCBA* (4th Ed.). Professional Scuba Inspectors, Inc.: Kenmore, Washington.

U.S. Department of the Navy, NAVSEA. 1982. *Operation and Maintenance Instructions, Diver Tools* (Vols. I and II). NAVSEA Report S9592-AJ-MMA-0l0. U.S. Department of the Navy, Naval Sea Systems Command: Washington, D.C.

Wolfinger, P. 2004. *Scuba Regulator Savvy*. (See www.scubatools.com). 187 pp.

Physiology and Diving Medicine

Bachrach, A.J., and G.H. Egstrom. 1986. *Stress and Performance in Diving*. Best Publishing Co: Flagstaff, Arizona. 183 pp.

Bennett, P., and D. Elliot. 2003. *The Physiology and Medicine of Diving* (5th Ed.). A.O. Brubakk and T.S. Neuman, eds. W.B. Saunders Co.: Philadelphia, Pennsylvania. 864 pp.

Bookspan, J. 1997. *Diving Physiology in Plain English*. Undersea and Hyperbaric Medical Society, Inc.: Kensington, Maryland. 246 pp.

Bove, A.A. 1998. *Medical Examination of Sport Scuba Divers* (3rd Ed.). Best Publishing Co.: Flagstaff, Arizona. 74 pp.

Bove, A.A., J.C. Davis. 2004. *Diving Medicine* (4th Ed.). W.B. Saunders Company. 623 pp.

Edmonds, C., C. Lowry, J. Pennefather, and R. Walker. 2002. *Diving and Subaquatic Medicine* (4th Ed.). Arnold: Great Britain. 719 pp.

Somers, L.H. 1992. Diver Education Series: Physiology of Breath-Hold Diving. Sea Grant College Program, University of Michigan: Ann Arbor, Michigan.

Divers Alert Network (DAN). www.diversalertnetwork.org
Medical research and educational organization dedicated to safety and health of recreational divers

Diving Medicine Online. www.scuba-doc.com
Comprehensive medical information on diving and undersea medicine for non-medical divers, non-diving physicians and specialists

European Underwater and Baromedical Society. www.eubs.org
Society dedicated to the study and promotion of diving and hyperbaric medicine

Int'l Congress on Hyperbaric Medicine. www.ichm.net
Organization to promote and improve understanding among the international hyperbaric medicine community

South Pacific Underwater Medicine Society. www.spums.org.au
Organization to promote research and education on underwater and hyperbaric medicine

Undersea Hyperbaric Medical Society. www.uhms.org
Organization that provides scientific information to protect the health of sport, military and commercial divers

USC Wrigley Chamber. http://wrigley.usc.edu/hyperbaric/TOP.HTM
USC Catalina Island hyperbaric chamber provides treatment for scuba diving casualties, educational programs, and research facilities to improve diving safety

Underwater Research Techniques

Barsky, S.M. and T. Neuman. 2003. *Investigating Recreational and Commercial Diving Accidents.* Hammerhead Press: Ventura, California. 236 pp.

Ebert, E.E. 1964. Underwater tagging gun. Cal. Fish Wildlife 50(l):29-32.

Foster, M.S., T.A. Dean and L.E. Deysher. 1985. Subtidal techniques, pp. 189-232. *In*: Littler, M.M., and D.S. Littler, eds. *Handbook of Phycological Methods. Ecological Field Methods: Macroalgae*. Cambridge Univ. Press: New York, New York. 617 pp.

Gittings, S.R., K.J.P. Deslarzes, B.S. Holland, and G.S. Boland. 1990. Ecological monitoring on the Flower Gardens Banks: Study design and field methods. *In*: Jaap, W.C., ed. *Diving for Science*. *Proc. of AAUS Scientific Diving Symposium. St. Petersburg, Florida*. AAUS: Nahant, Massachusetts. pp. 107-118.

Hackman, D.J., and D.W. Caudy. 1981. *Underwater Tools*. Battelle Press: Columbus, Ohio. 152 pp.

Heine, J.N. 1999. *Scientific Diving Techniques: A Practical Guide for the Research Diver.* Best Publishing Co: Flagstaff, Arizona. 225 pp.

Heine, J.N., and N.L. Crane, eds. 1993. *Diving for Science. Proc. of AAUS Scientific Diving Symposium. Monterey, California.* AAUS: Nahant, Massachusetts.

Holmes, N.A., and A.D. McIntyre. 1984. *Methods for Study of Marine Benthos* (2nd Ed.). IBP Handbook No. 16. Blackwell Publishers. 394 pp. (New edition scheduled July, 2005).

Lang, M.A., and C.C. Baldwin, eds. 1996. *Methods and Techniques of Underwater Research. Proc. of AAUS Scientific Diving Symposium.* AAUS: Nahant, Massachusetts.

Ryan, E., and J.F. Bass. 1962. Underwater surveying and draughting: a technique. Antiquity 36(144):252-261.

Schroeder, W. 1974. Collecting and handling zoo-plankton and epibenthic organisms underwater. Mar. Technol. Soc. J. 8(5):40-43.

Teather, R.G. 1994. *Encyclopedia of Underwater Investigations.* Best Publishing Company: Flagstaff, Arizona. 186 pp.

Wickham, D.A., and J.W. Watson, Jr. 1976. SCUBA diving methods for fishing systems evaluation. Marine Fish. Rev. 38(7):15-23.

Witman, J., D. Steller, J. Coyer. 1999. *The Underwater Catalog: A Guide to Methods in Underwater Research* (2nd Ed.). Shoals Marine Laboratory: Ithaca, New York. 151 pp. (update to 2nd Edition at: www.sml.cornell.edu/smlpub/uwc.up04.pdf)

Woods, J., and J. Lythgoe, eds. 1971. *Underwater Science: An Introduction to Experiments by divers.* Oxford University Press: London. 330 pp.

NOAA National Undersea Research Program. www.nurp.noaa.gov
National service providing undersea scientists with tools and expertise

Specialized Diving Protocol

Archaeology, underwater

Delgado, J.P., ed. 1997. *Encyclopedia of Underwater and Maritime Archaeology*. Yale University Press: New Haven, Connecticut. 496 pp.

Green, J. 1990. *Maritime Archaeology: A Technical Handbook*. Academic Press: London. 470 pp.

Blue water diving

Heine, J.N., ed. 1986. *Blue Water Diving Guidelines*. California SeaGrant T-CSGCP-014. La Jolla, California.

Communications

Hollien, H., and H. Rothman. 1976. Diver communication. *In*: *Research Underwater*. Academic Press: London.

Deep diving

Gilliam, B., R. Von Maier, J. Crea. 1995. *Deep Diving* (Rev. Ed.). Aqua Quest Publications: Locust Valley, New York. 352 pp.

Dry suit diving

Barsky, S., D. Long, and R. Stinton. 1999. *Dry Suit Diving* (3rd Ed.). Hammerhead Press: Ventura, California. 187 pp.

Hazardous Diving

Barsky, S.M. 1999. *Diving in High-Risk Environments* (3rd Ed.). Hammerhead Press: Santa Barbara, CA. 198 pp.

Lotz W.E., ed. 1983. *Protection of Divers in Water Containing Hazardous Chemicals, Pathogenic Organisms, and Radioactive Material,* UMS Publ. No. 60. Undersea Medical Society: Bethesda, MD.

Hyperbaric chamber operations and protocol

Rutkowski, D. 1985. *Recompression Life Support Manual: Instructor/Student Guide for the Use of Breathing Gasses during Hyperbaric Exposures*. Hyperbarics International Inc.: Key Largo, Florida. 142 pp.

Workman, W.T. 1999. *Hyperbaric Facility Safety: A Practical Guide.* Best Publishing Company: Flagstaff, Arizona. 754 pp.

Limited visibility

Barsky, S.M. 2001. *Night Diving, Underwater Navigation, and Limited Visibility Diving.* International Training, Inc.: Topsham, Maine. 109 pp.

Re-breather diving

Barsky, S., M. Thurlow, and M. Ward. 1998. *The Simple Guide to Rebreather Diving*. Best Publishing Company: Flagstaff, AZ. 228 pp.

Bozanic, J.E. 2002. *Understanding Rebreathers.* Best Publishing Company: Flagstaff, Arizona. 548 pp.

Cold water diving

Heine, J.N. 1996. *Cold Water Diving*. Best Publishing Company: Flagstaff, Arizona. 127 pp.

Somers, L.H. 1986. "Thermal Stress and the Diver." NAUI News, (Sept/Oct).

International Maritime Organization. 1992. A Pocket Guide to Cold Water Survival. IMO-946E. International Maritime Organization: London.

Webb, P., ed. 1985. Prolonged and repeated work in cold water. Undersea Medical Society Workshop Report No. 68. Undersea Medical Society: Bethesda, Maryland.

Swift water

Ray, S. 1997. *Swiftwater Rescue*. CFS Press: Ashville, North Carolina, 243 pp.

Technical diving

Palmer, R. 1997. *An Introduction to Technical Diving*. Underwater World Publications: United Kingdom.

Wienke, B.R. 2002. *Technical Diving in Depth*. Best Publishing Company: Flagstaff, Arizona. 428 pp.

Altitude diving

Weinke, B. R., 1993, Diving Above Sea Level, Best Publishing Company: Flagstaff, Arizona. 66 pp.

Public safety diving

Hendrick, W., and A. Zaferes. 2000. *Public Safety Diving.* Fire Engineering Books and Videos: Saddle Brook, New Jersey. 350 pp.

Miscellaneous

California Department of Fish & Wildlife. 2003. Volunteer Coordinator Handbook. State of California, The Resources Agency. (Available on DFG Intranet).

Larson, H.E. 1959. *A History of Self-Contained Diving and Underwater Swimming.* National Academy of Sciences, Publication 469. National Academy of Sciences, National Research Council: Washington, D.C. 50 pp.

Historical Diving Society. www.hds.org
Organization that investigates and records diving history

This Page Intentionally Blank

APPENDIX 12
INDEX

This Page Intentionally Blank

April 2018