U.S. Department of
Homeland Security

**United States
Coast Guard**

Diving Casualty Investigations
Tactics, Techniques, and Procedures (TTP)

**Force Readiness Command
(FORCECOM)**

**CGTTP 3-72.4
May 2015**

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United States Coast Guard

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CGTTP 3-72.4
05 MAY 2015

COAST GUARD TACTICS, TECHNIQUES, AND PROCEDURES 3-72.4

Subj: DIVING CASUALTY INVESTIGATION (DCI)

Ref:
(a) Definitions, 46 CFR § 4.03
(b) Commercial Diving Operations, 29 CFR § 1910T
(c) USCG Marine Safety Manual, Volume V: Investigations and Enforcement, COMDTINST M16000.10 (series)
(d) Commercial Diving Operations 46 CFR § 197B
(e) Casualty and Accident Reporting, 33 CFR § 173.51C
(f) Evidence of criminal liability, 46 CFR § 5.69
(g) Operating a Vessel while under the Influence of Alcohol or a Dangerous Drug, 33 CFR § 95
(h) Logbook and entry requirements, 46 USC § 11301
(i) Mandatory Chemical Testing Following Serious Marine Incidents Involving Vessels in Commercial Service, 46 CFR § 4.06
(j) Investigation of marine casualties, 46 USC § 6301
(k) Violation of law or regulation, 46 CFR § 5.33
(l) Evidence of Criminal Liability, 46 CFR § 4.23
(m) Sailing short, 46 CFR § 15.725
(n) Commandant (CG-545) Policy Letter 1-11, Marine Casualty Report of Investigation (ROI) Policy
(o) Requirements for requalification of specification cylinders, 49 CFR § 180.209
(p) Notice of Marine Casualty and Voyage Records, 46 CFR § 4.05

1. PURPOSE. To provide Coast Guard marine investigators with Coast Guard tactics, techniques, and procedures (CGTTP) on conducting diving casualty investigations.

2. ACTION. This CGTTP publication applies to diving casualty investigations. Internet release authorized.

3. DIRECTIVES/TTP AFFECTED. None.

4. DISCUSSION. Underwater diving takes place in many forms and can be a complex, specialized sport or occupation. Often, with little or no formal training, a Coast Guard marine investigator is required to determine whether a dive casualty is a regulated diving incident. If determined to be a regulated marine casualty, the investigator must act in a timely manner to identify an array of varied evidence; collect, preserve, and interpret this evidence; and prepare for legal proceedings if warranted. This TTP publication was developed to assist understanding and proper application of proper investigative techniques.

5. DISCLAIMER. This guidance is not a substitute for applicable legal requirements, nor is itself a rule. It provides guidance for Coast Guard personnel and does not impose legally-binding requirements on any party outside the Coast Guard.

6. ENVIRONMENTAL ASPECT AND IMPACT CONSIDERATIONS. While developing this publication, Integrated Process Team (IPT) members examined environmental considerations under the National Environmental Policy Act (NEPA) and determined they are not applicable.

7. DISTRIBUTION. FORCECOM TTP Division posts an electronic version of this TTP publication to the CGTTP Library on CGPortal. In CGPortal, navigate to the CGTTP Library by selecting **References > Tactics, Techniques, and Procedures (TTP)**. FORCECOM TTP Division does not provide paper distribution of this publication.

8. RECORDS MANAGEMENT CONSIDERATIONS. Integrated Process Team (IPT) members thoroughly reviewed this publication during the TTP coordinated approval process and determined there are no further records scheduling requirements per Federal Records Act, 44 U.S.C. Chapter 31 § 3101 et seq., NARA requirements, and Information and Life Cycle Management Manual, COMDTINST M5212.12 (series). This publication does not have any significant or substantial change to existing records management requirements.

9. FORMS/REPORTS. None.

10. REQUEST FOR CHANGES. Submit recommendations for TTP improvements or corrections via email to FORCECOM-PI@uscg.mil or through the TTP Request form on CGPortal. In CGPortal, navigate to the TTP Request form by selecting **References > Tactics, Techniques, and Procedures (TTP) > TTP Request**.

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Chapter 1: Introduction

Introduction

This chapter overviews the contents of this TTP publication. It also defines the use of notes, cautions, and warnings in TTP publications.

In This Chapter

This chapter contains the following sections:

Section	Title	Page
A	Introduction	1-2
B	Notes, Cautions, and Warnings	1-3

Section A: Introduction

A.1. Purpose

Underwater diving takes place in many forms. At its most basic level, it is divided into two general groups: commercial diving and non-commercial (recreational) diving. It can be a Federally regulated occupation or a non-regulated, complex, and specialized sport. The Coast Guard has no formal training for marine investigators concerning dive-related casualties, and often, the Coast Guard marine investigator must identify whether a dive casualty is a regulated diving incident or not.

When a casualty is a regulated activity, the investigating officer (IO) must act in a timely manner to identify the type of diving that occurred, secure the equipment, preserve a wide array of potentially hazardous evidence, sample breathing air, recognize diving trauma signs, liaise with medical authorities, interpret technical data, and resolve many more highly technical and varied issues.

This TTP publication was developed to help IOs understand diving basics, equipment, regulations, and investigative techniques for diving casualties.

A.2. Scope

Reference (a), Definitions, 46 CFR § 4.03, defines marine casualties as, "Any occurrences of injury or loss of life to any person while diving from a vessel and using underwater breathing apparatus."

Investigating officers must become familiar with agency jurisdictions and existing memorandums of understanding (MOU) before initiating an investigation. Reference (b), Commercial Diving Operations, 29 CFR § 1910T, outlines requirements for commercial diving accidents involving inspected vessels and platforms. Reference (c), USCG Marine Safety Manual, Volume V: Investigations and Enforcement, COMDTINST M16000.10 (series), further delineates non-commercial and commercial diving and identifies overarching policies and MOUs.

Section B: Notes, Cautions, and Warnings

B.1. Overview The following definitions apply to notes, cautions, and warnings found in TTP publications.

NOTE: **An emphasized statement, procedure, or technique.**

CAUTION: **A procedure, technique, or action that, if not followed, carries the risk of equipment damage.**

WARNING: ***A procedure, technique, or action that, if not followed, carries the risk of personnel injury or death.***

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Chapter 2: Types of Diving Operations

Introduction

This chapter describes basic diving principles and types of diving operations. It provides regulatory references for each type operation where appropriate.

In This Chapter

This chapter contains the following sections:

Section	Title	Page
A	Diving 101	2-2
B	Commercial	2-4
C	Non-commercial	2-7
D	Military	2-8
E	Science	2-11
F	Public Safety	2-13

Section A: Diving 101

A.1. Immediately Dangerous to Life and Health (IDLH) Atmosphere

Immediately dangerous to life or health (IDLH), means an atmospheric concentration of any toxic, corrosive or asphyxiating substance that poses an immediate threat to life, causes irreversible or delayed adverse health effects, or interferes with an individual's ability to escape from a dangerous atmosphere. Without special equipment, humans can survive only as long as they can hold their breath. Risk factors include:

- Increased depths,
- Extreme temperatures,
- High currents,
- Low visibility,
- Wildlife,
- Limitations on human anatomy and physiology.

A.2. Types of Diving by Purpose

Following are types of diving by category:

- Non-commercial (recreational).
- Commercial:
  - Commercial employment,
  - Military,
  - Public safety,
  - Science/research,
  - Sport/recreation instruction.

A.3. Basic Physics

The following factors can affect human physiology underwater:

- Pressure - The overall pressure on a diver is the sum of the atmospheric pressure and the water pressure.
- Density - Density of water, the diver's body density and equipment density determine the diver's buoyancy and the use of buoyant equipment. Divers use high-density materials, such as lead, to increase density, and low-density materials, such as air, in buoyancy compensators (BC) and lifting bags to decrease density.

- Temperature - Thermal conductivity of water is higher than that of air. Because water conducts heat 20 times more than air, divers in cold water must insulate their bodies with diving suits to avoid hypothermia.
- Light (light refraction considerations) - Refraction affects the appearance of everything a diver sees underwater. Refraction is the change in direction of a wave due to a change in transmission medium (e.g. as light passes from air to water). The speed of a light wave slows and bends at the interface between two mediums. Refraction causes objects to appear 33% larger and closer. Observe this effect by placing a straw in a glass of water. The straw appears to break at the surface of the water because the portion in the water appears closer and larger than the portion above the water. Divers must consider the effects of refraction when judging distances and the size of marine life. Objects that appear within reach are actually farther in the water, and objects that appear massive, are actually much smaller.

Section B: Commercial

B.1. Introduction

Commercial diving is governed by two regulatory standards:

- Reference (b), Commercial Diving Operations, 29 CFR § 1910T.
- Reference (d), Commercial Diving Operations 46 CFR § 197B.

These two regulatory standards have jurisdictional and investigative authorities. Reference (d) falls under U.S. Coast Guard (USCG), and reference (b) falls under the U.S. Department of Labor's Occupational Safety and Health Administration (OSHA).

B.2. Commercial

Commercial dive activities operate on navigable waterways, deep-water ports, and the Outer Continental Shelf. They are generally associated with work or compensation on an inspected vessel or oil platform. IOs must be aware of dive incident location, jurisdiction, and agreements (MOU/memorandums of agreement [MOA]) in effect.

Per reference (d), commercial diving requires specific equipment, procedures, and techniques. In relation to marine investigations, commercial diving is diving and related support operations conducted in connection with all types of work and employment.

B.2.a. Commercial Authorities

Commercial diving accidents involving inspected vessels and platforms are explicitly under the sole investigative jurisdiction of the USCG. While OSHA cooperation and involvement can be useful, such assistance is without legal jurisdiction and entirely at the discretion of the investigative officer (IO) or Marine Board.

Commercial diving from platforms, other than inspected vessels, falls under OSHA jurisdiction. While the USCG retains overlapping authority to investigate these incidents, such duplication of effort is generally unnecessary and not desirable. Accordingly, the IO coordinates closely with OSHA representatives regarding these incidents and undertakes an independent investigation only when OSHA or similar state agency declines to investigate.

In general, commercial diving operations consist of three phases:

- Personnel;
- Operations;
- Equipment.

USCG and OSHA regulations are similar in scope; however, additional requirements apply when conducting operations from vessels that require a USCG certificate of inspection. See Appendix G: Diving Requirements Quick Reference for a checklist that summarizes the regulatory requirements for each phase of the inspection and distinguishes between USCG and OSHA regulations.

B.2.b. Commercial Exemptions

The Code of Federal Regulations (CFR) specifies regulatory authority for USCG and OSHA. Reference (d), Commercial Diving Operations 46 CFR § 197B, includes the following exemptions:

- Scientific marine research and development purposes by academic institutions.
- Research and development for the advancement of diving equipment and technology.
- Search and rescue or related public safety purposes by or under the control of a governmental agency.

Reference (b), Commercial Diving Operations, 29 CFR § 1910T, includes the following exemptions:

- Instructional purposes, using open-circuit, compressed air scuba (self-contained underwater breathing apparatus) and conducted within the no-decompression limits (NDL).
- Search and rescue (SAR) or related public safety purposes by or under the control of a governmental agency.
- Scientific diving under the direction and control of a scientific diving program.

B.2.c. Operations

For the purposes of marine investigation, commercial diving is diving and related support operations conducted in connection with all types of work and employment to include:

- General industry;
- Construction;
- Ship building and repair;
- Salvage;
- Pollution response operations.

During an oil spill or hazardous substance release, the National Contingency Plan requires that response operations, including commercial diving operations, adhere to the requirements, standards, and regulations of OSHA. In general, the OSHA diving standards apply to all commercial diving operations that take place in U.S. waters and on the U.S. Outer

Continental Shelf. Additionally, when diving in contaminated waters, commercial divers must meet the requirements of the hazardous waste operations and emergency response (HAZWOPER) standards.

Reference (d), Commercial Diving Operations 46 CFR § 197B, provides for commercial diving operations inspections per reference (b), Commercial Diving Operations, 29 CFR § 1910T, when operations occur from a:

- Deepwater port;
- Offshore platforms;
- Vessels requiring a certificate of inspection (COI).

B.3. Non-Credential Commercial Fishing

Non-credential commercial fishing includes sea urchin, abalone, scallops, and sea cucumbers.

There are non-credential fishermen who are recreational and other fisherman who are fishing for commercial purposes. Any accident in a commercial setting requires notification to the Coast Guard like any other marine casualty. If the non-credential fishing is recreational in nature, the state or local agency is responsible for conducting the investigation. However, if the state does not carry out an accident investigation, the Coast Guard conducts the investigation.

NOTE: **Many states have laws regarding these specific fisheries and specific permit requirements. Washington state and Alaska are examples of states with guidance for commercial fishing executed by diving.**

Section C: Non-commercial

C.1. Non-commercial

Diving conducted for purposes other than those outlined for commercial diving is considered non-commercial. Non-commercial scuba diving, even when from an inspected small passenger vessel and under the supervision of a dive master, is non-commercial diving. Reference (a), Definitions, 46 CFR § 4.03, requires a marine casualty investigation after the death or injury of persons diving for non-commercial purposes from a commercial vessel in Federal waters. Not all non-commercial diving occurs from an inspected vessel or under the supervision of a diver master.

NOTE: **For non-commercial vessel diving casualty-reporting requirements, see reference (e), Casualty and Accident Reporting, 33 CFR § 173.51C. IOs must understand the state's willingness to become involved in non-commercial dive accidents. In the absence of the state's investigation, the U.S. Coast Guard is responsible for the investigation per reference (a).**

NOTE: **Dive charters occurring from inspected or uninspected passenger vessels are investigated. Dive casualties involving credentialed mariners might be bound by reference (f), Evidence of criminal liability, 46 CFR § 5.69, and reference (g), Operating a Vessel while under the Influence of Alcohol or a Dangerous Drug, 33 CFR § 95.**

C.2. Public Vessel

Per reference (a), public vessels are exempt from marine casualty reporting requirements. Although normally not investigated by the USCG, there are a few exceptions where other agencies ask an IO to conduct an investigation.

- Mariners diving from public vessels, e.g.:
  - Navy-owned.
  - Military Sealift Command.

NOTE: **Independent diving contractors for private purposes might not be exempt per reference (b), Commercial Diving Operations, 29 CFR § 1910T. However, there might be an exception in an emergency per reference (d), Commercial Diving Operations 46 CFR § 197B.**

Section D: Military

D.1. General

Military diving does not generally meet the reporting requirements for a diving casualty. There are, however, important lessons to learn from investigating these incidents. All five branches of the armed services are involved in diving operations. Personnel assigned to these types of units can also provide assistance in discussing events and technical knowledge associated with diving operations.

D.2. U.S. Coast Guard (USCG)

The USCG's diving capabilities are available to support all 11 of the service's statutory missions:

- Ports, Waterways, and Coastal Security (PWCS);
- Drug Interdiction (DI);
- Defense Readiness (DR);
- Search and Rescue (SAR);
- Alien Migrant Interdiction Operations (AMIO);
- Marine Safety (MS);
- Aids to Navigation (ATON);
- Living Marine Resources (LMR);
- Marine Environmental Protection (MEP);
- Ice Operations (IO);
- Other Law Enforcement (OLE).

Divers perform a variety of missions, including buoy tending in the central Pacific, science support in the polar regions, and security diving operations in ports around the country.

D.3. U.S. Navy (USN)

The U.S. Navy uses diving resources for:

- Navy Sea, Air, Land teams (SEAL) – underwater demolition teams;
- Navy divers (non-combat swimmers):
  - Underwater welding;
  - Ship husbandry and underwater construction;
  - Harbor cleaning (except for explosive ordnance);

- Other varying duties involving underwater work;
- Mobile diving and salvage units.

D.4. U.S. Army (USA)

The U.S. Army (USA) uses diving resources for:

- Army Rangers certified through the Special Forces Combat Diver Qualification Course;
- Delta Force members (trained in combat swimming);
- Army Engineer divers:
  - Underwater construction;
  - Salvage;
  - Demolitions;
  - Hydrographic survey;
  - Hyperbaric chamber operations;
  - Beach and river reconnaissance;
  - Bridge reconnaissance;
  - Underwater cutting and welding;
  - Side scan sonar operations;
  - Mine and countermine operations;
  - Search and recovery operations;
  - Husbandry operations.

U.S. Army divers use both surface-supplied “hard hat” gear and scuba to perform their missions.

U.S. Army Special Forces maintain a robust combat diving capability. One Operational Detachment-Alpha (ODA) per Special Forces company is trained and equipped to conduct open and closed circuit sub-surface maritime infiltration operations. Special Forces combat divers, along with many combat divers from other services, attend the Special Forces Combat Diver Qualification Course, conducted at the Special Forces Underwater Operations School.

D.5. U.S. Marine Corps (USMC)

The U.S. Marine Corps Combatant Diver Course is located at the Navy Diving and Salvage Training Center, Naval Support Activity Panama City, Panama City, Florida. USMC units with dive capability are:

- Marine Special Operations Battalions;
- Marine Force Reconnaissance;
- Marine Reconnaissance Battalions;
- Maritime Special Purpose Force.

D.6. U.S. Air Force (USAF)

U.S. Air Force Pararescue (PJ) and Combat Control (CCT) personnel are trained in both open and closed circuit diving. They attend the Air Force Combat Dive Course for certification.

Some Air Force Tactical Air Control Party (TACP) members and some Special Operations Weather team (SOWT) members are scuba or combat diver qualified. Both they and PJ/CCT personnel can operate as members of Special Forces ODAs and Navy SEAL teams on diving operations, missions requiring subsurface infiltration, and other waterborne operations.

NOTE: **USCG investigators can assist military entities with an investigation and provide an objective view concerning the investigation.**

NOTE: **On 17 August 2006, two USCG members died aboard the USCGC HEALY while conducting two 20-minute cold water familiarization dives at 20-foot depth in 29º Fahrenheit water. Refer to Healy Administrative Investigation for investigation and final action reports.**

NOTE: **Two Navy members died at the Aberdeen Proving Ground during a training evolution. Casualty lessons learned from this incident can provide specific insight into the hazards of deep water diving. For more information, register and access Homeland Security, Joint Lessons Learned Information System and conduct a keyword search.**

Section E: Science

E.1. Description

Scientific diving is diving performed as a necessary part of a scientific, research, or educational activity. Scientific diving is not considered commercial diving and is exempt from commercial diving requirements.

E.2. General

Scientific diving must meet specific criteria to be exempt as science diving. As a general rule of distinction, a scientific diver observes and gathers data. The scientist chooses a work location and diving conditions that maximize the safety and efficiency of gathering data and minimize environmental stresses. By contrast, the commercial diver is an underwater construction worker, builder, and troubleshooter whose work area and diving conditions are determined by the employer and needs of the project.

To be identified as a scientific diving operation, it must contain the following elements:

- The Diving Control Board has a majority of active scientific divers and has autonomous and absolute authority over the scientific diving program's operations.
- The purpose of 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 observation and data collection. Construction and troubleshooting 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.

NOTE:

For scientific dive regulations per reference (b), Commercial Diving Operations, 29 CFR § 1910T, select the following link: OSHA Regulations.

E.2.a. Science Diving Safety Manual

Per reference (b), the science diving safety manual includes at a minimum:

- Procedures covering all diving operations specific to the program.
- Procedures for emergency care, including recompression and evacuation.

- Criteria for diver training and certification.

E.2.b. Dive Control Safety Board

The functions of a diving control safety board, where the majority of members are active divers, include the following:

- 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;
- Assure adherence to the buddy system.

Section F: Public Safety

F.1. Description

Public safety diving is the underwater work conducted by law enforcement, fire rescue, and search and rescue/recovery dive teams. Non-commercial, scientific, and commercial divers generally plan the date, time, and location of a dive, and dive only if the conditions are conducive to the task. Public safety divers respond to emergencies 24 hours a day, 7 days a week. They can be required to dive during inclement weather, in zero visibility "black water," or in waters polluted by chemicals and biohazards.

F.2. Law Enforcement and Firefighters

Many public safety divers are volunteers, but career law enforcement or fire rescue personnel also often take on these additional responsibilities as part of their occupation.

F.3. Rescue Divers

National Association of Rescue Divers maintains a list of rescue divers by state. This link is provided for information; however, the IO coordinates efforts through COMDT (CG-INV) and PACAREA (PAC-37DF) Dive Force manager initially and then PAC-37DF thereafter.

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Chapter 3:
Modes of Diving, Equipment, and Protocols

Introduction

This chapter discusses various modes of diving, equipment, and protocols that an investigator must be aware of before beginning an investigation.

In This Chapter

This chapter contains the following sections:

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Section A: Snorkeling

A.1. Description

Figure 3-1 Snorkeling

Snorkeling is swimming with a snorkel and mask (and usually fins). It allows swimmers to breathe with their faces looking downward in the water.

Recreationally, snorkeling is very common in warm shallow waters abundant with fish and/or corals.

Commercially, snorkeling is commonly used to harvest certain aquatic species for commercial sale. Occasionally, commercial workers elect to put a person in the water as a snorkeler for a quick "dive and fetch" operation to retrieve something dropped over the side. This activity is included in the definition of a marine casualty or accident per reference (a), Definitions, 46 CFR § 4.03: "…injury or loss of life while diving from a vessel and using underwater breathing apparatus."

A.2. Risks

Inherent risks associated with this activity:

- Physical exertion and fatigue;
- Watercraft hazards;
- Strong currents;
- Hypothermia;
- Hypoxia;

- Drowning;
- Sea life.

A.3. Equipment

Typical snorkeling equipment:

- Diving mask;
- Snorkel;
- Fins.

Section B: Free Diving

B.1. Description

Figure 3-2 Free diving

Also known as skin diving or breath-hold diving, free diving is a form of underwater diving that relies on a diver's ability to hold his or her breath until resurfacing rather than on the use of a breathing apparatus such as scuba gear.

Free diving is a common activity used non-commercially for spear fishing and by commercial divers to harvest certain aquatic species for commercial sale.

There is also an extreme sport of apnea in which divers attempt to attain great depths, times, and/or distance on a single breath. Free diving (long duration and deep dives) is becoming very popular. This activity is not included in the definition of a marine casualty or accident per reference (a), Definitions, 46 CFR § 4.03.

Characteristics of free diving include:

- Similar to snorkeling;
- Breath-hold diving to 60 feet or deeper;
- Usually performed by skilled swimmers/divers;

NOTE: **Records are held at free diving depths of over 700 feet.**

B.2. Risks

Inherent risks associated with this activity:

- Physical exertion and fatigue;
- Shallow water blackout:
  - Major risk to free divers;
  - Generally occurs in less than 50 feet of water;
- Watercraft hazards;
- Hypothermia;
- Ear trauma (and other squeezes);
- Hypoxia;
- Drowning.

B.3. Equipment

Equipment used by free divers:

- Mask;
- Long fins or “mono-fin”;
- Optional snorkel;
- Wet suit.

Activity can also include the use of:

- Spear gun (or Hawaiian sling);
- Weights;
- Other technical gear for competitive free diving.

Section C: SNUBA

C.1. Description

Figure 3-3 SNUBA

SNUBA is a combination of snorkeling and scuba diving. The swimmer uses fins, a diving mask, weights, and diving regulator similar to scuba diving. The air, however, comes through a long hose from tanks on pontoon rafts on the surface rather than from tanks strapped on a diver's back.

NOTE: **This activity is different from hookah diving where air is usually supplied with a gas-powered air compressor.**

- Often serves as an introductory form of diving, in the presence of a professional, insured guide, and following a half-hour lesson.
- Normally performed by novices.

C.2. Risks

Inherent risks associated with this activity:

- Illusion of safety; "same as snorkeling";
- Physical exertion and fatigue;
- Hypothermia;
- Pulmonary over-inflation syndrome;
- Ear trauma (and other squeezes);
- Decompression sickness (DCS);

- Breathing gas disorders (contaminated air);
- Gas embolism;
- Death,
- Sea life.

C.3. Equipment

Equipment used by SNUBA divers:

- Swim fins;
- Diving mask;
- Weight;
- Diving regulator;
- Air supplied from hose on pontoon rafts on the surface.

Section D: Scuba and Re-Breather (Non-Surface-Supplied)

D.1. Description

Figure 3-4 Scuba Diving

Scuba is a diving mode independent of surface supply in which the diver uses an open circuit self-contained underwater breathing apparatus. There are two types of scuba gear:

- Open-circuit:
  - Compressed air;
  - Mixed gas.
- Re-breathers:
  - Closed circuit;
  - Semi-closed circuit.

D.2. Re-Breather

A re-breather is a breathing apparatus that absorbs the carbon dioxide of a user's exhaled breath to permit the re-breathing (recycling) of the substantially unused oxygen content of each breath. Oxygen is added to replenish the amount metabolized by the user. This differs from an open-circuit breathing apparatus, where the exhaled gas is discharged directly into the environment. Re-breather technology is used where breathing gas

supply is limited, where the environment is toxic or hypoxic, or where the breathing gas is specially enriched or contains expensive components, such as helium diluents or anesthetic gases.

D.3. Risks

Risks generally associated with scuba are:

- Physical exertion and fatigue;
- Watercraft hazards;
- Ear trauma (and other squeezes);
- Pulmonary over-inflation syndrome;
- Decompression sickness (DCS);
- Breathing gas disorders (contaminated air);
- Gas embolism;
- Sea life.

NOTE: **Training is recommended for safe scuba diving; however, there is no regulatory requirement. The Coast Guard does not regulate recreational diving certification. Certain civilian organizations exist which provide training and informal certification for recreational divers. These organizations include Professional Association of Diving Instructors (PADI) and National Association of Underwater Instructors (NAUI).**

D.4. Types of Breathing Gases

Below are the sources of breathing gases that can be used in scuba.

D.4.a. Air

Normal air is 78% nitrogen, 21% oxygen, and 1% other (primarily argon).

D.4.b. Nitrox

Gas mixture composed of nitrogen and oxygen. In scuba, oxygen is higher and nitrogen is often reduced.

D.4.c. Trimix

Trimix is a breathing gas, consisting of oxygen, helium, and nitrogen. It is often used in deep commercial diving and during the deep phase of dives carried out using technical diving techniques. With a mixture of three gases, it is possible to create mixes suitable for different depths or purposes by adjusting the proportions of each gas.

D.4.d. Heliox	Generally known as heliox, it contains a mixture of helium and oxygen with 0% nitrogen content. It is frequently used as a breathing gas in deep commercial diving operations, where it is often recycled to save the expensive helium component. Analysis of two-component gases is much simpler than three component gases.
D.5. Technical Scuba	A form of scuba diving that exceeds the conventional limits – especially depth and bottom time – of non-commercial diving. Technical diving exposes the diver to significantly higher risks than non-commercial diving, including permanent illness and death. It requires extensive experience, advanced training, and specialized equipment. Technical diving also often involves breathing gases other than air or standard nitrox.

Section E: Surface-Supplied

E.1. Description

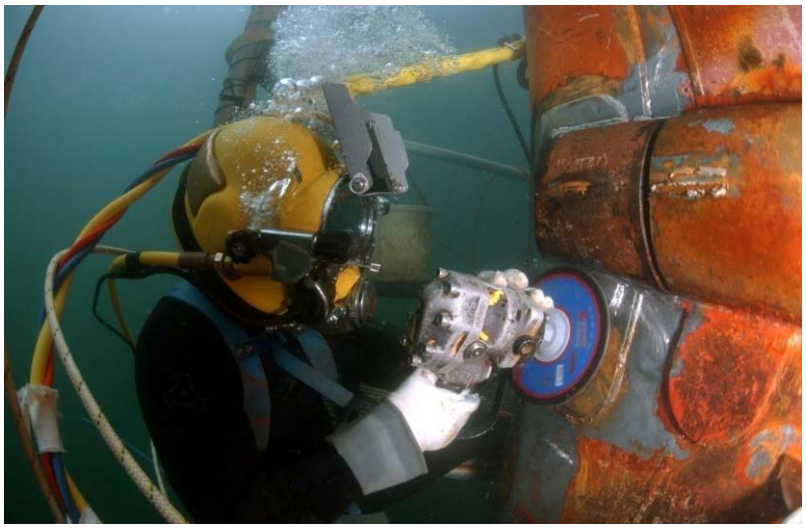

Figure 3-5 U.S. military diver during surface-supplied diving

Any type of diving where the diver is supplied with breathing gas from the surface via a long air hose (i.e., umbilical). This diving activity requires training and more personnel. It is common in the military and commercial diving environments.

E.2. Risks

Surface-supplied risks are generally the same as non-surface-supplied, with the exception that dives at deeper depths and for longer duration present a higher risk of decompression sickness (DCS). Common risks include:

- Physical exertion and fatigue;
- Watercraft hazards;
- Ear trauma (and other squeezes);
- Pulmonary over-inflation syndrome;
- DCS;
- Breathing gas disorders (contaminated air);
- Gas embolism;
- Entanglement;
- Explosion.

E.3. Types of Breathing Gases	Below are typical types of breathing gases used for surface-supplied diving.
E.3.a. Air	Normal air is 78% nitrogen, 21% oxygen, and 1% other, primarily argon.
E.3.b. Mixed Gas	A combination of mixed gases used for respiration. Typically contains mixtures of oxygen, nitrogen, helium, neon, or hydrogen. Formulations include nitrox, trimix, heliox, heliair, hydreliox, hydrox, and neox.

Section F: Hookah Diving

F.1. Description

Figure 3-6 Hookah diving

Figure 3-7 Hookah diving

Hookah diving is the simplest form of surface-supplied diving. Usually consisting of a low-pressure air compressor, a low-pressure steel gas container (volume tank), with a long hose connected to a second stage regulator. Typically used for seafood diving, gold dredging, cleaning boat hulls, and treasure hunters.

F.2. Equipment

Equipment generally associated with hookah diving:

- Low-pressure air compressor or low-pressure gas container;
- Long hose connected to a second stage regulator;
- Diving mask;
- Fins;
- Weight belt;
- Wet suit, dry suit, hot water suit.

Section G: Bell

G.1. Description

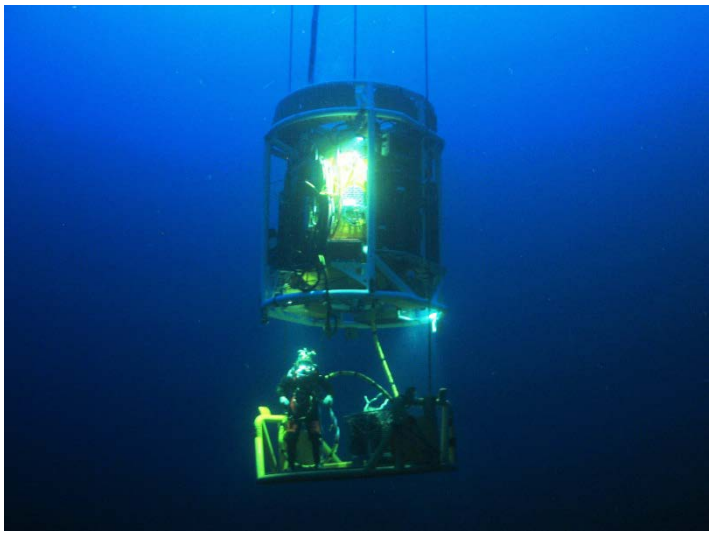

Figure 3-8 Bell diving

Figure 3-9 Bell diving

A diving bell is a rigid chamber used to transport divers to depth in the ocean.

An open bell, commonly referred to as a “wet bell” or “air diving,” is a cable suspended chamber, open at the bottom, which is lowered underwater to operate as a base or a means of transport for a small number of divers. The pressure of the water keeps the air trapped inside the bell.

These were the first type of diving chambers and usually operated to depths to 50 meters.

A closed bell is a sealed chamber that is used for saturation diving. Divers breathe mixed gas and wear hot water suits. Diving is generally performed in very deep water offshore in depths 50 to 300 meters. It is also common for closed bell divers to work in shallow water (shallow saturation) as it enables longer work periods, normally 10 to 28 days.

G.2. Equipment

Equipment normally used with bell diving:

- Suit;
- Helmet (stainless steel, fiberglass, or other strong lightweight material);
- Corselet;
- Weighted shoes;
- Diver's weight;
- Air control valve.

Section H: Saturation Diving

H.1. Description

Figure 3-10 Saturation diver at 230 feet

Saturation diving is a technique that allows divers to reduce the risk of decompression sickness (the bends) when working at deep depths for long periods. The diver lives in a pressurized environment until the work is complete, followed by a decompression period to re-acclimate to surface pressure. This form of diving is typically used for extended work periods in depths greater than 160 feet. Divers are transported by and work out of a closed diving bell.

H.2. Equipment

This diving system uses the specialized saturation system, along with the other common diver equipment.

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Chapter 4: Physiological Diving Disorders

Introduction

This chapter discusses disorders associated with diving.

In This Chapter

This chapter contains the following sections:

Section	Title	Page
A	Introduction	4-2
B	Pre-Diving Activities	4-3
C	Diving Disorders and Symptoms	4-4
D	Causes of Death	4-8

Section A: Introduction

A.1. Basic Physiological Functions

This chapter provides basic information on the changes in human anatomy and physiology that occur in the underwater environment. It also discusses the diving disorders that divers might encounter when they enter the water and experience increased ambient pressure.

A body at work requires the coordinated function of all organs and systems. The heart pumps blood to all parts of the body; the tissue fluids exchange dissolved materials with the blood; and the lungs keep the blood supplied with oxygen and cleared of excess carbon dioxide. Most of these processes are controlled directly by the brain, nervous system, and various glands. The individual is generally unaware that these functions are taking place. All of these functions and systems can be adversely affected in the pressure-increased water environment, and these adverse effects can cause death.

A.2. Setting Limits

The human body lacks effective ways of compensating for many of the effects of increased pressure at depth and can do little to keep its internal environment from being upset. Such external effects set definite limits on what a diver can do and, if not understood, can give rise to serious accidents or death.

A.3. Body Disposition

Only medical responders move an injured or deceased diver. In rare cases, the IO may need to take photographs of the evidence or additional data, which requires moving the body, the IO should ask medical responders.

Section B: Pre-Diving Activities

B.1. Equipment Checklist

Before any dive, divers complete a number of steps and checks such as the following:

- Ensure regulator hoses are properly connected;
- Ensure dive tanks have enough air;
- Perform regular routine servicing and maintenance of equipment;
- Develop a thorough dive plan.

B.2. Personal Activities Checklist

Pre-diving activities can also include a diver's activities in the hours and, in some cases, days before any dive. Examples of these could include a strenuous workout session, consumption of drugs or alcohol, airplane flight, or recent hyperbaric treatments. Any one of these could directly contribute to a diving casualty and possibly mimic or conceal symptoms of some diving disorders.

Section C: Diving Disorders and Symptoms

C.1. Arterial Gas Embolism (AGE)

Arterial gas embolism (AGE), sometimes simply called gas embolism, is an obstruction of blood flow caused by gas bubbles (emboli) entering the arterial circulation system. Obstruction of the arteries supplying the brain and heart can lead to death if not promptly relieved.

C.2. 3. Asphyxia

Condition where breathing stops and both hypoxia and hypercapnia (elevated CO_2) occur simultaneously. Asphyxia occurs when there is no gas to breathe, the airway is completely obstructed, the respiratory muscles become paralyzed, or when the respiratory center fails to send out impulses to breathe.

C.3. Barotraumas

Damage to body tissues from the mechanical effects of pressure results when pressure differentials between body cavities and the hydrostatic pressure surrounding the body, or between the body and the diving equipment, are not equalized properly.

Barotrauma most frequently occurs during descent, but can also occur during ascent. Barotrauma on descent is called squeeze. Barotrauma on ascent is called reverse squeeze.

C.4. Bites, Stings, and Contact Irritations

Divers also incur bites, stings, and contact irritations, as well as more common injuries like abrasions, lacerations, and fractures. Evaluate bites and stings based on severity. Anaphylaxis (allergic reaction) is always a concern. Warm water and vinegar neutralize many stings and irritations. If present, scuba instructors or dive masters are often familiar with various remedies for specific injuries. If the remedies do not contradict your local treatment protocol, heed their advice.

WARNING:

Call emergency personnel if divers show symptoms from bites, stings, or contact irritations, or if injuries such as abrasions, lacerations, and fractures worsen. Follow up with a physician or medical personnel as soon possible.

C.5. Carbon Monoxide Poisoning

While the human body may produce an incredibly small amount of carbon monoxide (CO), that amount will not cause CO poisoning. The cause of CO poisoning while diving is from the introduction of CO into the breathing media. This CO typically comes from the incomplete combustion of carbon-based fuels (e.g. exhaust of an internal combustion engine).

C.6. Chart of Symptoms Related to Disorders	See Appendix C: Diving Disorders.
C.7. Decompression Sickness (DCS)	A diver's blood and tissues absorb additional nitrogen (or helium) from the lungs when at depth. If a diver ascends too quickly, does not complete the full time of a required safety stop, or completely skips a required safety stop, the excess gas separates from solution and forms bubbles. These bubbles produce mechanical and biochemical effects that lead to a condition known as decompression sickness. The bubbles can restrict or block blood flow, put pressure on nerve endings, stretch and tear tissue leading to hemorrhage, tissue hypoxia, cell injury, and death. If a diver experiences an uncontrolled ascent (aka a blowup), then there is an increased chance of DCS or AGE. If a diver ascends at the proper rate (30 feet per minute or 1 foot per 2 seconds) but fails to either complete the full time of the required safety stop or completely skips it, then the diver might experience DSC symptoms.
C.8. Drowning or Near Drowning	Drowning is death through submersion in and inhalation of water, or fluid-induced asphyxia. Near drowning is the term used when a victim is successfully resuscitated following a drowning episode.
C.9. Hypercapnia (Carbon Dioxide Retention)	Abnormally high level of carbon dioxide in the blood and body tissues.
C.10. Hypoxia or Oxygen Deficiency	Abnormal deficiency of oxygen in the arterial blood. Severe hypoxia impedes the normal function of cells and can result in cell death. The brain is most vulnerable to the effects of hypoxia.
C.11. Immersion Pulmonary Edema (IPE)	A condition in which fluid fills the lungs during diving or swimming, particularly in cold water. It has sudden onset in swimmers and divers and is characterized by cough, shortness of breath, decreased blood oxygen levels, and hemoptysis (coughing up blood).

C.12. Mediastinal and Subcutaneous Emphysema

Mediastinal emphysema, also called pneumomediastinum, occurs when gas is forced through torn lung tissue into the loose mediastinal tissues in the middle of the chest surrounding the heart, the trachea, and the major blood vessels. Mediastinal emphysema is a prerequisite for subcutaneous emphysema.

Subcutaneous emphysema (air trapped underneath the skin) occurs when that gas subsequently migrates into the subcutaneous tissues of the neck.

C.13. Nitrogen Narcosis

Nitrogen narcosis is the state of euphoria and exhilaration that occurs when a diver breathes a gas mixture containing nitrogen. For a dive on air, narcosis usually appears at a depth of approximately 130 feet of seawater (fsw), is very prominent at a depth of 200 fsw, and becomes disabling at deeper depths. There is a wide range of individual susceptibility to narcosis. There is also some evidence that adaptation occurs on repeated exposures. Some divers, particularly those experienced in deep operations with air, can often work as deep as 200 fsw without serious difficulty.

C.14. Oxygen Toxicity

Oxygen toxicity can cause pulmonary oxygen toxicity and central nervous system (CNS) oxygen toxicity. While most common during hyperbaric chamber treatments while the patient is breathing 100% oxygen, it can also occur at depth if a diver is breathing a gas mixture with an increased percent of oxygen (i.e., greater than 21%). Breathing standard air at depths greater than 190 feet can also cause oxygen toxicity.

C.15. Pneumothorax

A pneumothorax is air trapped in the pleural space between the lung and the chest wall and causes the collapse of the lung.

C.16. Hyperbaric Oxygen Therapy (HBOT)

Figure 4-1 Hyperbaric oxygen therapy

Hyperbaric oxygen therapy (HBOT) is a common medical treatment for a wide range of traumatic, acute, and chronic diseases and conditions. HBOT is best known as a treatment for divers suffering decompression sickness, or "the bends."

- Safe - Proper hyperbaric oxygen therapy delivers a carefully managed dosage of pressure and pure oxygen over a prescribed period of time.
- Pressure - The word hyperbaric means above-normal pressure. Hyperbaric oxygen therapy is delivered in a chamber pressurized at 1.4 to 3.5 times the normal sea-level atmospheric pressure of 14.696 pounds per square inch.
- Oxygen - Patients breathe 100% oxygen during hyperbaric oxygen therapy, sometimes with short "air breaks" of normal air. Normal air contains 21% oxygen, 78% nitrogen, trace amounts of other gases, and water vapor. Air breaks ensure patients avoid oxygen toxicity.
- Time - Most HBOT treatments, often called "dives," last between 50 and 90 minutes. Some conditions, such as acute carbon monoxide poisoning and decompression sickness, are treated successfully in just one to three dives.

C.16.a. Facilities with Hyperbaric Chambers/ Capabilities

The hyperbaric directory includes hundreds of hospitals, medical centers, and independent clinics with hyperbaric facilities. Each listing includes contact information, type of facility, and chamber types. The link below directs you to hyperbaric chambers throughout the U.S., listed state by state.

Hyperbaric Oxygen Therapy Treatment Center Directory

Section D: Causes of Death

D.1. Pre-existing Conditions

Pre-existing conditions can increase the risk of a diving related death. Such conditions include ear infection; sinus problems; cold; congestion; sinusitis; bronchitis; respiratory problems; severe attack of hay fever; allergies; lung disease; history of pneumothorax; asthma; emphysema; tuberculosis; behavioral or nervous system disorders; pregnancy; colostomy; heart disease; blood vessel disease; high blood pressure; angina; bleeding disorders; diabetes; seizures; blackouts or fainting; convulsions; epilepsy; claustrophobia; agoraphobia; history of back, arm or leg problems following an injury; fracture; or surgery. Though extensive, this is not an all inclusive list.

D.2. Masked Causes

Left untreated, many diving disorders can cause death. However, diving disorders might mask other causes of death when a deceased diver is brought to the surface. For instance, a cardiac arrest or stroke might be disguised by the damage caused by the dissolved gases in body tissues forming bubbles as a deceased or unconscious diver is returned to the surface.

D.3. Fitness

A diver's physical fitness, particularly poor physical condition, can be a contributing factor to a diving casualty.

D.4. Underwater Explosions

An underwater explosion is a chemical or nuclear explosion that occurs under the surface of a body of water. The explosion creates a blast or sound wave. The energy from the explosion creates shock waves, turbulence, and thrusting action of the mass motion of the surrounding water.

A blast injury refers to the anatomical and clinical symptoms caused by exposure of a living body to the shock wave generated. Primary causes of death are:

- Pulmonary:
  - Low arterial oxygen saturation (hypoxemia);
  - High arterial CO_2 retention (hypercapnia);
  - Respiratory acidosis.

- Brain:
  - Hemorrhage and edema caused by rapid increase in venous pressure following compression of the thoracic and abdominal venous reservoirs by the pressure wave.
  - Transmission of pressure into the cerebral venous system causes small blood vessels to rupture.
- Air embolism:
  - Rupture of lung alveoli and compression of the alveolar gas enters the vascular system with an air embolism to the brain.

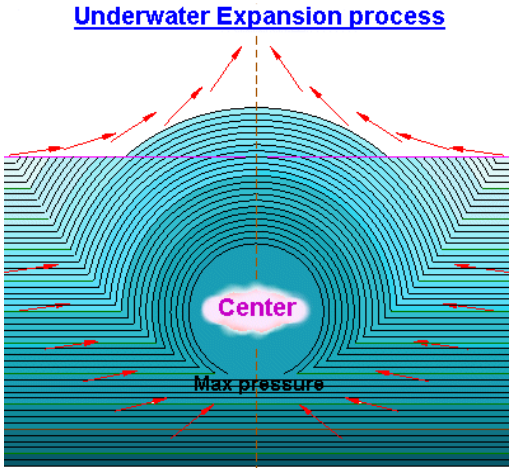

Figure 4-2 Underwater explosion

D.5. Sequential Analysis

In diving fatalities, the events and their significance are often obscure or unknown. However, a casualty is characterized into sequences of events:

- Trigger: A trigger is the earliest identifiable event (initiating event and subsequent event) that appears to transform an unremarkable dive into an emergency.
  - Insufficient gas;
  - Entrapment;
  - Equipment problems;
  - Rough water.
- Disabling agents: A disabling agent is a hazardous behavior or circumstance that was temporarily or logically associated with the trigger and perhaps caused the event.

- Emergency ascent;
- Insufficient gas;
- Buoyancy trouble.

- Disabling injuries: A disabling injury is directly responsible for death or incapacitation followed by death due to the original cause. Cause of death is determined by the medical examiner. Cause of death might be the same as the disabling injury or might be drowning secondary to injury.
  - Asphyxia;
  - Arterial gas embolism;
  - Cardiac incident;
  - Trauma;
  - Decompression sickness;
  - Unexplained loss of consciousness;
  - Inappropriate gas or gas mixtures.

NOTE: **For more information see "Common causes of open-circuit recreational diving fatalities" – UHM 2008, Vol 35, No. 6**

Chapter 5:
Conducting Diving Investigations: Commercial

Introduction

This chapter discusses commercial dive casualty investigative techniques. Whether the casualty is commercial or non-commercial, principles of investigation are similar and use many of the same processes. The investigator needs to be aware of relevant United States Code, Code of Federal Regulations, and applicable policies listed in this chapter; these are distinct and differentiate between commercial and non-commercial aspects associated with these investigations.

See reference (c), USCG Marine Safety Manual, Volume V: Investigations and Enforcement, COMDTINST M16000.10 (series), for distinctions in commercial and non-commercial diving.

In This Chapter

This chapter contains the following sections:

Section	Title	Page
A	Pre-Investigation	5-2
B	During Investigation	5-6
C	Enforcement	5-20
D	Lab Analysis Guidance	5-25
E	Post Investigation	5-27

Section A: Pre-Investigation

A.1. Components of the Investigator Bag

Investigating officers (IOs) use many tools. In addition to personal protective equipment, the IO conducting an investigation might need the items listed here:

- Applicable appendices in this document;
- Camera or video recorder;
- Chalk to help make serial numbers readable, especially when stamped into black plastic equipment. Rub chalk into numbers to increase readability;
- Coveralls to protect the investigator from potential biohazards;
- Evidence seizure tags and bags;
- Gloves – chemical and biohazard proof;
- Gowns to shield against biohazards;
- GPS – handheld to precisely locate sites, especially those not named;
- Laptop computer with Internet capability;
- Magnifying glass for reading very small serial numbers etched into equipment;
- Measuring tape – corrosion resistant and flexible;
- Nautical charts and/or maps of the region where the incident occurred. Use maps to locate hospitals, fire stations, etc;
- Oxygen sensor;
- Smartphone and/or tablets to send email and access Web;
- Vernier calipers to measure small pieces of equipment, damage to gear, depth of gouges, etc;
- Voice recorder to record interviews (always ask permission first).

NOTE: **Though this list is not all-encompassing, it provides the investigator with some minimum recommendations.**

A.2. Training

IO training opportunities improve, enhance, and maximize mission critical skill sets. They provide the IO technical expertise necessary to understand the complex relationship between the human body and its exposure to an underwater, pressurized environment. Training improves overall casualty analysis aimed at preventing casualty recurrence and/or assessing the most appropriate criminal or civil penalty actions.

Topics where additional training can inform IOs include the following:

- COMDT (CG-INV, CG-S&R), Investigation Center of Expertise, PACAREA (PAC-37);
- Dive courses to better understand the complex issues confronted during investigations;
- Witness interviewing;
- Photography and videography;
- Marine operations and equipment (deck and engine);
- Master and pilot relationship;
- Marine insurance.

NOTE: **Due to service school unavailability, commands are encouraged to provide and fund training opportunities.**

A.3. Diving Certification Agencies

The following organizations provide dive certified course training:

- Professional Association of Diving Instructors (PADI);
- Scuba Schools International (SSI);
- National Association of Underwater Instructors (NAUI);
- Young Men's Christian Association (YMCA).

Research other local organizations who provide additional training in:

- Advanced open water diving;
- Wreck diving;
- Cave diving;
- Enriched air diving.

Industry standards require divers to present dive certification cards before diving from a charter vessel, purchasing air fills, or renting/ purchasing scuba equipment.

NOTE: **Always determine if the diver was diving within proper training levels.**

NOTE: **For dive specific questions, contact PACAREA (PAC-37DF) PACAREA dive force manager.**

A.4. Sharing Investigation with Diving Organizations

Information sharing is an important tool for educating the dive public. The sharing of lessons learned fosters this education process and builds rapport between the USCG and various non-governmental organizations (NGOs). An example of an NGO is Divers Alert Network (DAN).

Investigating officers can benefit from interacting with various NGOs that support dive related information.

For USCG officials to release the investigation, the local unit and headquarters must review and close it. For release outside the USCG, the USCG redacts the report (personal identifiable information and other Privacy Act information blocked out), and the requesting dive agency makes a Freedom of Information Act (FOIA) request. COMDT (CG-611) appropriately redacts information as required.

A.5. Resources for Investigator

Establish relationships with resources:

- COMDT (CG-INV);
- Coast Guard Liaison Office at Navy Diving and Salvage Training Center, 350 S. Craig Road, Panama City, FL 32407;
- PAC-37;
- CG-7212, Dive Capabilities Division;
- Navy Experimental Diving Unit;
- International Association of Nitrox and Technical Divers (IANTD);
- Technical Diving International (TDI);
- Professional Scuba Association (PSA);
- Divers Alert Network (DAN);
- American Nitrox Divers International (ANDI);
- Local and Federal dive lockers (USCG dive program and dive lockers):
  - Primary resources: Dive Lockers East and West;
- State and local government representatives;

- Public safety divers (fire, sheriff, and fish and wildlife departments);
- Commercial diving community;
- Medical examiner;
- Forensics facilities.

NOTE: **Contact the Investigations National Center of Expertise for guidance on supporting forensics requests.**

- Coast Guard Investigative Services (CGIS);
- Local hospitals with hyperbaric chambers. See Undersea and Hyperbaric Medical Society - Accredited Facilities;
- Association of Dive Contractors International (ACDI).

Section B: During Investigation

B.1. Site Investigation

During the preliminary stages of a diving casualty or injury investigation, IOs are most often far removed from the incident location. It is imperative that the IO take proactive steps to ensure critical evidence is preserved and collected. Collect evidence and preliminary information regarding the incident from a variety of sources to include state, local, or other Federal agencies who are first responders on scene. Often times, other Coast Guard units are the first to arrive on scene to transport the injured diver to shore.

When dealing with commercial diving operations regulated under reference (d), Commercial Diving Operations 46 CFR § 197B, the designated person-in-charge or diving supervisor is best suited to answer preliminary questions, secure the scene, and preserve evidence until the Coast Guard IO can arrive.

B.2. Jurisdiction Determination

The IO immediately determines if the diving accident is classified as non-commercial or commercial. If the accident is commercial in nature, the IO reaches out to OSHA for collaboration and discusses which agency is best suited to take lead. If the accident is non-commercial, the USCG leads the investigation.

Once jurisdiction has been determined, the IO can develop a clear picture as to what evidence is on scene as well as what interview or equipment questions (commercial or non-commercial) to ask upon arrival.

For more information, see Section C: Enforcement.

B.3. Interviews

IOs must conduct interviews at the scene of a commercial diving casualty investigation. Use the following resources:

- Appendix E: Commercial Diving Investigation Questionnaire has a copy of a questionnaire for diving supervisors in commercial settings. Following is the link to an electronically fillable questionnaire for accident supervisors in commercial settings. IOs can also print the questionnaire if no tablet is available during interviews and gear inspection. Link to commercial questionnaire: http://www.uscg.mil/forcecom/ttp/downloads/Commercial_Diving_Interview_Questions.pdf
- Reference (d) lists regulations regarding equipment, records, personnel, etc.

- Appendix D: Commercial Diving Casualty Checklist provides a checklist for IOs to use while gathering data. Link to fillable form: http://www.uscg.mil/forcecom/ttp/downloads/Commercial_Diving_Casualty.pdf

B.4. Equipment Inspection

Dive equipment is complex; therefore, the IO scrutinizes every item of equipment involved in a marine casualty for proper functionality. Collect all equipment associated with the diving operation for possible analysis.

For example, investigating officer does the following when arriving on scene:

- Investigates if equipment was maintained and used correctly.
- Documents appearance of the equipment;
- Determines if the equipment is properly connected;
- Photographs equipment before dismantling (dive mask, snorkel, fins, weight belt, wet suit, knife, camera, etc.);
- If a wet suit was used, identifies its thickness and the cut of the suit because of the implications on a diver's buoyancy.
- Records the weight of the weight belt worn by the diver to determine if a diver was diving with too little or too much weight for that depth.
- Checks gauges and records data. When retrieving scuba tanks and recording the pressure gauge, close the tank valve and simultaneously count the number of full revolutions it takes to fully close the valve and record the revolution count.

See the links in B.3. Interviews for a list of questions and observations for IOs.

See B.5 Equipment for equipment descriptions.

B.5. Equipment

During a commercial diving investigation, the IO refers to reference (d), Commercial Diving Operations 46 CFR § 197B, for specific diving equipment requirements. Below is a brief overview of some equipment that might be pertinent to the IO's investigation. However, the list is not exhaustive.

See also 46 CFR 197.300.

B.5.a. Air Compressor System

Air compressor systems are regulated by reference (d).

- Built and stamped in agreement with Section VIII, Division 1 of the ASME Code with:

- ➢ Check valve on the inlet side;
- ➢ Pressure gauge;
- ➢ Relief valve;
- ➢ Drain valve.

- Air intake located away from exhaust fumes or other hazardous contaminates.
- Equipped with an efficient filtration system.
- Equipped with slow opening shut off valves when maximum allowable working pressure (MAWP) exceeds 500 psig.

Figure 5-1 Example of commercial air compressor

B.5.b. Breathing Supply Hose

Breathing supply hoses are regulated by reference (d), Commercial Diving Operations 46 CFR § 197B. Ensure that the following conditions are met when in use:

- The stated MAWP for the hose is equal to or exceeds the supply system (air compressor) to which it is attached.

- The supply source maximum pressure exceeds the depth of the dive by at least 100 pounds/square inch (psig).
- The burst pressure is four times the stated MAWP of the hose.
- Check that the connections are:
  - Made of corrosion resistant material;
  - Resistant to accidental disengagement;
  - Rated to a MAWP equal or greater than the hose that is attached.
- Kink resistant.

Figure 5-2 Breath hose

B.5.c. Commercial Diver's Suit

For varying regulatory controls for commercial diver equipment, see reference (d), Commercial Diving Operations 46 CFR § 197B. Examine the diver's complete outfit for any abnormalities. The following sections list the components of the suit. This list is not exhaustive.

Figure 5-3 Commercial diving suit and equipment

B.5.d. Buoyancy Control Device

A buoyancy control device (BCD), is a piece of diving equipment containing a bladder that divers wear to establish neutral buoyancy underwater and positive buoyancy on the surface, when needed. A BCD is also known as a compensator, BC, stabilizer, stab jacket, wing, or adjustable buoyancy life jacket (ABLJ) depending on design.

Points to consider when evaluating the BCD:

- Note the size of the BCD. A BCD that is too small might not provide enough buoyancy to the diver.
- Determine if the diver was using an integrated weight system (weights incorporated into the BCD releasable by clip, Velcro fastener, or ripcord).
- Inspect the general appearance of the BCD. Determine if the BCD was damaged due to over-pressurization.
- Check the vents and auto (power) inflator function properly.

Figure 5-4 Buoyancy control device

NOTE: **Do not use the tank involved in the casualty to test the functionality of the BCD.**

B.5.e. Dive Computer

IOs can access data from dive computers using specialized cables from manufacturers.

Figure 5-5 Dive computer

Dive computers function essentially like a black box for an aircraft. They can capture and log information, such as time entered the water, descent

time, bottom time, ascent time, ascent rate, surface interval time, and water temperature. Divers use computers to ensure they are diving within appropriate bottom times and to calculate repetitive dives.

Additionally, some divers keep a history of all dives on their computers. Accessing this data might yield information about the diver's propensity for risk and could establish a pattern of unsafe diving practices.

The features on dive computers are not standard throughout the dive industry. Each manufacturer writes propriety software. Therefore, when investigating a casualty involving a dive computer, the IO seeks assistance from technical representatives familiar with the computer before attempting to access data. Untrained operators can accidently delete data from dive computers. Contact a local dive shop or the manufacturer for assistance.

Dive computers must be set up for the breathing medium (i.e., compressed air, enriched air) a diver was using at the time of a marine casualty.

NOTE: **Be sure to verify the computer was set to the correct breathing medium. Incorrect settings cause the computer to incorrectly calculate dive safety data.**

B.5.f. Diver Safety Harness

A safety harness is a positive buckling device with an attachment point for a lifeline that prevents any strain on the diver's mask, helmet and umbilical. Worn by the diver, it is strong enough to lift the diver from the water in an emergency.

Diver safety harnesses are regulated per reference (d), Commercial Diving Operations 46 CFR § 197B. Inspect for:

- Positive buckling device;
- Attachment point for umbilical. Does harness distribute pulling force of the umbilical over the diver's body and prevent strain on the mask or helmet?

Figure 5-6 Diver safety harness with umbilical attachment points to the sides

B.5.g. Gauges and Timekeeping Devices

A depth gauge is a pressure gauge that displays the equivalent depth in water. Gauges and timekeeping devices are regulated by reference (d), Commercial Diving Operations 46 CFR § 197B.

Inspect the following devices:

- Gauge indicating diver depth (surface-supplied dives);
- Timekeeping device at each dive location.

Figure 5-7 Diving gauge

Figure 5-8 Timekeeping device

B.5.h. Surface-Supplied Helmets and Masks

A diving helmet seals the diver's head from the water and allows the diver to see clearly underwater. The helmet provides the diver with breathing gas, protects the head, and usually provides voice communications with the surface.

A mask creates an air space in front of the eyes that allows a diver to focus properly when submerged.

Surface-supplied helmets and masks are regulated per reference (d), Commercial Diving Operations 46 CFR § 197B.

There are several types of surface-supplied helmets:

- Free-flow helmet– A free-flow helmet supplies a continuous flow of air to the diver that the diver easily breathes as it flows past. The flow rate must be high if the diver works hard, creating a noisy environment, affecting communications, and requiring hearing protection to avoid damage to the ears. This type of helmet is popular where divers have to work hard in relatively shallow water for long periods. It is also useful when diving in contaminated environments, where the helmet is sealed onto a dry suit and the entire system is kept at a slight positive pressure. This type of helmet is often large in volume, and as it is attached to the suit, it does not move with the head. Divers must move their entire body to face anything they want to see. The faceplate is large and there is often an upper window or side windows to improve the field of vision. Free-flow helmets require at least 6 actual cubic feet per minute (ACFM) per diver.
- Reclaim helmets – Since gas cost is a significant factor in deep open circuit diving with helium-based mixtures for long periods, reclaim helmets are a popular choice. By using a return line for the exhaled gas, it can be recompressed and used again, almost indefinitely. It is necessary to remove carbon dioxide from the reclaimed gas, but removal is relatively cheap and uncomplicated. It is generally removed by a scrubber, which is a filter packed with a chemical that reacts with and removes the carbon dioxide from the gas.
- Open circuit demand helmets – The open circuit demand system exhausts gas to the environment at ambient pressure. As a result, all exhaled gas is lost to the surroundings

For hookah masks, they require a rate of 3.2 ACFM.

Per reference (d), each surface-supplied helmet or mask must have:

- A non-return valve at the attachment point between helmet or mask and umbilical that closes readily and positively;
- An exhaust valve;
- A two-way voice communication system between the diver and the

dive location or bell.

Each surface-supplied reclaim helmet or mask must:

- Ventilate at least 4.5 ACFM at any depth at which it is operated; or
- Be able to maintain the diver's inspired carbon dioxide partial pressure below 0.02 ATA when the diver is producing carbon dioxide at the rate of 1.6 standard liters per minute.

Figure 5-9 Surface-supplied mask with communication system (wireless or hardwire)

B.5.i. Regulator

A diving regulator is a pressure regulator used in scuba or surface-supplied diving that reduces pressurized breathing gas to ambient pressure to the diver. The regulator (or demand valve) delivers gas only when the diver is breathing, reducing the gas pressure to ambient.

In single hose regulators, the demand valve is part of the second stage, held in the diver's mouth by a mouthpiece. In double hose regulators, the demand valve is attached to the cylinder.

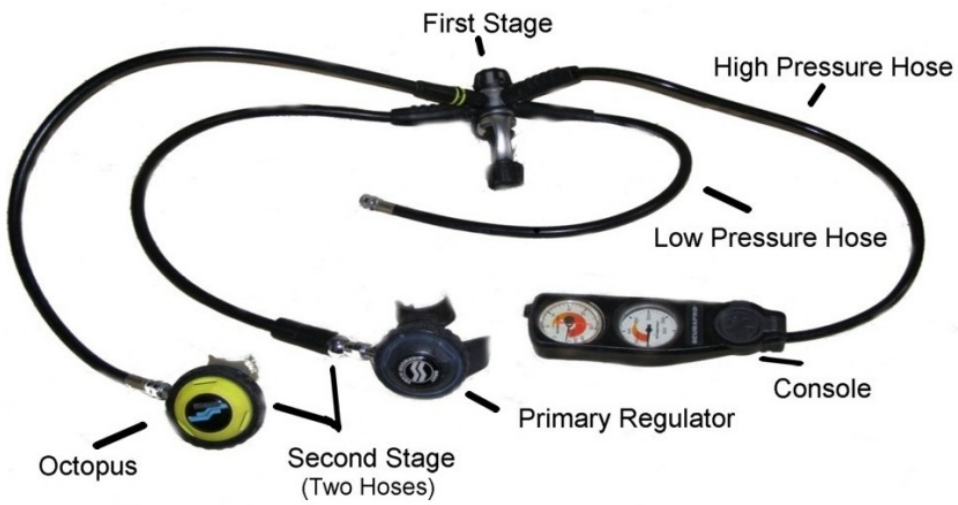

Figure 5-10 Double hose regulator

Handle the regulator with care until the air source is secured, keeping in mind the hose to the pressure gauge is a high pressure hose. Identify the manufacturer, model, and general appearance of the regulator and attachments. Do not use the tank involved in the casualty to test the functionality of any equipment. Look at the pressure gauge and document the pressure of the air remaining in the tank.

To inspect the regulator (recommended):

- Once determining the pressure in the tank, shut the tank valve. Document how many revolutions it took to secure the tank.
- Do not disconnect the regulator, immediately open the tank valve and document how many revolutions it takes to fully open the tank.
- Closely examine the depth gauge. Analog depth gauges have a sweep hand designed to shadow the primary depth gauge needle. The sweep hand stays in the position of the maximum depth until manually zeroed by the diver. Use the sweep hand to document the maximum depth, keeping in mind that if the diver did not zero out the gauge before the dive, it might show an incorrect reading.
- Once all completed, secure the tank, remove the regulator and inspect the inside of the yolk for corrosion.

B.5.j. Tanks

Yolk connection system – After removing the regulator from the tank, inspect the inside of the tank valve for corrosion and determine the condition of the o-ring located where the regulator meets the tank.

Dutch industry standard (DIN) system – DIN systems are used for more high pressure tanks. In a DIN system, the regulator screws into the tank,

the o-ring is retained on the regulator, not the tank.

Find out if the tank was a rental tank and identify the time and location it was filled. If you suspect the breathing air in the tank has been contaminated, consult with the external resources listed in A.5 Resources for Investigator to arrange for testing. Ensure the tank was filled with the proper medium (compressed air or enriched air). Perform air quality checks on enriched air to determine correct mixture.

WARNING: ***Always handle air tanks with care. Never leave a standing tank unattended. If it falls and the valve is sheared off, it might become a missile hazard.***

B.6. Commercial Dive Logs

Per reference (d), Commercial Diving Operations 46 CFR § 197B, the person-in-charge (PIC) maintains an official logbook aboard the vessel or facility. Ensure all log entries are made on form CG-706 if the vessel or facility is required to have an official logbook per reference (h), Logbook and entry requirements, 46 USC § 11301. When rules do not apply to a vessel or facility, the PIC maintains a logbook aboard for making the entries required by reference (d).

- Include information in logs (required);
- Include video and/or DVR systems.

B.7. Video and Audio Recordings

The IO specifically notes the presence or use of:

- Video;
- Audio (deck cameras);
- Personal video cameras (e.g., GoPro);
- Camera phones;
- Camera videos.

These items can potentially yield valuable evidence.

B.8. Alcohol and Drug Testing

For alcohol and drug testing following a diving casualty, IOs follow marine casualty protocols per reference (i), Mandatory Chemical Testing Following Serious Marine Incidents Involving Vessels in Commercial Service, 46 CFR § 4.06.

B.9. Maintenance Records

Maintenance record requirements on commercial vessels can provide valuable clues indicating causal factors. Ensure availability of any records found on non-commercial vessels. If any of the vessel equipment is a suspected casual factor, collect maintenance records from dive shop. Items to check:

- Determine if equipment has been serviced or altered;
- Consider test dates on tags;
- Compare serial numbers as applicable to service records;
- Consider standards per manufacturer recommendation (contact manufacture to determine those standards if necessary).

B.10. Company Policies

Determine if there are company (organization) polices that define positions and responsibilities.

B.11. Emergency Procedure

Sound emergency procedures are an important component of safe diving practices. During a diving investigation, it is important for an IO to understand what emergency procedures are standard in commercial settings and observe if these practices are being followed during an investigation.

The following are recommendations for standard commercial emergency procedures:

- Standby diver. This individual is skilled at recovering an unresponsive diver from depth, assisting a trapped diver to get free, and providing alternative breathing gas via his or her pneumofathometer hose.
- A rescue tether is a short length of rope or webbing with a clip at one or both ends. The standby diver clips the tether to his or her harness and to the unresponsive diver to free up both hands during a recovery. This can be useful if they need to climb a structure, shotline, or topographical feature, and the umbilical cannot be safely used to lift the divers due to snags or sharp edges.
- In bell diving, the bellman is the standby diver and might have to recover a distressed diver to the bell and give first aid if necessary and possible. Bailout to back gas, in the case of a gas supply failure from the umbilical, or if the main air supply is contaminated.
- Begin pneumo breathing if the main air supply is cut but the pneumo hose is intact.
- Communications failure is not usually an emergency, but can adversely affect work effectiveness. Ability to communicate with line

signals can help in this situation, particularly to assist in the decision whether to abort the dive, and if there are other more urgent problems.

- Helmet flood. Depending on the severity of the flood, this can range from an annoyance to an emergency. A slow leak can be controlled by opening the free-flow valve, which drives a moderate flow of water out of the exhaust valve. A neck dam failure usually has this effect.
- Broken faceplate. This is a real emergency, but very unlikely as the faceplate is usually a highly impact-resistant polymer. Divers mitigate the danger by opening the free-flow valve, holding the opening level facing down, and breathing very carefully.
- Demand valve failure. This is a minor problem if there is a free-flow valve. If not, dives are terminated, as the bailout does not last long if needed.
- Exhaust valve failure, like demand valve failure, divers open the free-flow valve and ensure a constant outflow of air.
- Vomiting in the helmet. This can be a real emergency and life-threatening if not handled effectively, as the diver can aspirate the vomit and asphyxiate. The action is to open the free-flow valve, preferably before vomiting, and to inhale as carefully as possible. If there is no free-flow valve, as on a full face mask, the purge button clears the demand valve and oro-nasal mask. Divers can rinse the mask by lifting the bottom edge away from the face to let in some water, before purging again.
- Hot water supply failure. This can be life-threatening for deep heliox diving. The diver must return to the bell immediately.

Section C: Enforcement

C.1. Introduction

Reference (j), Investigation of marine casualties, 46 USC § 6301, requires the Coast Guard to investigate marine casualties in order to determine, among other things:

1. Whether an act of misconduct, incompetence, negligence, unskillfulness, or willful violation of law committed by any credential merchant mariner contributed to the cause of the casualty, or to a death involved in the casualty, so that appropriate suspension and revocation action can be taken;
2. Whether there is evidence an act subjecting the offender to civil or criminal penalty has been committed.

If the IO discovers an act of wrongdoing, there are several courses of enforcement action available. These options include civil (monetary), and administrative (remedial), and criminal (penal).

C.2. Civil Enforcement

Although there can be other peripheral violations to the dive casualty (e.g., failure to report a marine casualty, failure to render assistance, navigation rule violations), the statutes covered in following sections can also be charged as civil penalties. For commercial dive operations, IOs consider the actions in Appendix H.

C.3. Administrative Enforcement

The purpose of administrative suspension and revocation (S&R) proceedings is to promote safety at sea. The administrative action against a Merchant Mariner Credential (MMC) is remedial and not penal in nature. A MMC can be suspended or revoked for (among other things):

- Violation of law or regulation intended to promote marine safety or to protect navigable waters, when acting under the authority of that MMC:
  - For specifics, see reference (k), Violation of law or regulation, 46 CFR § 5.33.
- Act of misconduct, when acting under the authority of that MMC:
  - Misconduct is generally human behavior that violates some formal, duly established rule. Such rules are found in statutes, regulations, common law, general maritime law, ship's regulation or order, or shipping articles (list not all-inclusive).
- Act of negligence, when acting under the authority of that MMC:

- Negligence is the commission of an act which a reasonable and prudent person of the same station, under the same circumstances, would not commit, or the failure to perform an act which a reasonable and prudent person of the same station, under the same circumstances, would not fail to perform.

C.4. Criminal Enforcement

Refer any evidence of criminal liability to the local United States Attorney's Office (USAO) or other appropriate law enforcement authority having jurisdiction over the matter, per the following references:

- Reference (f), Evidence of criminal liability, 46 CFR § 5.69.
- Reference (l), Evidence of Criminal Liability, 46 CFR § 4.23.

IOs do not conduct criminal investigations. At the earliest opportunity, they notify their local Coast Guard Investigative Service (CGIS) office of any dive casualty within their area of responsibility per established unit and district policy. Once CGIS is made aware of the dive casualty, it is responsible for determining if criminal liability exists and whether or not to refer such evidence to the district commander (via the district JAG) for further referral to the USAO.

C.5. Criminal Laws Relevant to Diving Investigations

Some criminal laws which might be relevant during a dive casualty investigation include:

- 46 USC § 2302(b) – Penalties for negligent operations and interfering with safe operation: *A person operating a vessel in a grossly negligent manner that endangers the life, limb, or property of a person commits a class A misdemeanor*.
- 46 USC § 2302(c) – Penalties for negligent operations and interfering with safe operation: *An individual who is under the influence of alcohol, or a dangerous drug in violation of a law of the United States when operating a vessel, as determined under standards prescribed by the Secretary by regulation. . .commits a class A misdemeanor*.
- 18 USC § 1115 – Misconduct or neglect of ship officers*: Every captain, engineer, pilot, or other person employed on any steamboat or vessel, by whose misconduct, negligence, or inattention to his duties on such vessel the life of any person is destroyed, and every owner, charterer, inspector, or other public officer, through whose fraud, neglect, connivance, misconduct, or violation of law the life of any person is destroyed, shall be fined under this title or imprisoned not more than 10 years, or both. When the owner or charterer of any steamboat or vessel is a corporation, any executive officer of such corporation, for the time being actually charged with the control and management of the operation, equipment, or navigation of such steamboat or vessel, who has knowingly and willfully caused or*

allowed such fraud, neglect, connivance, misconduct, or violation of law, by which the life of any person is destroyed, shall be fined under this title or imprisoned not more than 10 years, or both.

C.6. Jurisdiction

When deciding if suspension and revocation action is appropriate when a diving casualty is the prominent factor, the IO must first determine if the Coast Guard has jurisdiction over the mariner and the subject matter.

Jurisdiction is a question of fact and must be determined before the substantive issues of the case are decided. Jurisdiction is also based on the fact a mariner is:

- The holder of a MMC, and
- Performing activities (or acting) under the authority of his or her MMC.

The matter of determining if a mariner is the holder of an MMC is simple. However, determining if the mariner is acting under the authority of an MMC requires some investigation.

A mariner is acting under the authority of a MMC if:

- The mariner is employed in the service of a vessel when the holding of such MMC or endorsement is required by law or regulation or required by an employer as a condition for employment; or
- While engaged in official matters regarding the MMC or endorsement.

NOTE: **A person does not cease to act under the authority of a credential or endorsement while on authorized or unauthorized shore leave from the vessel.**

Particulars used to establish jurisdiction:

- In the case of a dive casualty investigation, the IO first determines if the casualty involved an inspected vessel. If so, the certificate of inspection (COI), issued by an officer in charge, Marine Inspection (OCMI) to a vessel, specifies the minimum complement of officers and crew necessary for the safe operation of the vessel. Except as provided by reference (m), Sailing short, 46 CFR § 15.725, no vessel can be navigated unless it has in its service and aboard, the crew complement required by the COI. Also, no vessel subject to inspection can be navigated unless it is under the direction and control of an individual who holds an appropriate endorsement on his or her MMC. There must be an individual holding an endorsement as master in command of every: self-propelled, seagoing documented vessel of 200 GRT and

over; self-propelled inspected vessel; inspected passenger vessel; and inspected small passenger vessel. Therefore, if the vessel is inspected, there must be a credentialed master and that master is acting under the authority of his or her MMC.

- If the vessel is an uninspected passenger vessel, it must be under the direction and control of a master or operator of an uninspected passenger vessel.
- Although a mariner might be required to hold a MMC and be acting under the authority of that MMC or endorsement, when conducting non-commercial vessel supported non-commercial dive operations, there also needs to be a nexus between the MMC and the activities being performed. In general, a credentialed mariner is responsible for the safe conveyance of passengers for hire to and from the dive site. Once divers intentionally enter the water of their own free will, they are no longer carried on the vessel and are therefore no longer passengers. However, the master or operator is not relieved of their responsibility to recover the diver and return them to shore as agreed upon in their charter or implied agreement.

C.7. Violation of Law or Regulation

When S&R proceedings are based exclusively on a violation of law or regulation intended to promote marine safety or protect navigable waters, the complaint must state the specific statute or regulation by title and section number. It must also state the particular manner in which it was allegedly violated.

Although there might be other violations peripheral to the dive casualty (e.g., failure to report a marine casualty, failure to render assistance, navigation rule violations), the statutes and regulations covered in this section can be charged as criminal or civil penalties, as applicable.

C.8. Misconduct

In order to prove misconduct, the IO must first identify a formal, duly established rule that the mariner violated by his or her action, including acts of omission. To determine what rules a might have been violated during a dive casualty investigation, IOs review:

- Applicable United States Code (USC) titles;
- Applicable Code of Federal Regulations (CFR) titles;
- Applicable state statutes;
- Applicable state regulations;
- Common law;
- General maritime law;
- Ship’s and or employer’s regulations, orders, policies, or shipping

articles and similar sources;

- Once the rules are established, the IO must identify and be able to articulate what actions or inactions violated the rule.

C.9. Negligence

In order to prove negligence, the IO must first identify an act that a reasonable and prudent person of the same station, under the same circumstances, would not commit or would not fail to commit.

Section D: Lab Analysis Guidance

D.1. Forensics

In general terms, forensics is the application of scientific knowledge to legal problems. In dive casualty investigation, IOs must understand how scientific principals affect the outcome of a casualty.

D.1.a. Medical Examiners

Medical examiner: Investigators are encouraged to reach out to the medical examiner/coroner who conducts the autopsy of a deceased diver. The investigator also provides as much known information as possible to the medical examiner about the dive accident for them to document in the autopsy results.

D.1.b. Autopsies

Autopsies usually include physical description of the decedent including measurements, features, as well as thorough examinations of the internal organs. The overall results also include an interpretation of the examination, a toxicology report, and the cause of death.

Many medical examiners or coroners are not divers and might not understand diving, diving practices, diving equipment, and diving physiology. If there are any items which are unclear, or in need of further interpretation, investigators reach out to the medical examiner for clarification.

The most typical error in an autopsy report is for the death to be ascribed to drowning, when evidence points to another cause. Drowning is plausible for a diver who runs out of air while submerged due to being trapped. However, if a diver suffers some sort of distress, such as heart attack, immersion pulmonary edema, or other physical ailment before drowning, drowning might not be the actual cause of death. It is not the position of the investigator to make this final determination; however, outline all such evidence in the report of investigation (ROI).

D.1.c. CO Exposure

Carbon monoxide exposure is a waste gas product of most internal combustion engines. It is odorless, colorless, and extremely toxic. The toxicity is due to its affinity for hemoglobin, the iron-based chemical in red blood cells, which typically bonds with oxygen for delivery to cells throughout the body.

When carbon monoxide is present, it attaches to the hemoglobin, thereby displacing the oxygen carrying capability of the red blood cell. The most common scenario where a diver might suffer from carbon monoxide poisoning is if an air compressor intake is placed too close to the exhaust of an internal combustion engine. Carbon monoxide poisoning can occur if the diver is using a cylinder filled with the carbon monoxide polluted air,

or a diver receiving polluted air from the surface.

D.1.d. Drug Testing	Perform drug testing per reference (g), Operating a Vessel while under the Influence of Alcohol or a Dangerous Drug, 33 CFR § 95, for those who are directly involved in the marine casualty as determined by the marine employer.
D.2. Equipment Analysis	IOs can send equipment to a laboratory for analysis (tanks, dive computers, regulator, buoyancy compensator, any specialized equipment the diver was wearing). Scripps Institute of Oceanography in San Diego has capability to compile a full report of gear. However, many universities with scientific research involving diving can also render assistance. Identify facilities or consult with the nearest scientific dive officer before a casualty occurs.
D.2.a. Dive Computers	Areas to consider: • Make, model, and serial number, • Battery status, • Log status, • Associated software and hardware.
D.2.b. Valve Analysis	Areas to consider: • Make, model, and serial number, • Condition of the first and second stage, • Condition of the first stage filter, • Hose condition and connections.
D.2.c. Gas Analysis	Gas analysis can be contracted by local industrial services. Investigators research these services and points of contact before a casualty occurs.

NOTE: **See Appendix E: Commercial Diving Investigation Questionnaire for applicable equipment checklists.**

Section E: Post Investigation

E.1. Documentation

The following are recommended methods for collection or release of investigative reports:

- Lab results:
  - Toxicology reports are received through voluntary submission or through subpoena of medical records. Otherwise, this information is part of the toxicology section of the autopsy report. In many cases, these reports are considered public record per reference (n), Commandant (CG-545) Policy Letter 1-11, Marine Casualty Report of Investigation (ROI) Policy.
- External public organizations can request a report of investigation (ROI) through the Freedom of Information Act (FOIA) by emailing: EFOIA@USCG.MIL
- Complete ROIs per reference (n).

NOTE:

Select this link to access reference (n):

MARINE CASUALTY REPORT OF INVESTIGATION (ROI) POLICY

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Chapter 6:
Conducting Diving Investigations: Non-Commercial

Introduction

This chapter discusses non-commercial dive casualty investigative techniques. Many of the standards adhered to in the non-commercial realm are industry standard as opposed to regulatory governance. Whether the casualty is commercial or non-commercial, investigative principles are similar and use many of the same processes.

See reference (c), USCG Marine Safety Manual, Volume V: Investigations and Enforcement, COMDTINST M16000.10 (series), for distinctions in commercial and non-commercial diving.

In This Chapter

This chapter contains the following sections:

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C	Enforcement	6-16
D	Lab Analysis Guidance	6-19
E	Post Investigation	6-21

Section A: Pre-Investigation

A.1. Components of the Investigator Bag

Investigating officers (IOs) use many tools. In addition to personal protective equipment, the IO conducting an investigation might need the items listed here:

- Applicable appendices in this document;
- Camera or video recorder;
- Chalk to help make serial numbers readable, especially when stamped into black plastic equipment. Rub chalk into numbers to increase readability;
- Coveralls to protect the investigator from potential biohazards;
- Evidence seizure tags and bags;
- Gloves – chemical and biohazard proof;
- Gowns to shield against biohazards;
- GPS – handheld to precisely locate sites, especially those not named;
- Laptop computer with Internet capability;
- Magnifying glass for reading very small serial numbers etched into equipment;
- Measuring tape – corrosion resistant and flexible;
- Nautical charts and/or maps of the region where the incident occurred. Use maps to locate hospitals, fire stations, etc;
- Oxygen sensor;
- Smartphone and/or tablets to send email and access Web;
- Vernier calipers to measure small pieces of equipment, damage to gear, depth of gouges, etc;
- Voice recorder to record interviews (always ask permission first).

NOTE: **Though this list is not all-encompassing, it provides the investigator with some minimum recommendations.**

A.2. Training

IO training opportunities improve, enhance, and maximize mission critical skill sets. They provide the IO technical expertise necessary to understand the complex relationship between the human body and its exposure to an underwater, pressurized environment. Training improves overall casualty analysis aimed at preventing casualty recurrence and/or assessing the most appropriate criminal or civil penalty actions.

Topics where additional training can inform IOs include the following:

- COMDT (CG-INV, CG-S&R), Investigation Center of Expertise, PACAREA (PAC-37);
- Dive courses to better understand the complex issues confronted during investigations;
- Witness interviewing;
- Photography and videography;
- Marine operations and equipment (deck and engine);
- Master and pilot relationship;
- Marine insurance.

NOTE: **Due to service school unavailability, commands are encouraged to provide and fund training opportunities.**

A.3. Diving Certification Agencies

Non-commercial diving casualties can include dives taking place from commercially operated vessels as well as recreational vessels operating within or outside state waters. Often a local law enforcement entity declines to investigate. Non-commercial scuba diving is essentially self-regulated. There are no Federal regulations governing diver certification or equipment requirements. However, there are several agencies offering diver training and certification.

The following organizations provide dive certified course training:

- Professional Association of Diving Instructors (PADI);
- Scuba Schools International (SSI);
- National Association of Underwater Instructors (NAUI);
- Young Men’s Christian Association (YMCA).

Research other local organizations who provide additional training in:

- Advanced open water diving;
- Wreck diving;

- Cave diving;
- Enriched air diving.

Industry standards require divers to present dive certification cards before diving from a charter vessel, purchasing air fills, or renting/ purchasing scuba equipment.

NOTE: **Always determine if the diver was diving within proper training levels.**

NOTE: **For dive specific questions, contact PACAREA (PAC-37DF) PACAREA dive force manager.**

A.4. Sharing Investigation with Diving Organizations

Information sharing is an important tool for educating the dive public. The sharing of lessons learned fosters this education process and builds rapport between the USCG and various non-governmental organizations (NGOs). An example of an NGO is Divers Alert Network (DAN).

Investigating officers can benefit from interacting with various NGOs that support dive related information.

For USCG officials to release the investigation, the local unit and headquarters must review and close it. For release outside the USCG, the USCG redacts the report (personal identifiable information and other Privacy Act information blocked out), and the requesting dive agency makes a Freedom of Information Act (FOIA) request. COMDT (CG-611) appropriately redacts information as required.

A.5. Rental Companies

If the investigation determines that a rental company outsourced any equipment, those facilities might contain records applicable to the investigation. Ensure these records are reviewed as applicable to the case.

A.6. Resources for Investigator

Establish relationships with resources:

- COMDT (CG-INV);
- Coast Guard Liaison Office at Navy Diving and Salvage Training Center, 350 S. Craig Road, Panama City, FL 32407;
- PAC-37;
- CG-7212, Dive Capabilities Division;
- Navy Experimental Diving Unit;
- International Association of Nitrox and Technical Divers (IANTD);

- Technical Diving International (TDI);
- Professional Scuba Association (PSA);
- Divers Alert Network (DAN);
- American Nitrox Divers International (ANDI);
- Local and Federal dive lockers (USCG dive program and dive lockers):
  - Primary resources: Dive Lockers East and West;
- State and local government representatives;
- Public safety divers (fire, sheriff, and fish and wildlife departments);
- Commercial diving community;
- Medical examiner;
- Forensics facilities.

NOTE: **Contact the Investigations National Center of Expertise for guidance on supporting forensics requests.**

- Coast Guard Investigative Services (CGIS);
- Local hospitals with hyperbaric chambers. See Undersea and Hyperbaric Medical Society - Accredited Facilities;
- Association of Dive Contractors International (ACDI).

Section B: During Investigation

B.1. Site Investigation

During the preliminary stages of a diving casualty or injury investigation, IOs are most often far removed from the incident location. It is imperative that the IO take proactive steps to ensure critical evidence is preserved and collected. Collect evidence and preliminary information regarding the incident from a variety of sources to include state, local, or other Federal agencies who are first responders on scene. Often times, other Coast Guard units are the first to arrive on scene to transport the injured diver to shore.

B.2. Jurisdiction Determination

The IO immediately determines if the diving accident is classified as non-commercial or commercial. If the accident is commercial in nature, the IO reaches out to OSHA for collaboration and discusses which agency is best suited to take lead. If the accident is non-commercial, the USCG leads the investigation.

Once jurisdiction has been determined, the IO can develop a clear picture as to what evidence is on scene as well as what interview or equipment questions (commercial or non-commercial) to ask upon arrival.

For more information, see Section C: Enforcement.

B.3. Interviews

Appendix F: Non-Commercial Diving Investigation Questionnaire has a copy of a questionnaire for diving supervisors in non-commercial settings. Following is the link to an electronically fillable questionnaire for recreational diving investigations. IOs can also print the questionnaire if no tablet is available during interviews and/or gear inspection. Link to the non-commercial questionnaire:
http://www.uscg.mil/forcecom/ttp/downloads/Non-Commercial_Diving_Interview_Questions.pdf

B.4. Equipment Inspection

Dive equipment is complex; therefore, the IO scrutinizes every item of equipment involved in a marine casualty for proper functionality. Collect all equipment associated with the diving operation for possible analysis.

For example, investigating officer does the following when arriving on scene:

- Investigates if equipment was maintained and used correctly.
- Documents appearance of the equipment;
- Determines if the equipment is properly connected;

- Photographs equipment before dismantling (dive mask, snorkel, fins, weight belt, wet suit, knife, camera, etc.);
- If a wet suit was used, identifies its thickness and the cut of the suit because of the implications on a diver's buoyancy.
- Records the weight of the weight belt worn by the diver to determine if a diver was diving with too little or too much weight for that depth.
- Checks gauges and records data. When retrieving scuba tanks and recording the pressure gauge, close the tank valve and simultaneously count the number of full revolutions it takes to fully close the valve and record the revolution count.

See the links in B.3. Interviews for a list of questions and observations for IOs.

See B.5 Equipment for equipment descriptions.

B.5. Equipment

Dive equipment is complex. Scrutinize every item of equipment involved in a marine casualty for proper functionality.

Below is a brief overview of some equipment that might be pertinent to the IO's investigation. However, the list is not exhaustive.

B.5.a. Air Compressor System

Air compressor systems are constructed similar to the figure below.

- Built and stamped in agreement with Section VIII, Division 1 of the ASME Code with:
  - Check valve on the inlet side;
  - Pressure gauge;
  - Relief valve;
  - Drain valve.
- Air intake located away from exhaust fumes or other hazardous contaminates.
- Equipped with an efficient filtration system.
- Equipped with slow opening shut off valves when maximum allowable working pressure (MAWP) exceeds 500 psig.

Figure 6-1 Example of 30 gallon air compressor

B.5.b. Breathing Supply Hose

Breathing supply hoses as follows:

- The stated MAWP for the hose is equal to or exceeds the supply system (air compressor) to which it is attached.
- The supply source maximum pressure exceeds the depth of the dive by at least 100 pounds/square inch (psig).
- The burst pressure is four times the stated MAWP of the hose.
- Check that the connections are:
  - Made of corrosion resistant material;
  - Resistant to accidental disengagement;
  - Rated to a MAWP equal or greater than the hose that is attached.
- Kink resistant

Figure 6-2 Breath hose

B.5.c. Scuba Diver's Equipment

Examine the following equipment items for any abnormalities:

- Primary gas supply with a cylinder pressure gauge and reserve breathing gas supply;
- Regulator;
- Face mask and snorkel;
- Inflatable flotation device or buoyancy compensator;
- Weight belt capable of quick release;

- Knife;
- Swim fins or shoes;
- Dive computer (diving wristwatch);
- Depth gauge (pressure gauge).

Figure 6-3 Scuba diving equipment

B.5.d. Buoyancy Control Device

Points to consider when evaluating the BCD:

- Note the size of the BCD. A BCD that is too small might not provide enough buoyancy to the diver.
- Determine if the diver was using an integrated weight system (weights incorporated into the BCD releasable by clip, Velcro fastener, or ripcord).
- Inspect the general appearance of the BCD. Determine if the BCD was damaged due to over-pressurization.
- Check the vents and auto (power) inflator function properly.

Figure 6-4 Buoyancy control device

NOTE: **Do not use the tank involved in the casualty to test the functionality of the BCD.**

B.5.e. Dive Computer

IOs can access data from dive computers using specialized cables from manufacturers.

Figure 6-5 Dive computer

Dive computers function essentially like a black box for an aircraft. They can capture and log information, such as time entered the water, descent time, bottom time, ascent time, ascent rate, surface interval time, and water temperature. Divers use computers to ensure they are diving within appropriate bottom times and to calculate repetitive dives.

Additionally, some divers keep a history of all dives on their computers. Accessing this data might yield information about the diver's propensity for risk and could establish a pattern of unsafe diving practices.

The features on dive computers are not standard throughout the dive industry. Each manufacturer writes propriety software. Therefore, when investigating a casualty involving a dive computer, the IO seeks assistance from technical representatives familiar with the computer before attempting to access data. Untrained operators can accidently delete data from dive computers. Contact a local dive shop or the manufacturer for assistance.

Dive computers must be set up for the breathing medium (i.e., compressed air, enriched air) a diver was using at the time of a marine casualty.

NOTE: **Be sure to verify the computer was set to the correct breathing medium. Incorrect settings cause the computer to incorrectly calculate dive safety data.**

B.5.f. Gauges and Timekeeping Devices

A depth gauge is a pressure gauge that displays the equivalent depth in water.

Inspect the following devices:

- Gauge indicating diver depth (surface-supplied dives);
- Timekeeping device at each dive location.

Figure 6-6 Diving gauge

Figure 6-7 Timekeeping device

B.5.g. Regulator

A diving regulator is a pressure regulator used in scuba or surface-supplied diving that reduces pressurized breathing gas to ambient pressure to the diver. The regulator (or demand valve) delivers gas only when the diver is breathing, reducing the gas pressure to ambient.

In single hose regulators, the demand valve is part of the second stage, held in the diver's mouth by a mouthpiece. In double hose regulators, the demand valve is attached to the cylinder.

Figure 6-8 Two-stage regulator

Handle the regulator with care until the air source is secured, keeping in mind the hose to the pressure gauge is a high pressure hose. Identify the manufacturer, model, and general appearance of the regulator and attachments. Do not use the tank involved in the casualty to test the functionality of any equipment. Look at the pressure gauge and document the pressure of the air remaining in the tank.

To inspect the regulator (recommended):

- Once determining the pressure in the tank, shut the tank valve. Document how many revolutions it took to secure the tank.
- Do not disconnect the regulator, immediately open the tank valve and document how many revolutions it takes to fully open the tank.
- Closely examine the depth gauge. Analog depth gauges have a sweep hand designed to shadow the primary depth gauge needle. The sweep hand stays in the position of the maximum depth until manually zeroed by the diver. Use the sweep hand to document the maximum depth, keeping in mind that if the diver did not zero out the gauge before the dive, it might show an incorrect reading.
- Once all completed, secure the tank, remove the regulator and inspect the inside of the yolk for corrosion.

B.5.h. Tanks

Yolk connection system – After removing the regulator from the tank, inspect the inside of the tank valve for corrosion and determine the condition of the o-ring located where the regulator meets the tank.

Dutch industry standard (DIN) system – DIN systems are used for more high pressure tanks. In a DIN system, the regulator screws into the tank, the o-ring is retained on the regulator, not the tank.

Find out if the tank was a rental tank and identify the time and location it was filled. If you suspect the breathing air in the tank has been contaminated, consult with the external resources listed in Section A: Resources for Investigator to arrange for testing. Ensure the tank was filled with the proper medium (compressed air or enriched air). Perform air quality checks on enriched air to determine correct mixture.

WARNING: ***Always handle air tanks with care. Never leave a standing tank unattended. If it falls and the valve is sheared off, it might become a missile hazard.***

B.6. Personal Dive Logs

Personal logs are optional in the non-commercial setting. Check to see if any personal dive logs were recorded during the casualty.

There are no regulations governing recreational dive logs. The recreational dive industry as a whole encourages divers to maintain personal log books. Divers use these log books for continuing qualification progression (i.e., open water to advanced open water) and to determine recent dives.

Some commercial dive boat charters ask to review log books to ensure proficiency; in these instances, divers without proficiency or recency are denied the opportunity to dive.

B.7. Video and Audio Recordings

The IO specifically notes the presence or use of:

- Video;
- Audio (deck cameras);
- Personal video cameras (e.g., GoPro);
- Camera phones;
- Camera videos.

These items can potentially yield valuable evidence.

B.8. Alcohol and Drug Testing

Drug and alcohol tests are required for all non-commercial dive casualties resulting in a serious marine incident on inspected passenger vessels.

Because of the uncertainty involved in some dive casualties, IOs recognize their authority for reasonable cause testing per reference (g), Operating a Vessel while under the Influence of Alcohol or a Dangerous Drug, 33 CFR § 95. IOs exercise this authority when deemed appropriate. IOs follow marine casualty protocols per reference (i), Mandatory Chemical Testing Following Serious Marine Incidents Involving Vessels in Commercial Service, 46 CFR § 4.06. Drug and alcohol testing is required after any serious marine incident.

B.9. Maintenance Records

Check for any maintenance records that might be on recreational vessels. If any of the vessel equipment is a suspected casual factor, collect maintenance records. Determine if equipment has been serviced or altered. Consider test dates on tags. Compare serial numbers as applicable to service records. Standards are per recommendation (contact manufacture to determine those standards).

There are no regulations governing maintenance of non-commercial dive equipment. Each manufacturer establishes recommended intervals at which equipment is recommended for service. If faulty equipment is suspected, send the serial number of the suspect component to the manufacturer to determine manufacture date and recommended service intervals.

Non-commercial divers are not required to keep service records; however, more experienced divers have a maintenance logbook. All scuba tanks are required to pass visual and hydro tests. These dates are stamped into the neck of the tank, and annual visual inspections are documented by placing a sticker on the side of the tank per reference (o), Requirements for requalification of specification cylinders, 49 CFR § 180.209.

B.10. Company Policies

Determine if there are company (organization) polices that define positions and responsibilities.

Section C: Enforcement

C.1. Introduction

Reference (j), Investigation of marine casualties, 46 USC § 6301, requires the Coast Guard to investigate marine casualties in order to determine, among other things:

1. Whether an act of misconduct, incompetence, negligence, unskillfulness, or willful violation of law committed by any credential merchant mariner contributed to the cause of the casualty, or to a death involved in the casualty, so that appropriate suspension and revocation action can be taken;
2. Whether there is evidence an act subjecting the offender to civil or criminal penalty has been committed.

If the IO discovers an act of wrongdoing, there are several courses of enforcement action available. These options include civil (monetary), and administrative (remedial), and criminal (penal).

C.2. Civil Enforcement

Although there can be other peripheral violations to the dive casualty (e.g., failure to report a marine casualty, failure to render assistance, navigation rule violations), the statutes covered in sections C.3 through C.5 can also be charged as civil penalties.

C.3. Administrative Enforcement

The purpose of administrative suspension and revocation (S&R) proceedings is to promote safety at sea. The administrative action against a Merchant Mariner Credential (MMC) is remedial and not penal in nature. A MMC can be suspended or revoked for (among other things):

- Violation of law or regulation intended to promote marine safety or to protect navigable waters, when acting under the authority of that MMC:
  - For specifics, see reference (k), Violation of law or regulation, 46 CFR § 5.33.
- Act of misconduct, when acting under the authority of that MMC:
  - Misconduct is generally human behavior that violates some formal, duly established rule. Such rules are found in statutes, regulations, common law, general maritime law, ship's regulation or order, or shipping articles (list not all-inclusive).
- Act of negligence, when acting under the authority of that MMC:
  - Negligence is the commission of an act which a reasonable and

prudent person of the same station, under the same circumstances, would not commit, or the failure to perform an act which a reasonable and prudent person of the same station, under the same circumstances, would not fail to perform.

- Although a mariner might be required to hold a MMC and be acting under the authority of that MMC or endorsement, when conducting non-commercial vessel supported non-commercial dive operations, there also needs to be a nexus between the MMC and the activities being performed. In general, a credentialed mariner is responsible for the safe conveyance of passengers for hire to and from the dive site. Once divers intentionally enter the water of their own free will, they are no longer carried on the vessel and are therefore no longer passengers. However, the master or operator is not relieved of their responsibility to recover the diver and return them to shore as agreed upon in their charter or implied agreement.

C.4. Criminal Enforcement

Refer any evidence of criminal liability to the local United States Attorney's Office (USAO) or other appropriate law enforcement authority having jurisdiction over the matter, per the following references:

- Reference (f), Evidence of criminal liability, 46 CFR § 5.69.
- Reference (l), Evidence of Criminal Liability, 46 CFR § 4.23.

IOs do not conduct criminal investigations. At the earliest opportunity, they notify their local Coast Guard Investigative Service (CGIS) office of any dive casualty within their area of responsibility per established unit and district policy. Once CGIS is made aware of the dive casualty, it is responsible for determining if criminal liability exists and whether or not to refer such evidence to the district commander (via the district JAG) for further referral to the USAO.

C.5. Criminal Laws Relevant to Diving Investigations

Some criminal laws which might be relevant during a dive casualty investigation include:

- 46 USC § 2302(b) – Penalties for negligent operations and interfering with safe operation: *A person operating a vessel in a grossly negligent manner that endangers the life, limb, or property of a person commits a class A misdemeanor*.
- 46 USC § 2302(c) – Penalties for negligent operations and interfering with safe operation: *An individual who is under the influence of alcohol, or a dangerous drug in violation of a law of the United States when operating a vessel, as determined under standards prescribed by the Secretary by regulation. . .commits a class A misdemeanor*.
- 18 USC § 1115 – Misconduct or neglect of ship officers*: Every captain, engineer, pilot, or other person employed on any steamboat or*

vessel, by whose misconduct, negligence, or inattention to his duties on such vessel the life of any person is destroyed, and every owner, charterer, inspector, or other public officer, through whose fraud, neglect, connivance, misconduct, or violation of law the life of any person is destroyed, shall be fined under this title or imprisoned not more than 10 years, or both. When the owner or charterer of any steamboat or vessel is a corporation, any executive officer of such corporation, for the time being actually charged with the control and management of the operation, equipment, or navigation of such steamboat or vessel, who has knowingly and willfully caused or allowed such fraud, neglect, connivance, misconduct, or violation of law, by which the life of any person is destroyed, shall be fined under this title or imprisoned not more than 10 years, or both.

Section D: Lab Analysis Guidance

D.1. Forensics

In general terms, forensics is the application of scientific knowledge to legal problems. In dive casualty investigation, IOs must understand how scientific principals affect the outcome of a casualty.

D.1.a. Medical Examiners

Medical examiner: Investigators are encouraged to reach out to the medical examiner/coroner who conducts the autopsy of a deceased diver. The investigator also provides as much known information as possible to the medical examiner about the dive accident for them to document in the autopsy results.

D.1.b. Autopsies

Autopsies usually include physical description of the decedent including measurements, features, as well as thorough examinations of the internal organs. The overall results also include an interpretation of the examination, a toxicology report, and the cause of death.

Many medical examiners or coroners are not divers and might not understand diving, diving practices, diving equipment, and diving physiology. If there are any items which are unclear, or in need of further interpretation, investigators reach out to the medical examiner for clarification.

The most typical error in an autopsy report is for the death to be ascribed to drowning, when evidence points to another cause. Drowning is plausible for a diver who runs out of air while submerged due to being trapped. However, if a diver suffers some sort of distress, such as heart attack, immersion pulmonary edema, or other physical ailment before drowning, drowning might not be the actual cause of death. It is not the position of the investigator to make this final determination; however, outline all such evidence in the report of investigation (ROI).

D.1.c. CO Exposure

Carbon monoxide exposure is a waste gas product of most internal combustion engines. It is odorless, colorless, and extremely toxic. The toxicity is due to its affinity for hemoglobin, the iron-based chemical in red blood cells, which typically bonds with oxygen for delivery to cells throughout the body.

When carbon monoxide is present, it attaches to the hemoglobin, thereby displacing the oxygen carrying capability of the red blood cell. The most common scenario where a diver might suffer from carbon monoxide poisoning is if an air compressor intake is placed too close to the exhaust of an internal combustion engine. Carbon monoxide poisoning can occur if the diver is using a cylinder filled with the carbon monoxide polluted air,

or a diver receiving polluted air from the surface.

D.1.d. Drug Testing	Perform drug testing per reference (g), Operating a Vessel while under the Influence of Alcohol or a Dangerous Drug, 33 CFR § 95, for those who are directly involved in the marine casualty as determined by the marine employer.
D.2. Equipment Analysis	IOs can send equipment to a laboratory for analysis (tanks, dive computers, regulator, buoyancy compensator, any specialized equipment the diver was wearing). Scripps Institute of Oceanography in San Diego has capability to compile a full report of gear. However, many universities with scientific research involving diving can also render assistance. Identify facilities or consult with the nearest scientific dive officer before a casualty occurs.
D.2.a. Dive Computers	Areas to consider: • Make, model, and serial number, • Battery status, • Log status, • Associated software and hardware.
D.2.b. Valve Analysis	Areas to consider: • Make, model, and serial number, • Condition of the first and second stage, • Condition of the first stage filter, • Hose condition and connections.
D.2.c. Gas Analysis	Gas analysis can be contracted by local industrial services. Investigators research these services and points of contact before a casualty occurs.

NOTE: **See Appendix F: Non-Commercial Diving Investigation Questionnaire for applicable equipment checklists.**

Section E: Post Investigation

E.1. Documentation

The following are recommended methods for collection or release of investigative reports:

- Lab results:
  - Toxicology reports are received through voluntary submission or through subpoena of medical records. Otherwise, this information is part of the toxicology section of the autopsy report. In many cases, these reports are considered public record per reference (n), Commandant (CG-545) Policy Letter 1-11, Marine Casualty Report of Investigation (ROI) Policy.
- External public organizations can request a report of investigation (ROI) through the Freedom of Information Act (FOIA) by emailing: EFOIA@USCG.MIL
- Complete ROIs per reference (n).

NOTE:

Select this link to access reference (n):

MARINE CASUALTY REPORT OF INVESTIGATION (ROI) POLICY

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Chapter 7: Prevention

Introduction

This chapter discusses methods investigating officers can use to prevent diving accidents in their jurisdictions.

In This Chapter

This chapter contains the following sections:

Section	Title	Page
A	Non-Commercial Dive Outreach	7-2
B	Commercial Dive Outreach	7-5
C	Resources	7-6

Section A: Non-Commercial Dive Outreach

A.1. Introduction

An important aspect of dive investigations is outreach and networking. Visit local dive shops and establish a rapport with owners and operators. Building credibility before an incident helps when dive casualties occur. The time to meet dive shop owners and operators is before an incident, not after one has occurred.

A.2. Guidelines

Outreach guidelines are not intended to transform the IO into a skilled dive outreach specialist. The following guidelines are designed to serve as a reference resource, organizational tool, and functional checklist.

The IO:

- Researches and is familiar with local unit outreach guidelines;
- Ensures the senior investigating officer (SIO) has knowledge and gives approval for pending investigations;
- Maintains diligence while discussing “lessons learned” by not divulging names, personal information, or specific boats. Discussing diving locations is acceptable.
- Be cautious while presenting photographs during outreach. Exclude images of the victim and other graphic images;
- Accurately represent the opinions approved by the officer in charge, Marine Inspections (OCMI).

NOTE: **The SIO approves all materials presented during outreach efforts before release or presentation.**

A.3. Methods of Outreach

Outreach can be an effective preventative tool and can build resources during the critical times of a case investigation:

- Be familiar with your area of responsibility (AOR): where the dives occur, what type of diving occurs there, and dive seasons;
- Get to know the owners/operators of local dive shops and who runs the dive tours;
- Get to know what types of training dive shops offer;
- Understand dive gear and operations – courses and training provided by the dive shop.

A.3.a. Presentation

The senior investigating officer (SIO):

- Coordinates local dive outreach;
- Assigns available IO to contact public representative.

The investigating officer (IO):

- Contacts target representatives;
- Determines audience and needs of the group;
- Delivers outreach mission and any follow-up as required;
- Briefs the SIO on contact outcome.

A.3.b. Outreach Characterization

IOs are encouraged to create partnerships with dive shops, dive boats, boat dealers, and marinas to pass along dive casualty lessons learned. Distribute lessons learned material as dive safety flyers and/or pamphlets promoting renewed emphasis on skills enforcement and improved understanding between boaters and divers.

Depending on the area of responsibility, possible outreach efforts might include:

- Dive boats:
  - Crew training and risk management: IO gains an understanding of what captains and crew do during a dive casualty;
  - Ride-along program: IO rides the dive boat during a typical dive day to view the general skill level and problem areas of sport divers and to interact with the crew to better understand their challenges and tasks. IO's presence is not invasive, intrusive, confusing, or distracting;
  - Establish rapport with dive boat captains, crews, and dive masters;
  - Attend charter boat association meetings to network, communicate, and increase understanding at boarding meetings;
  - Visit dive boats during diver boarding before a dive trip to support the boat's safety programs and emphasize good dive skills and training among divers. Make them aware of Coast Guard presence and concern.
- Dive shops:
  - Present general boating and diving safety lectures for local dive classes;

- Promote shops by enhancing safety relationships with the diving public.

- Commercial dive operations:
  - Become familiar with the regulatory requirements for commercial dive operations;
  - Become familiar with the companies that employ commercial divers in their operations;
  - Establish a rapport with the company by asking to learn about commercial diving and how the company trains and implements the commercial dive regulations.
- Dive industry:
  - Assist where possible with statistical data sharing (DAN, DEMA, NAUI, PADI, SSI, etc);

NOTE: **COMDT (CG-INV-1) authorizes sharing statistical data, provided information is redacted per Freedom of Information Act (FOIA) guidelines.**

  - Present a general boating and diving safety lecture at national dive trade shows (e.g., Long Beach Scuba Show, Our World Underwater, Boston Sea Rovers Show, Work Boat Trade Show, DEMA);
  - Present a general boating and diving safety lecture at dive symposiums;
  - Present a general boating and diving safety lecture at local dive club meetings.

Section B: Commercial Dive Outreach

B.1. Outreach Goals

Similar to non-commercial dive operators, learn about the companies that conduct commercial dive operations. Get to know what type of diving equipment and procedures the company uses. Learn about the vessel(s) that conduct dive operations for the company. The time to meet and become familiar with commercial diving and company representatives is not during the time of the dive incident.

Section C: Resources

C.1. Introduction

COMMANDANT (CG-INV) and the Investigations National Center of Expertise (INCOE) are available for consultation during dive casualty investigations. The INCOE has a dedicated subject matter expert to assist with dive casualty investigations. Local law enforcement offices can provide historical information regarding dive incident occurrences and training for certain type of diving operations.

It is recommended that IOs in high diving risk locations collaborate with law enforcement officers who conduct rescue diving, local medical examiner/coroners, medical practitioners who run hyperbaric chambers, as well as other prominent members within the dive community to form a diver safety committee. This committee can assist with outreach and information dissemination to local diver attractions. IOs can then use this information to formulate legitimate safety recommendations.

Also collaborate with vessel operators whose passengers engage in recreational diving to keep them aware of current cases where divers have been injured or have died. This also includes key aspects where Coast Guard investigators initiated suspension and revocation (S&R) action against the operator's credential.

Since the Coast Guard does not regulate diving, findings from investigations are not publicized in the same manner of safety alerts and bulletins. Many small passenger vessel operators whose passengers engage in recreational diving are unaware of how their actions could be interpreted as negligence or misconduct.

C.2. Outreach Goals

Outreach is a mission to make the diving public aware of the lessons learned from dive casualty investigation cases and to redirect the public focus toward using methods to enhance diver safety. In that mission concept, IOs inform the public while also involving the various commercial, industrial, and teaching enterprises involved in diving.

IOs put personal impressions aside and do not point fingers or lay blame on individuals, organizations, shops, agencies, etc. IOs provide the impetus for public thought by presenting analytical data and making suggestions as possible avenues to dive accident avoidance and skills enhancement. IOs and presenters must also be careful not to assume the position as instructors, even if one or more of the IOs present is, indeed, a certified instructor.

If someone in the audience disagrees with the IO, the USCG's position is that the IO is merely pointing out the lessons learned.

C.3. Outreach Guide

For the outreach missions, determine:

- Location and setting;
- Nature of the mission;
- Audience demographic (i.e., age, culture, gender);
- How many IOs are needed (minimum and maximum);
- IO introduction to diving marine casualties;
- Presentation media (PowerPoint, DVDs);
- Other teaching aids.

Mission-conduct outreach:

- Perform mission tasks;
- Address audience questions;
- General demographic (percentage of gender and age).

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Appendix A: Glossary and Acronyms

ABLJ	Adjustable buoyancy life jacket.
ACOE	Army Corps of Engineers.
ACDI	Association of Dive Contractors International.
ACFM	Actual cubic feet per minute.
ADC	Association of Dive Contractors. Potential resource for commercial diving investigations.
AGE	Arterial gas embolism.
Air compressor	An air compressor is a device that converts power (usually from an electric motor, a diesel engine, or a gasoline engine) into kinetic energy by compressing and pressurizing air, which, on command, can be released in quick bursts. There are numerous methods of air compression, divided into either positive-displacement or negative-displacement types.
AMIO	Alien Migrant Interdiction Operations.
ANDI	American Nitrox Divers International.
AOR	Area of responsibility.
ASTM	American Society for Testing and Materials.
ATON	Aids to Navigation.
Autopsy report	A report generated by a medical professional who examines the body for signs of trauma, animal bites, envenomation, or toxicology. Findings from an autopsy report include air embolism, decompression sickness, venomous stings or bites, drowning, or carbon monoxide poisoning.

Bailout cylinder	For scuba, a “bailout bottle” or “self-contained ascent bottle” is a small diving cylinder meant to be used as an alternate air source to allow a controlled ascent with any required decompression; used in place of a controlled emergency swimming ascent, which does not allow required decompression. Also known as a pony bottle.
Barotrauma	Damage to body tissues from the mechanical effects of pressure results when pressure differentials between body cavities and the hydrostatic pressure surrounding the body, or between the body and the diving equipment, are not equalized properly. Barotrauma most frequently occurs during descent, but can also occur during ascent. Barotrauma on descent is called squeeze. Barotrauma on ascent is called reverse squeeze.
BC	Buoyancy compensator. A buoyancy compensator, also called a buoyancy control device, BC, BCD, stabilizer, stab jacket, or wing depending on design, is a piece of diving equipment containing a bladder which is worn by divers to establish neutral buoyancy underwater and positive buoyancy on the surface, when needed. The buoyancy is controlled by adjusting the volume of air in the bladder. The bladder is filled with gas from the diver’s air tank or from the diver’s mouth.
BCD	Buoyancy control device.
Breathing gas quality analysis	Analysis report on breathing gas. Common constituents measured are oxygen, carbon dioxide, carbon monoxide, methane (THC), water vapor, dew point, and oil/particles. Air quality specifications vary according to organization. Click the following link for a chart on various specifications: https://www.aircheckclab.com/services/breathing-air/commercial-diving/
CCT	USAF Combat Control.
CFR	Code of Federal Regulations.
CG-2692	Report of Marine Accident, Injury or Death. The owner, master, agent, operator, or person-in-charge must fill and submit CG-2692 to the USCG within 5 days of a reportable marine casualty per reference (p), Notice of Marine Casualty and Voyage Records, 46 CFR § 4.05.
CGIS	Coast Guard Investigative Service.

CNS	Central nervous system.
CO	Carbon monoxide.
COI	Certificate of inspection.
Commercial diving vessel	Vessel engaged in underwater work for hire, excluding sport and non-commercial diving and the instruction thereof.
Corselet	This is an oval copper and brass collar-piece resting on the top middle parts of the chest and back to support the helmet. Most helmets are joined to the corselet (also known as a breastplate) by 1/8th turn interrupted thread. The helmet is placed on the breastplate facing the divers left front and then turned forward, seating on a leather gasket. The helmet usually has a safety lock which prevents it from rotating back and thus separating underwater. However, if other styles were used, the joins might be by clamp or bolts. Some helmets and breast plates are one piece and secured to the suit in other ways.
CPR	Cardio-pulmonary respiration.
CRZ	Contamination reduction zone.
Cylinder - aluminum	Aluminum cylinders are popular because of their lower cost. Another advantage is that aluminum doesn't rust. But these cylinders also have some disadvantages. Aluminum is softer than steel, so they can be dented when dropped or knocked over. Also, the cylinder walls must be thicker to compensate for aluminum's weaker strength. This results in a larger physical size than steel cylinders of the same capacity. Aluminum is also more buoyant than steel, so divers need to wear more weight when using aluminum cylinders.
Cylinder - steel	Steel is stronger than aluminum, which allows the walls of steel cylinders to be thinner than aluminum tanks. This results in a smaller physical size than aluminum cylinders of the same capacity. The increased strength also makes steel cylinders more resistant to exterior damage. Unfortunately, steel rusts, so special care must be taken to avoid allowing water to enter the cylinder.

Cylinder band	Cylinder bands are straps, usually of stainless steel, which are used to clamp two cylinders together as a twin set. The cylinders can be manifolded together or independent. It is usual to use a cylinder band near the top of the cylinder, just below the shoulders, and one lower down. The standard distance between center lines for bolting to a back-plate is 11 inches (280 mm).
Cylinder boot	A cylinder boot is a hard rubber or plastic cover which fits over the base of a diving cylinder to protect the paint from abrasion and impact, to protect the surface the cylinder stands on from impact with the cylinder, and in the case of round bottomed cylinders, to allow the cylinder to stand upright on its base.
Cylinder capacity	Most aluminum cylinders have their capacity stamped on the cylinder. This is not a required specification, and very few steel tanks have a capacity stamp. The capacity of most cylinders ranges from 50 cubic feet to 120 cubic feet.
Cylinder DOT stamp	Many countries, including the United States, require a cylinder to be approved by a government agency. Cylinders used in the United States must be approved by the Department of Transportation (DOT). Cylinders manufactured before 1970 have the letters “ICC” instead of “DOT.”
Cylinder handle	A cylinder handle can be fitted, usually clamped to the neck, to conveniently carry the cylinder. This can also increase the risk of snagging in an enclosed environment.
Cylinder manifold	A cylinder manifold is a tube which connects two cylinders together so that the contents of both can be supplied to one or more regulators.
Cylinder material	Cylinders can be made out of either steel or aluminum. Steel cylinders are stamped with the characters “3AA.” Aluminum cylinders are stamped with the characters “3AL.”
Cylinder net	A cylinder net is a tubular net which is stretched over a cylinder and tied on at top and bottom. The function is to protect the paintwork from scratching, and on booted cylinders it also helps drain the surface between the boot and cylinder, which reduces corrosion problems under the boot. Mesh size is usually about 6 mm (0.24 in). Some divers do not use boots or nets as they can snag more easily than a bare cylinder and constitute an entrapment hazard in some environments such as caves and the interior of wrecks.

Cylinder pressure	All cylinders are stamped with their maximum filling pressure. The location varies by manufacturer, but becomes easier to identify when you become familiar with common maximum service pressures. Common pressure ratings include 2250, 2500, 3000, and 3500 psi.
DAN	Divers Alert Network, a dive safety organization.
DCS	Decompression sickness. A condition that results when sudden decompression causes nitrogen bubbles to form in the tissues of the body. It is suffered particularly by divers (who often call it the bends), and can cause pain in the muscles and joints, cramps, numbness, nausea, and paralysis.
Deep-Water Port	An area or platform entered into from the sea by very large and heavily loaded ships; allows for protected staging and anchoring or docking for these ships to load and unload consignments and continue up towards their destinations.
DEMA	Diving Equipment and Marketing Association.
DI	Drug Interdiction.
DIN	Dutch industry standard.
Dive computer	A dive computer, personal decompression computer, or decompression meter is a device used by an underwater diver to measure the time and depth of a dive so that a safe ascent profile can be calculated and displayed so that the diver can avoid decompression sickness. Can be in the form of a watch.
Dive log	A dive log is used by a scuba diver to record the details of dives. The log may either be in a book, software, or web based. The log serves purposes both related to safety and personal records. Information in a log contains such things as date, time, and location; the profile of the dive; equipment used; air usage; above and below water conditions, such as temperature, current, wind and waves; general comments; verification of buddy and instructor, etc.

Diver's harness

The diver's harness is an item of strong webbing, and sometimes cloth, which is fastened around a diver over the exposure suit, and allows the diver to be lifted without risk of falling out of the harness. Types of harnesses are jacket, bell, or a harness with buoyancy compensator.

DR

Defense Readiness.

Dry suit

A dry suit provides thermal insulation or passive thermal protection to the wearer while immersed in water and is worn by divers who work or play in or near cold water. A dry suit normally protects the whole body except the head, hands, and possibly the feet. In some configurations, however, all of these are covered as well. Dry suits are used typically in these cases:

- Water temperature is below 15°C (60°F).
- Extended immersion in water above 15°C (60°F), where discomfort would be experienced by a wet suit user.
- With an integral helmet, boots, and gloves for personal protection when working in and around hazardous liquids.

The main difference between dry suits and wet suits is that dry suits are designed to prevent water entering. This generally allows better insulation making them more suitable for use in cold water. Dry suits can be uncomfortably hot in warm or hot air, and are typically more expensive and more complex to don. For divers, they add some degree of complexity as the suit must be inflated and deflated (inflator valve) with changes in depth in order to avoid "squeeze" on descent or uncontrolled rapid ascent due to over-buoyancy. Most dry suits are made of a laminate of rubber and nylon and are called shell suits.

EPA

Environmental Protection Agency.

Exhaust valve

The air inside a dry suit expands during ascent. If this expanding air is not vented, the diver becomes more buoyant and an uncontrolled ascent results. For this reason, dry suits must have an exhaust valve to allow excess air to be vented. This valve is usually mounted on the left arm, and automatically vents air when the left arm is raised.

FJ Zipper

Zipper on a farmer john (no sleeves) wet suit. Farmer john covers the torso and legs only. Also known as long john, johnny, johnny suit or farmer jane.

FOIA

Freedom of Information Act.

fsw	Feet of seawater.
Gas embolism	An air embolism is a blockage of blood supply caused by air bubbles in a blood vessel or the heart. Arterial gas embolism is a potentially catastrophic event that occurs when gas bubbles enter or form in the arteries and block blood flow, causing an organ to fail. Arterial gas embolism can restrict the blood supply to the central nervous system with rapid loss of consciousness, other nervous system manifestations, or both; it can also affect other organs. Diagnosis is clinical and can be corroborated by imaging tests. Treatment is immediate recompression.
GRT	Gross register tonnage (GRT, grt, g.r.t.) a ship's total internal volume expressed in "register tons," each of which is equal to 100 cubic feet (2.83 m3). Gross register tonnage uses the total permanently enclosed capacity of the vessel as its basis for volume.
HAZWOPER	Hazardous waste and emergency response.
HBOT	Hyperbaric oxygen therapy.
Hot water suit	Hot water suits are used in cold water commercial surface-supplied diving. An insulated pipe in the umbilical line, which links the diver to the surface support, carries the hot water from a heater on the surface down to the suit. The diver controls the flow rate of the water from a valve near the waist, allowing the diver to vary the warmth of the suit in response to changes in environmental conditions and workload. Pipes inside the suit transport the water to the limbs, chest, and back. Special boots, gloves, and hood are worn. These suits are normally made of foamed neoprene and are similar to wet suits in construction and appearance, but they do not fit as closely by design. The wrists and ankles of the suit are open, allowing water to flush out of the suit as it is replenished with fresh hot water from the surface.
HSE	Health and safety executive.
Hydrostatic test date	During this test the cylinder is overfilled to a specified amount and its permanent expansion is measured. If the cylinder meets passing criteria the test date is permanently stamped on the cylinder. All tanks (cylinders) must pass a hydrostatic test every 5 years. A plus "+" symbol following the test date indicates the cylinder can be filled 10% higher than the stated maximum service pressure. Because this test is performed every 5 years, the cylinder might have several hydro dates stamped on the cylinder.

IANTD	International Association of Nitrox and Technical Divers.
IDLH	Immediately dangerous to life and health.
IMCA	International Marine Contractors Association.
INCOE	Investigations National Center of Expertise.
Inflator hose	The low pressure inflator hose connects a regulator first stage to a buoyancy compensator's (BC) inflation mechanism, allowing divers to add air to the BC at the touch of a button.
Inflator valve	Dry suits retain an air space around the diver's body. Because air compresses at depth, additional air must be added to the suit to prevent the suit from squeezing the diver during descent. This is accomplished by using an inflation valve that fills the suit with air from the scuba cylinder.
Instrument (gauge) console	Divers carry gauges that display information such as remaining cylinder pressure, current depth, elapsed dive time, and direction of travel. These gauges are usually held by a console that's attached to the regulator by a high-pressure hose. This minimizes confusion over where your gauges are located, and also helps prevent misplacing or forgetting your gauges. Some divers prefer to wear gauges on their wrist, so most are available with wristbands as an option.
IO	Investigating officer.
IO	Ice Operations.
IPE	Immersion pulmonary edema.
Jacket zip	Zipper in the front of a wet suit jacket.
JAG	Judge Advocate General.
Job safety analysis (JSA) (or job hazard analysis (JHA))	A job safety analysis (JSA) is one of the risk assessment tools used to identify and control workplace hazards. A JSA is a second tier risk assessment with the aim of preventing personal injury to a person, their colleagues, and any other person passing or working adjacent, above, or below. JSAs are also known as activity hazard analysis (AHA), job hazard analysis (JHA), and task hazard analysis (THA).

LMR	Living Marine Resources.
Manifold	In scuba diving, a manifold is used to connect two diving cylinders with breathing gas, providing a greater amount of gas for longer dive times and greater safety due to redundancy. Diving with two or more cylinders is associated with technical diving.
Manufacturer	All cylinders are stamped with manufacturer identification.
MAWP	Maximum allowable working pressure.
MEP	Marine Environmental Protection.
MMC	Merchant Mariner Credential. The Merchant Mariner Credential or MMC is a credential issued by the USCG per guidelines of the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW) to United States seafarers in order to show evidence of a mariner's qualifications.
MMC	Merchant Marine Credential.
MOA	Memorandum of agreement.
MOU	Memorandum of understanding.
MS	Marine Safety.
MSHA	Mine Safety Health Administration.
NAUI	National Association of Underwater Instructors.
NDL	A no-decompression limit is a time limit. No-decompression limits vary from dive to dive. A diver who stays underwater longer than the no-decompression limit for the dive cannot ascend directly to the surface, but must pause periodically as he or she ascends to avoid a high risk of decompression sickness. A diver must never exceed a no-decompression limit without specialized training in decompression procedures.
NFPA	National Fire Protection Association.

NGO	Non-governmental organizations.
NOAA	National Oceanic and Atmospheric Administration.
OCMI	Officer in charge, Marine Inspection.
Octopus	Alternate air source that allows diver to share air with a dive buddy in the event of an out-of-air emergency. An octopus is an additional 2nd stage that is connected to the 1st stage and is the most common alternate air source used today. With an octopus, two divers can breathe from one cylinder while ascending. The octopus works like any other 2nd stage, but most have minor modifications. The most important is a longer hose that allows it to reach second diver. Another common modification is a yellow cover to make it more visible when clipped to the chest. Some have a low-profile design to decrease their size. The octopus is popular because it's easy to use and costs less than other options.
ODA	Operational Detachment-Alpha.
OLE	Other law enforcement.
Operation specific diving supervisor designation letter	Statement written by the diving company to designate a specific person as diving supervisor. An "operation specific diving supervisor" is required per 46 CFR 197.210. The name of the diving supervisor for each commercial diving operation is (a) designated in writing; and (b) given to the person-in-charge before the commencement of any commercial diving operation.
Operation specific person-in-charge designation letter	Statement written by the diving company to designate a specific person as person-in-charge. A "person-in-charge designation letter" is required per 46 CFR 197.208. The owner or agent of a vessel or facility without a designated master must designate, in writing, an individual to be the person-in-charge of the vessel or facility. Where a master is designated, the master is the person-in-charge.
OSHA	Occupational Safety and Health Administration; a Federal agency of the United States that regulates workplace safety and health.
Outer Continental Shelf (OCS)	The Outer Continental Shelf (OCS) is a peculiarity of the political geography of the United States. The OCS is the part of the internationally recognized continental shelf of the United States which does not fall under the jurisdictions of the individual U.S. States. Formally, the OCS is governed by Title 43, Chapter 29 "Submerged Lands," Subchapter III "Outer Continental Shelf Lands," of the U.S. Code. The term "Outer Continental Shelf" refers to all submerged lands, its subsoil, and seabed

	that belong to the United States and are lying seaward and outside of the states' jurisdiction; the latter defined as the "lands beneath navigable waters" in Title 43, Chapter 29, Subchapter I, Section 1301.[1]
Overpressure relief (dump) valve	One or more overpressure relief valves must be present on a buoyancy control device. These vent excessive pressure to prevent rupturing or over-inflation. Most overpressure relief valves have knobs attached to them to allow manual venting as well. For this reason, they are sometimes referred to as "dump valves."
PADI	Professional Association of Diving Instructors.
PIC	Person-in-charge.
PJ	USAF Pararescue.
Pneumo-fathometer	Device which measures a diver's depth. The small hose is part of the diver's umbilical.
Power inflator or auto inflator	The power inflator uses air from the diver's cylinder to inflate the buoyancy compensator, and the air enters the bladder through a flexible inflator hose. Most BCDs have an overpressure relief valve at the base of the inflator hose, and this can be manually vented by pulling the power inflator straight down. There is usually an oral inflation option. These are usually at the end of a corrugated rubber inflation hose.
ppm	Particles per million.
PSA	Professional Scuba Association.
psig	Pounds per square inch.
Public safety vessel	Diving solely for search, rescue, or related public-safety purposes by or under the control of a government agency.
Public vessel	Vessel used solely for search and rescue or related public safety purposes by or under the control of a governmental agency.
Pulmonary over-inflation syndrome (POIS)	Pulmonary over-inflation syndrome (POIS) is a group of barotrauma-related diseases caused by the expansion of gas trapped in the lung, or over-pressurization of the lung with subsequent over-expansion and rupture of the alveolar air sacs. This group of disorders includes arterial gas embolism, tension pneumothorax, mediastinal emphysema, subcutaneous

	emphysema, and (rarely) pneumopericardium. In the case of diving activities, POIS is rarely reported and is frequently related to unsafe diving techniques
PVHO	Pressure vessels for human occupancy.
PWCS	Ports, Waterways, and Coastal Security.
Rebreather	A rebreather is a breathing apparatus that absorbs the carbon dioxide of a user's exhaled breath to permit the rebreathing (recycling) of the substantially unused oxygen content of each breath. Oxygen is added to replenish the amount metabolised by the user. This differs from open-circuit breathing apparatus, where the exhaled gas is discharged directly into the environment. Rebreather technology can be used where breathing gas supply is limited, where the environment is toxic or hypoxic, or where the breathing gas is specially enriched or contains expensive components, such as helium diluent or anaesthetic gases.
Recompression	In-water recompression (IWR) or underwater oxygen treatment is the emergency treatment of decompression sickness (DCS) where a diver goes back underwater to allow the gas bubbles in the tissues, which are causing the symptoms, to resolve. It is a risky procedure that must only be used when the time to travel to the nearest recompression chamber is too long to save the victim's life.
Recreational vessel	Vessel used solely for recreational purposes.
Regulator	A diving regulator is a pressure regulator used in scuba or surface-supplied diving equipment that reduces pressurized breathing gas to ambient pressure and delivers it to the diver. The gas can be air or one of a variety of specially blended breathing gases. The gas can be supplied from a cylinder worn by the diver (as in a scuba set) or via a hose from a compressor or a bank of cylinders on the surface (as in surface-supplied diving). A gas pressure regulator has one or more valves in series which reduce pressure from the source and use the downstream pressure as feedback to control the delivered pressure, lowering the pressure at each stage.
Regulator – first stage	Regulators consist of two components. These are the 1st and 2nd stages. The function of the 1st stage is to reduce the pressure to about 140 psi from the cylinder which can be as high as 3500 psi. The 1st stage connects directly to the cylinder's valve, and threaded ports allow you to attach air hoses for the 2nd stage, BCD power inflator, and alternate air source. One of these ports is labeled "HP" (high pressure) because the air pressure

	delivered through this port is not reduced by the 1st stage. This port is used to attach the submersible pressure gauge, which indicates the cylinder's pressure while you dive.
Regulator – second stage	The 2nd stage is the component you hold in your mouth, and delivers air on demand when you breathe. When you inhale, a flexible diaphragm is pulled in which opens the 2nd stage's valve. The valve closes when you stop inhaling. When you exhale, the air exits through one-way valves located underneath the mouthpiece. The 2nd stage delivers air at ambient pressure, or the pressure equivalent to your surrounding pressure. This means that no matter how deep you are diving, the regulator provides the amount of air you need to breathe. The front of the 2nd stage has a button that pushes in on the diaphragm. This allows you to clear the 2nd stage in the event it fills with water.
Respiratory acidosis	Respiratory acidosis is a condition that occurs when the lungs cannot remove all of the carbon dioxide the body produces. This causes body fluids, especially the blood, to become too acidic.
ROI	Report of investigation.
S&R	Suspension and revocation.
SAR	Search and rescue.
Scuba	Scuba stands for self-contained underwater breathing apparatus. A diving mode independent of surface supply in which the diver uses an open circuit self-contained underwater breathing apparatus.
SEAL	Navy Sea, Air, Land teams.
Serial number	All cylinders are stamped with a unique serial number for identification purposes. The format of the serial number varies by manufacturer.
SIO	Senior investigating officer.
SOWT	Special Operations Weather team.
SSI	Scuba Schools International.

Submersible pressure gauge (SPG)	The submersible pressure gauge (more commonly called SPG) is the gauge that tells you how much air you have left in your tank. Air pressure is measured in PSI or bar. Most SPGs have a section of the dial highlighted in red which shows you when you're getting low on air.
TACP	Tactical Air Control Party.
TDI	Technical Diving International.
Umbilical cable	An umbilical cable or umbilical is a cable which supplies required consumables to a diver. An umbilical can for example supply air, optics, and power to a pressure suit or other submerged equipment. In commercial activities, it typically has an air hose, pneumofathometer, communications, and hot water and is fixed in place through a threaded connection to the dive helmet. In non-commercial activities, the umbilical is typically not present except in hookah diving where an air hose can be referred to as an umbilical. The air hose is affixed directly to the dive regulator that the diver places in his or her mouth.
USA	U.S. Army.
USAF	U.S. Air Force.
USAO	United States Attorney's Office.
USC	United States Code.
USCG	United States Coast Guard.
USMC	U.S. Marine.
USN	U.S. Navy.
Valve	A cylinder's valve opens and closes the tank.
Valve - DIN	DIN valves are installed on cylinders with service pressures exceeding 3000 psi. These valves are designed for use with regulators equipped with DIN attachments instead of yoke attachments. The regulator is attached by screwing its DIN fitting into the valve's internal threads. With these valves the o-ring is attached to the regulator instead of the valve. The o-ring is thicker than yoke valve o-rings and is more dependable. This system is sometimes referred to as a "captured o-ring."

Valve "J" style	"J" valves are similar to "K" valves. What makes the "J" valve unique is a reserve mechanism. This is a spring-loaded valve that closes airflow when the cylinder's pressure drops below about 500 psi. The reserve is then opened by pulling a rod that's attached to the reserve lever. "J" valves are no longer considered to be an acceptable method of monitoring your air supply because reliable cylinder pressure gauges have become standard equipment. For this reason, if you find a cylinder that's equipped with a "J" valve, it's important that you disable the reserve mechanism to prevent air supply from being shut off while there is still air remaining. If the reserve lever is in the down position, the reserve mechanism has been disabled.
Valve "K" style	"K" valves are the simplest of all valves, and are found on most modern cylinders. These valves fit regulators with yoke attachments. The regulator is attached by slipping the yoke attachment over the valve and tightening a screw against the rear of the valve. The O-ring on a "K" valve is expanded by air pressure, and this expansion creates the seal between the regulator and valve.
Valve knob	The knob opens and closes the valve. Turning the valve clockwise closes the valve, and a counterclockwise turn opens the valve.
Valve O-ring	The o-ring creates the seal between the valve and regulator. Over time, the o-ring can crack, wear out, or fall out. Inspect it before attaching the regulator.
VCP	Vessel critical profile.
Wet suit	A wet suit is a garment, usually made of a foam rubber called neoprene, which is worn by divers engaged in water sports, providing thermal insulation, abrasion resistance, and buoyancy. The insulation properties depend on bubbles of gas enclosed within the material. The gas bubbles inside the neoprene trap body heat and warm water that enters the suit. The bubbles also give the wet suit a low density, providing buoyancy in water. Most wet suits are lined with nylon on both sides of the neoprene. This helps protect the neoprene from tears and cuts and is easier to wear.
YMCA	Young Men's Christian Association.
Yolk	The yolk is the connection on the regulator which surrounds the valve pillar and presses the output O-ring of the pillar valve against the input seat of the regulator. The yoke is screwed down snug by hand (over-tightening can make the yoke impossible to remove later without tools), and the seal is created by pressure when the valve is opened. This type of connection to

the regulator is simple, cheap, and very widely used worldwide. It has a maximum pressure rating of 232 bar and the weakest part of the seal, the O-ring, is not well protected from over-pressurization.

Appendix B:
Dive Thermal Graphic Chart

Use this chart as a guide for both scuba and surface-supplied dive planning.

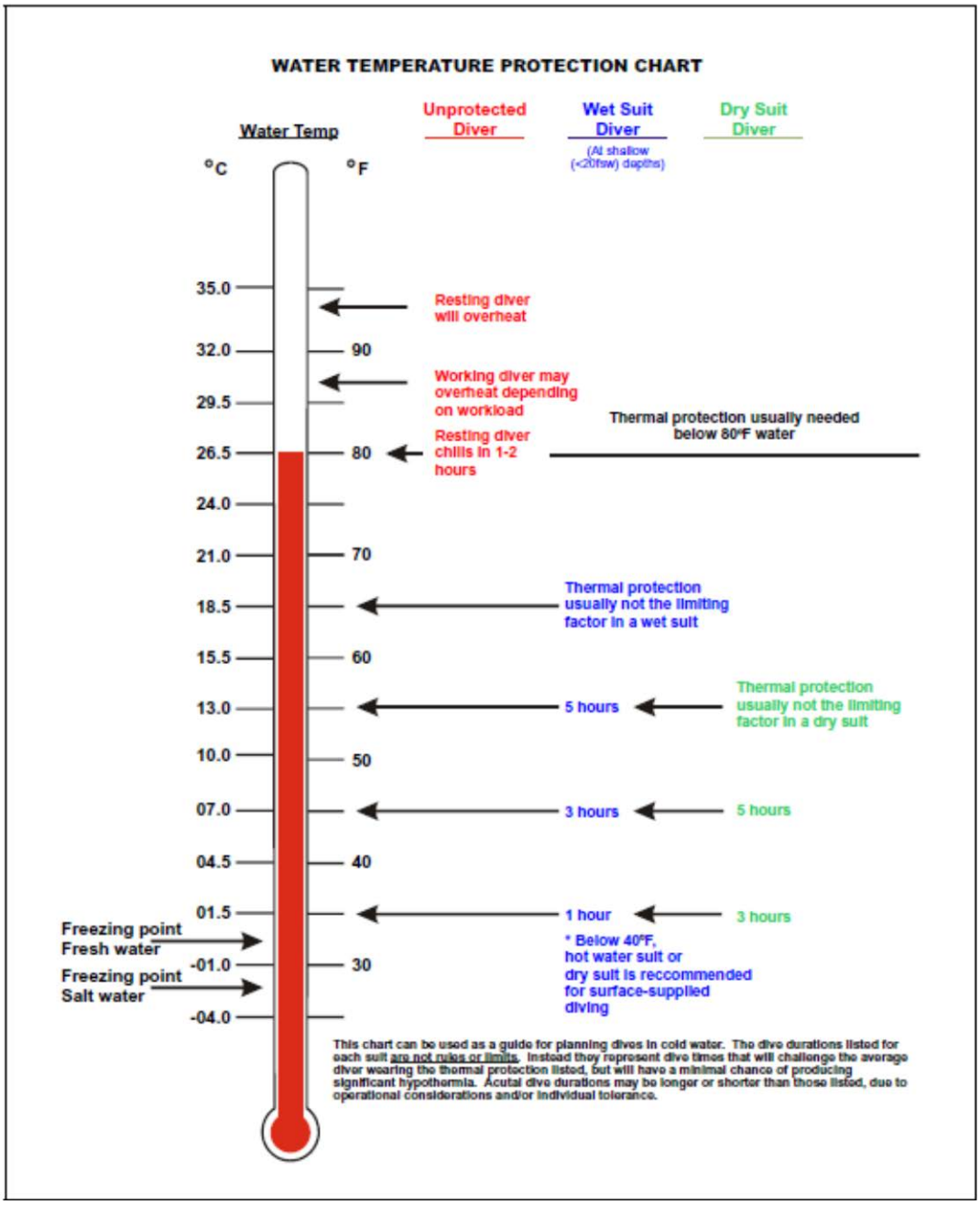

Figure B-1 Diver's temperature tolerance chart for water conditions

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Appendix C: Diving Disorders

C.1. Introduction

The following is a table of diving disorders and typical associated symptoms. "X" indicates a symptom; "XX" represents a predominant symptom of the condition.

	DIVING DISORDERS											
SYMPTOMS	Hypoxia	Hypercapnia	Asphyxia	Drowning / Near Drowning	Carbon Monoxide Poisoning	Arterial Gas Embolism (AGE)	Mediastinal / Subcutaneous Emphysema	Pneumothorax	Nirtogen Narcosis	Oxygen Toxicity	Type I Decompression Sickness (DCS)	Type II Decompression Sickness (DCS)
Agitation	X									X		
Anxiety								X				
Bloody Sputum						X						
Confusion / Difficulty Thinking		X			X	X				X		
Convulsions		X				X				XX		X
Coughing							X					X
Cyanosis (Bluish Discoloration)								X				
Difficult Breathing		X					X					
Dizziness					X	X				X		X
Drowsiness	X	X										
Dull Ache							X					
Euphoria	X	X							XX			
Fatigue						X				X		X
Headache		X			X							
Hearing Abnormalities						X				X		X
Inability to Perform Delicate Tasks	X											
Inappropriate Laughter									XX			
Increased Breathing Rate		X		X								
Increased Sweating		X										
Lack of Concentration	X	X										
Lack of Concern / Safety									X			
Lack of Muscle Control	X											
Large Areas of Abnormal Sensations (Paresthesias)						X						
Loss of Coordination						X						
Loss of Judgment	X								X			
Lost Control of Bodily Functions						X						
Nausea					X	X				X		
Numbness						X			X			X
Pain							X	X			X	X
Paralysis						X						
Personality Changes						X				X		
Pulmonary Edema				X								
Radiating / Shooting Pain							X					
Rapid Heart Rate								X				
Shortness of Breath		X						XX				X
Swelling							X				X	
Tightness Across Forehead					XX							
Tingling									X	X		
Tremors						X						
Unconsciousness	X	X	X	X		X						X
Vertigo						X						X
Vision Abnormalities						X				X		X
Vomiting					X	X				X		
Weak Pulse								X				
Weakness	X					X						
Itching / Burning Skin Sensation											XX	
Rash											X	
Paralysis												X

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Appendix D:
Commercial Diving Casualty Checklist

Below is a checklist for collected evidence during a commercial diving investigation. Click this link for an electronically fillable form:
http://www.uscg.mil/forcecom/ttp/downloads/Commercial_Diving_Casualty.pdf

Case Number: _____

Collect the following paperwork, audio, and video for the case file:	***Date Collected***
Operation Specific Diving Supervisor Designation Letter	
Operations Specific Person-in-Charge Designation Letter	
Operations Manual	
Equipment Maintenance Records (At Least Past 2 Years)	
Breathing Gas Quality Analysis (At Least Past 2 Years)	
Operations Manual	
Dive Logs	
Dive Job Records/Contract	
Vessel Logs	
Dive Tables	
Job Safety Analysis (JSA)	
Site Specific Safety Plan	
Autopsy Report	
Work Rest Histories for Diver, Dive Team, and Vessel Crew	
On-Scene Weather / Sea State Report	
Charted Location of Diving Casualty	
Diver's Work History and Personal Dive Log	
Diver's Medical History and Copy of Last Physical	
Diver's Personal Equipment Maintenance Records (Obtain from prior employers and family members)	
Command Center Logs and Recordings	
Written Statements / Transcription of Interviews (dive supervisor, divers, master, crewmembers, company representatives, safety officer, life support technicians, project managers, etc.)	
Drawings of Diving Systems	
CPR/First Aid Certification Cards	
Association of Diving Contractors International (ADCI) Certifications	
CG-2692: Report of Marine Accident, Injury or Death	
Drug and Alcohol Testing Results (Dive and Vessel Crew)	
Diving Operation Video and/or Audio	
Expert Witness Statements	
Commercial Vessel Critical Profile	
Photographs of Diving Equipment (prior to breakdown)	
News Articles / Media Information	
Review the following resources during the investigation analysis:	

Marine Safety Manual Volumes II and V and CG-545 Policies
U.S. Coast Guard and OSHA Regulatory Standards
U.S. Navy Dive Manual and Diver's Handbook
National Oceanic and Atmospheric Administration (NOAA) Diving Manual
Classification Society Standards
Association of Diving Contractors International (ADCQ) Consensus Standards
International Marine Contractors Association (IMCA) Standards
Health and Safety Executive (HSE) and other International Standards

Appendix E:
Commercial Diving Investigation Questionnaire

Below are typical interview questions that investigating officers ask diving supervisors at the scene of a commercial diving casualty investigation. Click this link for an electronically fillable form:
http://www.uscg.mil/forcecom/ttp/downloads/Commercial_Diving_Interview_Questions.pdf

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INTERVIEW QUESTIONS

1. Case number: _____
2. Date of accident: _____
3. Date of interview: _____
4. Location of accident: _____
5. Vessel name and number: _____

CONTACT INFORMATION

1. Name (first, last): _____
2. Position (check):
   - ☐ Victim ☐ Dive supervisor ☐ Diver ☐ Master ☐ Crew member
   - ☐ Company representative ☐ Safety officer ☐ Life support technician
   - ☐ Project manager ☐ Other _____
3. Title: _____
4. Age: _____
5. Date of birth: _____
6. Driver's license number: _____
7. Home address: _____
8. Home telephone: _____
9. Cell phone: _____
10. Email: _____
11. Employer: _____
12. Business address: _____
13. Business telephone: _____

EXPERIENCE LEVEL

1. Number of years with employer:_____
2. Do you have any special relevant education or training? ☐ Yes ☐ No
3. If yes, describe the training, date, and school(s): _____
4. First started diving: _____
5. How many dives have you logged? _____

   What are the typical depths and purposes of these dives? _____

   Were these dives in the day, night, or both? _____

   Air? _____

   Mixed gas? _____

   Saturation? _____
6. How long have you been a diving supervisor?_____
7. How many dives have you supervised? _____
8. Have you dived with the victim before? ☐ Yes ☐ No

   If yes, how many dives have you conducted together? _____

   If yes, what was the purpose of these dives together (fishing, deep dive, reef, wreck, enriched gas)?_____

RECORDS

1. Do you have an Operation Specific Diving Supervisor designation letter?

   ☐ Yes ☐ No ☐ Don't know
2. Do you have an Operation Specific Person-in-Charge designation letter?

   ☐ Yes ☐ No ☐ Don't know
3. Do you have a Dive Operations Manual?

   ☐ Yes ☐ No ☐ Don't know
4. Do you have equipment maintenance records for the past 2 years?

   ☐ Yes ☐ No ☐ Don't know
5. Do you have breathing gas quality analyses for the past 2 years?

   ☐ Yes ☐ No ☐ Don't know
6. Do you have dive job records or contract?

   ☐ Yes ☐ No ☐ Don't know

7. Do you have dive logs?

☐ Yes ☐ No ☐ Don't know

8. Do you have dive tables?

☐ Yes ☐ No ☐ Don't know

9. Do you have vessel logs?

☐ Yes ☐ No ☐ Don't know

10. Do you have a site specific safety plan?

☐ Yes ☐ No ☐ Don't know

11. Do you have command center logs and recordings?

☐ Yes ☐ No ☐ Don't know

12. Do you have a charted location of diving casualty?

☐ Yes ☐ No ☐ Don't know

13. Do you have a commercial vessel critical profile (VCP)?

☐ Yes ☐ No ☐ Don't know

14. Have you filled out a CG-2692 (Report of Marine Accident, Injury or Death)?

☐ Yes ☐ No ☐ Don't know

VICTIM HISTORY

1. How did you first meet the victim? _____

2. Describe the victim's personality? _____

3. Did you have any sort of personal relationship with the victim outside of the job environment? _____

4. Was the victim physically fit? ☐ Yes ☐ No ☐ Don't know

5. Did the victim require prescription lenses for work? ☐ Yes ☐ No ☐ Don't know

   If yes, was the victim wearing contacts during the dive?

   ☐ Yes ☐ No ☐ Don't know

   If yes, was the victim wearing prescription mask during the dive?

   ☐ Yes ☐ No ☐ Don't know

6. Did the victim smoke cigarettes? ☐ Yes ☐ No ☐ Don't know

7. Was there any indication the victim was using prescription drugs or over the counter drugs?

   ☐ Yes ☐ No ☐ Don't know

8. Did you see any sign that the victim used recreational drugs or alcohol at any time before the accident? ☐ Yes ☐ No ☐ Don't know

9. How many dives had you supervised for this victim? _____

10. How many dives of this type have you supervised? _____

11. Did victim have any special relevant education or training? ☐ Yes ☐ No

    If yes, describe the training and organization(s): _____

12. Did you review the victim's log book to find out diving experience before the accident?
    ☐ Yes ☐ No

13. Was the victim involved in a previous diving accident? ☐ Yes ☐ No ☐ Don't know

14. Do you have the victim's personal dive log? ☐ Yes ☐ No ☐ Don't know

15. Do you have a work history for the victim, dive team, and vessel crew?

    ☐ Yes ☐ No ☐ Don't know

16. Do you have the victim's medical history and copy of his or her last physical?

    ☐ Yes ☐ No ☐ Don't know

EVIDENCE

1. What type of diving was the victim engaged in? _____

2. Do you have drawings of the diving system used? ☐ Yes ☐ No ☐ Don't know

3. Who is responsible for selecting the victim's dive equipment?

   _____

4. Was there any equipment that was missing when the equipment was selected for the dive (for the victim or standby diver)? ☐ Yes ☐ No ☐ Don't know

5. What activities preceded the accident on the day that it took place?

   _____

6. What was the victim's health like before the accident?

   _____

7. Had the victim made any dives during the 24 hours before the accident?

   ☐ Yes ☐ No ☐ Don't know

   If yes, what were the dive profiles for those dives? _____

8. Do you have a 96-hour work rest history of the victim? ☐ Yes ☐ No ☐ Don't know

9. Were photographs or video taken of the victim in diving gear before the accident?

   ☐ Yes ☐ No

10. How much experience did the victim have with the type of diving being conducted at the time of the accident? _____

11. What time did you arrive at the job site? _____

12. What time did the victim arrive at the job site? _____

13. By what mode did the victim arrive at the job site? _____

14. Was the equipment inspected once it arrived on the job site?

    ☐ Yes ☐ No ☐ Don't know

    If yes, who performed the inspection? _____

    Was the equipment damaged during transport? ☐ Yes ☐ No ☐ Don't know

15. Did the victim appear apprehensive before the accident? ☐ Yes ☐ No

16. Did you inspect the victim's gear before entry into the water? ☐ Yes ☐ No

17. Did you do a pre-dive briefing? ☐ Yes ☐ No

18. What was the weather like on the day of the accident? _____

    What was the air temperature? _____

    What was the water temperature? _____

    What was the sea surface like? _____

    What was the underwater visibility on the bottom? _____

19. Was the victim's dive recorded on video or audio? ☐ Yes ☐ No ☐ Don't know

20. Did you perform a job hazard analysis (JHA)? ☐ Yes ☐ No ☐ Don't know

21. When did you first become aware the diver had a problem?

    _____

22. What made you first aware the diver was having a problem?

    _____

23. Was standby diver fully prepared and suited up when the victim entered the water?

    ☐ Yes ☐ No ☐ Don't know

24. Was there any delay in getting the standby diver deployed into the water?

    ☐ Yes ☐ No ☐ Don't know

25. What time did the standby diver enter the water? _____

26. Where was the victim recovered? _____

27. When was the victim recovered? _____

28. What position was the victim in when he or she was recovered?

    _____

29. How was the victim brought to the surface? _____

30. What dive gear was the victim wearing when recovered?

    _____

31. Did anyone administer CPR, and if yes, who? _____

    What time did CPR start? _____

What time did CPR end?_____

Who ordered CPR to end?_____

Did the person who administered the CPR have any documented CPR training?

☐ Yes ☐ No ☐ Don't know

Is CPR training current? ☐ Yes ☐ No ☐ Don't know

32. Was an oxygen kit present? ☐ Yes ☐ No ☐ Don't know
33. Was oxygen administered? ☐ Yes ☐ No ☐ Don't know
34. Was a first aid kit present? ☐ Yes ☐ No ☐ Don't know
35. Was the victim medically evacuated? ☐ Yes ☐ No ☐ Don't know
36. What time was the mayday/911 call made? _____
37. What time did the first rescue agency arrive on scene? _____
38. Did you inspect the victim's equipment after the accident? ☐ Yes ☐ No

    If yes, what did you find? _____
39. What happened to the victim's equipment after the accident?

    _____
40. Were there other witnesses to this accident who are not mentioned in your report?

    ☐ Yes ☐ No ☐ Don't know
41. Were there any articles about the accident in the newspaper or footage on local TV?

    ☐ Yes ☐ No ☐ Don't know
42. Did you give any statement to the coroner after the accident? ☐ Yes ☐ No
43. Have you had contact with the victim or family since the accident? ☐ Yes ☐ No
44. Do you have an original or rough set of notes regarding this accident? ☐ Yes ☐ No
45. Do you make an entry in your logbook regarding this accident? ☐ Yes ☐ No
46. Can you think of anything else important that I should know about this accident?

    _____

    _____

    _____

Gear Inspection

General information

1. Date of gear inspection: _____
2. Location of gear inspection: _____

3. Parties present during inspection:_____

4. Has gear been washed or cleaned since accident? ☐ Yes ☐ No ☐ Don't know

Complete System

1. Is cylinder band tight? ☐ Yes ☐ No ☐ Don't know
2. Is cylinder band at appropriate height? ☐ Yes ☐ No ☐ Don't know
3. Is regulator oriented properly? ☐ Yes ☐ No ☐ Don't know
4. Is buoyancy control device inflated? ☐ Yes ☐ No ☐ Don't know

Tank ☐ Not present

1. Manufacturer: _____
2. Date of manufacture:_____
3. Serial number: _____
4. Type (aluminum or steel): _____
5. Capacity: _____
6. Working pressure: _____
7. Type of medium (compressed air, enriched air) _____

   If enriched air, percentage of enriched air mixture: _____

   Did victim verify percentage of enriched air? _____
8. Color of tank: _____
9. Other marks: _____
10. Hydro test dates: _____
11. VIP history: _____
12. Pressure in tank: _____
13. Facility that filled tank: _____
14. General condition: _____
15. Boot: _____
16. Photos taken? ☐ Yes ☐ No ☐ Don't know

Tank Valve ☐ Not present

1. Manufacturer: _____
2. Serial number: _____

3. Type of valve (K, J, or DIN valve): _____

4. Condition of valve: _____

5. O-ring condition: _____

6. Operation of valve: _____

7. Number of revolutions to fully open valve: _____

8. Number of revolutions to fully close valve: _____

9. Is there any visible corrosion on the filter screen? _____

10. Other marks: _____

Helmet ☐ Not present

1. Manufacturer: _____

2. Date of Manufacture: _____

3. Model #: _____

4. Serial number: _____

5. Working pressure: _____

6. Color: _____

7. Shell material: _____

8. Shell condition: _____

9. Logbook: _____

10. General helmet condition: _____

11. Emergency valve: _____

    Number of revolutions to open/close valve:_____

12. Non-return valve: _____

    Number of revolutions to open/close valve:_____

13. Sideblock: _____

14. Port: _____

15. Neck dam: _____

16. Regulator:_____

17. Yoke or locking collar: _____

18. Tube from sideblock to regulator: _____

19. Photos taken of helmet components? ☐ Yes ☐ No ☐ Don't know

Air Compressor ☐ Not present ☐ Not used ☐ N/A

1. Manufacturer: _____
2. Date of manufacture: _____
3. Model #: _____
4. Serial number: _____
5. Volume of tank: _____
6. Operation of air compressor: _____
7. Location of air compressor during accident:_____
8. Type of valve: _____
9. Condition of valves: _____
10. Operation of valves: _____
11. Belt condition: _____
12. Fuel tank: _____
13. Oil level compression: _____
14. Oil level drive: _____
15. Photos taken of air compressor, valves, or oil level? ☐ Yes ☐ No ☐ Don't know
16. Where are the inspection records for air compressor? ☐ Yes ☐ No ☐ Don't know
17. Any other marks on compressor? ☐ Yes ☐ No ☐ Don't know

Dry Suit Inspection ☐ Not present ☐ Not used ☐ N/A

1. Manufacturer: _____
2. Date of manufacture: _____
3. Model #: _____
4. Serial number: _____
5. In-service date: _____
6. Size: _____
7. Color: _____
8. Condition: _____
9. Type of suit: _____
10. Zipper manufacturer/condition: _____
11. Inflator valve manufacturer/condition: _____
12. Exhaust valve manufacturer/condition: _____

13. Hood type/condition (hood with bib or hooded vests): _____
14. Zipper condition/function: _____
15. Wrist seals type/condition: _____
16. Neck seal type/condition: _____
17. Yoke type/condition: _____
18. Boot type/condition: _____
19. Inflator hose: _____
20. Contents of right pocket: _____
21. Contests of left pocket: _____
22. Does suit leak? ☐ Yes ☐ No ☐ Don't know
23. Photos taken of dry suit? ☐ Yes ☐ No ☐ Don't know

Hot Water Suit ☐ Not present ☐ Not used ☐ N/A

1. Manufacturer: _____
2. Date of manufacture: _____
3. Model #: _____
4. Serial number: _____
5. Condition of valves:_____
6. Model number: _____
7. General condition: _____
8. Photo taken? ☐ Yes ☐ No ☐ Don't know

Wet Suit ☐ Not present ☐ Not used ☐ N/A

1. Manufacturer: _____
2. Date of manufacture: _____
3. Model #: _____
4. Serial number: _____
5. Color(s): _____
6. Style: _____
7. Size: _____
8. Thickness (3mm, 5mm, 7mm): _____
9. Hood type/condition (hood with bib or hooded vests)

10. General condition: _____
11. Jacket zip condition: _____
12. FJ zipper condition: _____
13. Beaver tail closure: _____
14. Closure condition: _____
15. Comments: _____

Regulator Assembly ☐ Not present ☐ Not used ☐ N/A

1. Manufacturer: _____
2. Date of manufacture: _____
3. Model #: _____
4. In-service date: _____
5. First stage
   - Serial number: _____
   - Condition: _____
   - Filter condition: _____
   - Environmental cap: _____
   - Color: _____
   - Relief valve: _____
   - Pressure gauge: _____
   - Tank pressure: _____
   - Shop ID marks: _____
   - Photo taken? ☐ Yes ☐ No ☐ Don't know
6. Primary second stage
   - Manufacturer: _____
   - Model: _____
   - Serial number: _____
   - Color & shop ID marks: _____
   - Condition: _____
   - Condition mouthpiece lugs: _____
   - Condition tie-wrap: _____
7. Octopus second stage

Manufacturer: _____

Model: _____

Serial number: _____

Color: _____

Shop ID marks: _____

Condition: _____

Condition mouthpiece lugs: _____

Condition tie-wrap: _____

8. Inflator hose

For BC, what is condition? _____

For dry suit, what is condition? _____

9. Position of the breath demand sensitivity selector, if equipped:
_____

10. Are there any other devices included in pressure gauge console (depth, computer, etc.)?
_____

11. Photos taken of :

Primary second stage ☐ Yes ☐ No ☐ Don't know

Octopus second stage ☐ Yes ☐ No ☐ Don't know

Inflator hose ☐ Yes ☐ No ☐ Don't know

High pressure hose for pressure gauge ☐ Yes ☐ No ☐ Don't know

<u>Bail Out Cylinder (or pony bottle)</u> ☐ Not present ☐ Not used ☐ N/A

1. Manufacturer: _____
2. Date of manufacture: _____
3. Serial number: _____
4. Type (aluminum, steel, etc): _____
5. Capacity: _____
6. Working pressure: _____
7. Number of revolutions to open/close tank valve:_____
8. Other marks: _____
9. Hydrostatic test dates: _____
10. VIP history: _____
11. Pressure in tank: _____

12. General condition: _____

13. Boot: _____

14. Photos taken? ☐ Yes ☐ No ☐ Don't know

Cylinder Valve ☐ Not present ☐ Not used ☐ N/A

1. Manufacturer: _____

2. Type of valve (K, J, or DIN valve): _____

3. O-ring condition: _____

4. Operation of valve: _____

5. Photos taken: ☐ Yes ☐ No ☐ Don't know

6. Number of turns to fully open: _____

7. Serial number: _____

Buoyancy Control Device ☐ Not present ☐ Not used ☐ N/A

1. Manufacturer: _____

2. Model name: _____

3. Serial number: _____

4. In-service date: _____

5. Bladder type (jacket style or back inflation): _____

6. Is buoyancy compensator bladderless? ☐ Yes ☐ No ☐ Don't know

7. Were any repairs made to the BCD? ☐ Yes ☐ No ☐ Don't know

8. Last service date for BCD? _____

9. Did BCD have weights incorporated (integral)? ☐ Yes ☐ No ☐ Don't know

10. Condition: _____

11. Size: _____

12. Color: _____

13. Other marks: _____

14. Photos taken: ☐ Yes ☐ No ☐ Don't know

15. Lift capability: ☐ Yes ☐ No ☐ Don't know

16. Corrugated hose attachment: _____

17. Condition of waist belt: _____

18. Condition of chest strap: _____

19. Condition of shoulder straps: _____
20. Condition of cylinder band: _____
21. Contents of right pocket: _____
22. Contents of left pocket: _____
23. Items clipped to buoyancy compensator: _____
24. Strap condition: _____
25. Strap properly threaded: ☐ Yes ☐ No ☐ Don't know
26. Photos taken: ☐ Yes ☐ No ☐ Don't know
27. Buoyancy control device function tests:
    - Does BCD hold air? ☐ Yes ☐ No ☐ Don't know
    - Does power inflator function properly? ☐ Yes ☐ No ☐ Don't know
    - Does regulator function work? ☐ Yes ☐ No ☐ Don't know
    - Does overpressure relief work? ☐ Yes ☐ No ☐ Don't know
    - Does overpressure relief (dump) valve work? ☐ Yes ☐ No ☐ Don't know
28. Notes: _____

<u>Diver's Harness</u> ☐ Not present ☐ Not used ☐ N/A

1. General condition: _____
2. Snap hook function: _____
3. Jock strap present? ☐ Yes ☐ No ☐ Don't know
4. Photos taken? ☐ Yes ☐ No ☐ Don't know

<u>Power Inflator</u> ☐ Not present ☐ Not used ☐ N/A

1. General condition: _____
2. Manufacturer: _____
3. Number tie-wraps: _____
4. Serial number: _____
5. Other marks: _____
6. Mouthpiece condition: _____
7. Wraps: _____

Diver's Breathing Gas Manifold ☐ Not present ☐ Not used ☐ N/A

1. Manufacturer: _____
2. Pneumo gauge range: _____
3. Pneumo gauge model: _____
4. Pneumo gauge manufacturer: _____
5. Last calibration of pneumo #1: _____
6. Last calibration of pneumo #2: _____
7. Number of regulators: _____
8. Do regulator adjustments turn freely? ☐ Yes ☐ No ☐ Don't know
9. Do ball valves turn freely? ☐ Yes ☐ No ☐ Don't know
10. Photos taken? ☐ Yes ☐ No ☐ Don't know

Weight belt (refer to BCD if integrated) ☐ Not present ☐ Not used ☐ N/A

1. Type of belt (nylon or rubber): _____
2. Type of buckle: _____
3. Type of weights (bullet, block, or soft): _____
4. Number of weights: _____
5. Color of weights: _____
6. Total weight: _____
7. Weight keepers condition: _____
8. Clips & accessories: _____
9. Weight distribution: _____
10. Weight release function: _____
11. Photos taken? ☐ Yes ☐ No ☐ Don't know

Mask ☐ Not present ☐ Not used ☐ N/A

1. Manufacturer: _____
2. Model: _____
3. Color: _____
4. Condition (leaks, cracks, scratches, etc.) _____
5. Purge valve type/condition: _____
6. Strap condition: _____

7. Does mask have prescription lenses? ☐ Yes ☐ No ☐ Don't know

8. Photos taken? ☐ Yes ☐ No ☐ Don't know

Snorkel ☐ Not present ☐ Not used ☐ N/A

1. Manufacturer: _____

2. Model: _____

3. Color: _____

4. Purge valve type/condition: _____

5. Photos taken? ☐ Yes ☐ No ☐ Don't know

Fins ☐ Not present ☐ Not used ☐ N/A

1. Manufacturer: _____

2. Model: _____

3. Size: _____

4. Color: _____

5. General condition: _____

6. Strap condition: _____

7. Photos taken? ☐ Yes ☐ No ☐ Don't know

Umbilical ☐ Not present ☐ Not used ☐ N/A

1. Manufacturer: _____

2. Manufacture date: _____

3. Model number: _____

4. Serial number: _____

5. Color: _____

6. In-service date: _____

7. Condition: _____

8. Company ID marks: _____

9. Length: _____

10. Photos taken? ☐ Yes ☐ No ☐ Don't know

11. Air hose: _____

12. Communication wire: _____

13. Pneumo hose: _____
14. Strength member: _____
15. Hot water hose: _____
16. Topside air hose fitting: _____
17. Diver's end air hose fitting: _____
18. Topside pneumo hose fitting: _____
19. Topside communications: _____
20. Diver's end communications: _____
21. Hot water topside: _____
22. Diver's end hot water: _____
23. D-ring and seizing: _____

Communications System ☐ Not present ☐ Not used ☐ N/A

1. Manufacturer: _____
2. Manufacture date: _____
3. Model #: _____
4. Serial #: _____
5. General condition: _____
6. Does communications system work? ☐ Yes ☐ No ☐ Don't know
7. Photos taken? ☐ Yes ☐ No ☐ Don't know

Dive Computer ☐ Not present ☐ Not used ☐ N/A

1. Manufacturer: _____
2. Model number: _____
3. Serial number: _____
4. Color: _____
5. In-service date: _____
6. Condition: _____
7. Shop ID marks: _____
8. Battery condition: _____
9. Service information: _____
10. Photos taken? ☐ Yes ☐ No ☐ Don't know

11. Readings: _____

Dive#	Date	Time of Day	Depth	Bottom Time	Ascent Rate	Surface Interval Time
Dive #1						
Dive #2						
Dive #3						
Dive #4						
Dive #5						
Dive #6						
Dive #7						
Dive #8						
Dive #9						
Dive #10						

Instrument Console ☐ Not present ☐ Not used ☐ N/A

1. Manufacturer: _____
2. Depth gauge: _____
3. Depth gauge model: _____
4. Depth gauge serial number: _____
5. Max depth indicator reading: _____
6. Range of depth gauge: _____
7. Does gauge read zero? ☐ Yes ☐ No ☐ Don't know
8. General condition: _____
9. Photos taken? ☐ Yes ☐ No ☐ Don't know
10. Compass: _____

Submersible Pressure Gauge ☐ Not present ☐ Not used ☐ N/A

1. Range: _____
2. Manufacturer: _____
3. Serial number: _____
4. Does gauge read zero? ☐ Yes ☐ No ☐ Don't know
5. Condition: _____
6. Photos taken: ☐ Yes ☐ No ☐ Don't know
7. Slate present (for notes)? ☐ Yes ☐ No ☐ Don't know
8. Markings on slate? _____

Maintenance Records ☐ Not present ☐ Not used ☐ N/A

1. Helmet:_____
2. Air compressor: _____
3. Dry suit: _____
4. Bail-out regulator: _____
5. Buoyancy compensator: _____
6. Cylinder: _____
7. Power inflator: _____
8. Dive computer: _____
9. Other:_____

Investigating officer: _____

Date: _____

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Appendix F:
Non-Commercial Diving Investigation Questionnaire

Below are typical interview questions that investigating officers ask masters or crew at the scene of a non-commercial diving casualty investigation. Click the link for an electronically fillable form: http://www.uscg.mil/forcecom/ttp/downloads/Non-Commercial_Diving_Interview_Questions.pdf

INTERVIEW QUESTIONS

1. Case number: _____
2. Date of accident: _____
3. Date of interview: _____
4. Location of accident:_____
5. Vessel name and number: _____

CONTACT INFORMATION

1. Name (first, last): _____
2. Position (check): ☐ Victim ☐ Instructor ☐ Diver ☐ Master ☐ Crew member
3. Title: _____
4. Age: _____
5. Date of birth: _____
6. Driver's license number: _____
7. Home address: _____
8. Home telephone: _____
9. Cell phone: _____
10. Email: _____
11. Employer: _____
12. Business address: _____
13. Business telephone: _____

EXPERIENCE LEVEL

1. Number of years experience as a non-commercial diver: _____

2. What agency did you receive your open water certification from? _____

3. What is your certification number? _____

4. Do you hold an advanced certification (open water, advanced open water, wreck diver, enriched air, etc.)? ☐ Yes ☐ No ☐ Don't know

   If yes, which and when did you receive those qualifications?

   _____

   _____

5. How many dives have you logged (as an open water and any advanced certifications)? _____

   In the last 6 months, what were the depths and purposes of these dives?

   _____

   Were these dives in the day, night, or both?_____

6. Are you a diving instructor? _____

   Through which organization? (i.e., PADI, NAUI, SSI, etc.) _____

   And when?_____

7. How many dives have you supervised? _____

8. Have you dived with the victim before? _____

   If yes, were you both breathing the same or different medium (compressed air, enriched air)? _____

   If yes, how many dives have you conducted together? _____

   If yes, what was the purpose of these dives together (fishing, deep dive, reef, wreck,)?

   _____

RECORDS

1. Do you have maintenance records for your dive equipment? ☐ Yes ☐ No

2. Do you maintain a dive log book? ☐ Yes ☐ No

3. Where are your dive tables? _____
   What agency's tables do you use? _____

4. Do you have a charted location of the diving casualty? ☐ Yes ☐ No

5. Have you filled out a CG-2692 (Report of Marine Accident, Injury or Death)?

6. Did you and your dive partner discuss your diving operation before entering the water (depth, bottom time, emergency procedures?)_____

VICTIM HISTORY

1. How did you first meet the victim? _____

2. Describe the victim's personality?

_____

3. Was the victim physically fit? ☐ Yes ☐ No ☐ Don't know
4. Did the victim require prescription lenses? ☐ Yes ☐ No ☐ Don't know
5. If so, was the victim wearing contacts during the dive?

   ☐ Yes ☐ No ☐ Don't know
6. If so, was the victim wearing a prescription mask during the dive?

   ☐ Yes ☐ No ☐ Don't know
7. Did the victim smoke cigarettes? ☐ Yes ☐ No ☐ Don't know
8. Was there any indication the victim was using prescription drugs or over the counter drugs?

   ☐ Yes ☐ No ☐ Don't know
9. Did you see any sign that the victim used recreational drugs or alcohol at any time before the accident? ☐ Yes ☐ No ☐ Don't know
10. How many dives had you conducted with the victim? _____
11. How many dives of this type have you conducted?_____
12. Did victim have any special relevant education or training?

    ☐ Yes ☐ No ☐ Don't know
13. If yes, describe the training and organization(s): _____
14. Did you review the victim's log book to find out diving experience before the accident?
    ☐ Yes ☐ No
15. Was the victim involved in a previous diving accident? ☐ Yes ☐ No ☐ Don't know
16. Do you have the victim's personal dive log? ☐ Yes ☐ No ☐ Don't know
17. Do you have a work history for the victim, dive team, and vessel crew?

    ☐ Yes ☐ No ☐ Don't know
18. Do you have the victim's medical history and copy of last physical?

    ☐ Yes ☐ No ☐ Don't know

EVIDENCE

1. What type of diving was the victim engaged in?_____
2. What activities preceded the accident on the day that it took place? _____
3. What was the victim's health like before the accident? _____
4. Had the victim made any dives during the 24 hours before the accident?

   ☐ Yes ☐ No ☐ Don't know

If yes, what were the dive profiles for those dives? _____

5. Were photographs or video taken of the victim in gear before the accident or during the dive?
☐ Yes ☐ No

6. How much experience did the victim have with the type of diving being conducted at the time of the accident?_____

7. Did you inspect the victim's gear before his or her entry into the water? ☐ Yes ☐ No

8. Did you do a pre-dive briefing? ☐ Yes ☐ No

9. What was the weather like on the day of the accident? _____

What was the air temperature? _____

What was the water temperature? _____

What was the sea surface like? _____

What was the underwater visibility on the bottom? _____

10. Was the victim's dive recorded on video or audio? ☐ Yes ☐ No

11. When did you first become aware the diver had a problem? _____
_____

12. What made you first aware the diver was having a problem? _____
_____

13. Where was the victim recovered? _____

14. When was the victim recovered? _____

15. What position was the victim in when recovered? _____

16. How was the victim brought to the surface? _____

17. What dive gear was the victim wearing when recovered? _____

18. Did anyone administer CPR, and if yes, who? _____

What time did CPR start? _____

What time did CPR end?_____

Who ordered CPR to end?_____

Did the person who administered the CPR have any documented CPR training?

☐ Yes ☐ No ☐ Don't know

Is CPR training current? ☐ Yes ☐ No ☐ Don't know

19. Was an oxygen kit present? ☐ Yes ☐ No ☐ Don't know

20. Was oxygen administered? ☐ Yes ☐ No ☐ Don't know

21. Was a first aid kit present? ☐ Yes ☐ No ☐ Don't know

22. Was the victim medically evacuated? ☐ Yes ☐ No ☐ Don't know

23. What time was the mayday/911 call made? _____

24. What time did the first rescue agency arrive on scene? _____

25. Did you inspect the victim's equipment after the accident? ☐ Yes ☐ No

If yes, what did you find? _____

26. What happened to the victim's equipment after the accident? _____

_____

27. Were there other witnesses to this accident who are not mentioned in your report?
☐ Yes ☐ No ☐ Don't know

28. Were there any articles about the accident in the newspaper or footage on local TV?
☐ Yes ☐ No ☐ Don't know

29. Did you give any statement to the coroner after the accident? ☐ Yes ☐ No

30. Have you had contact with the victim or family since the accident? ☐ Yes ☐ No

31. Did you make an entry in your logbook regarding this accident? ☐ Yes ☐ No

32. Can you think of anything else important that I should know about this accident?

_____

_____

_____

GEAR INSPECTION

General Information

1. Date of gear inspection:_____

2. Location of gear inspection: _____

3. Parties present during inspection:_____

4. Has gear been washed or cleaned since accident? ☐ Yes ☐ No ☐ Don't know

Complete System

1. Is cylinder band tight? ☐ Yes ☐ No ☐ Don't know

2. Is cylinder band at appropriate height? ☐ Yes ☐ No ☐ Don't know

3. Is regulator oriented properly? ☐ Yes ☐ No ☐ Don't know

4. Is buoyancy control device inflated? ☐ Yes ☐ No ☐ Don't know

Tank ☐ Not present ☐ Not used ☐ N/A

1. Manufacturer: _____

2. Date of manufacture: _____

3. Serial number: _____

4. Type (aluminum or steel): _____

5. Capacity: _____

6. Working pressure: _____

7. Type of medium (compressed air, enriched air): _____

If enriched air, percentage of enriched air mixture: _____

Did victim verify percentage of enriched air? ☐ Yes ☐ No ☐ Don't know

8. Color of tank: _____

9. Other marks: _____

10. Hydro test dates: _____

11. Last internal inspection of tank: _____

12. Pressure in tank: _____

13. Facility that filled tank: _____

14. General condition: _____

15. Boot: _____

16. Photos taken? ☐ Yes ☐ No ☐ Don't know

Tank Valve ☐ Not present ☐ Not used ☐ N/A

1. Manufacturer: _____

2. Serial number: _____

3. Type of valve (K, J, or DIN valve): _____

4. Condition of valve: _____

5. O-ring condition: _____

6. Operation of valve: _____

7. Number of revolutions to fully open valve: _____

8. Number of revolutions to fully close valve: _____

9. Is there any visible corrosion on the filter screen? ☐ Yes ☐ No ☐ Don't know

10. Photos taken? ☐ Yes ☐ No ☐ Don't know

11. Other marks: _____

Air Compressor ☐ Not present ☐ Not used ☐ N/A

1. Manufacturer: _____

2. Date of manufacture: _____
3. Model #: _____
4. Serial number: _____
5. Volume of tank: _____
6. Operation of air compressor: _____
7. Location of air compressor during accident: _____
8. Type of valve: _____
9. Condition of valves: _____
10. Operation of valves: _____
11. Belt condition: _____
12. Fuel tank: _____
13. Oil level compression: _____
14. Oil level drive: _____
15. Photos taken of air compressor, valves, or oil level? ☐ Yes ☐ No ☐ Don't know
16. Where are the inspection records for air compressor? _____
17. Any other marks on compressor? ☐ Yes ☐ No ☐ Don't know

Dry Suit Inspection ☐ Not present ☐ Not used ☐ N/A

1. Manufacturer: _____
2. Date of manufacture: _____
3. Model #: _____
4. Serial number: _____
5. In-service date: _____
6. Size: _____
7. Color: _____
8. Condition: _____
9. Type of suit: _____
10. Zipper manufacturer/condition: _____
11. Inflator valve manufacturer/condition: _____
12. Exhaust valve manufacturer/condition: _____
13. Hood type/condition (hood with bib or hooded vests): _____
14. Zipper condition/function: _____

15. Wrist seals type/condition: _____

16. Neck seal type/condition: _____

17. Yoke type/condition: _____

18. Boot type/condition: _____

19. Inflator hose: _____

20. Contents of right pocket: _____

21. Contests of left pocket: _____

22. Does suit leak? ☐ Yes ☐ No ☐ Don't know

23. Photos taken of dry suit? ☐ Yes ☐ No ☐ Don't know

Wet Suit ☐ Not present ☐ Not used ☐ N/A

1. Manufacturer: _____

2. Date of manufacture: _____

3. Model #: _____

4. Serial number: _____

5. Color(s): _____

6. Style: _____

7. Size: _____

8. Thickness (3mm, 5mm, 7mm): _____

9. Hood type/condition:(hood with bib or hooded vests): _____

10. General condition: _____

11. Jacket zip condition: _____

12. FJ zipper condition: _____

13. Beaver tail closure: _____

14. Closure condition: _____

15. Comments: _____

16. Photos taken? ☐ Yes ☐ No ☐ Don't know

Regulator Assembly ☐ Not present ☐ Not used ☐ N/A

1. Manufacturer: _____

2. Date of manufacture: _____

3. Model #: _____

4. In-service date: _____

5. First stage

Serial number: _____

Condition: _____

Filter condition: _____

Environmental cap: _____

Color: _____

Relief valve: _____

Pressure gauge: _____

Tank pressure: _____

Shop ID marks: _____

Photos taken? ☐ Yes ☐ No ☐ Don't know

6. Primary second stage

Manufacturer: _____

Model: _____

Serial number: _____

Color & shop ID marks: _____

Condition: _____

Condition of mouthpiece: _____

Condition tie-wrap: _____

Position of the breath demand sensitivity selector, if equipped _____

7. Octopus second stage

Manufacturer: _____

Model: _____

Serial number: _____

Color: _____

Shop ID marks: _____

Condition: _____

Condition mouthpiece lugs: _____

Condition tie-wrap: _____

Position of the breath demand sensitivity selector, if equipped: _____

Photos taken? ☐ Yes ☐ No ☐ Don't know

8. Inflator hose

For BC, what is condition? _____

For dry suit, what is condition? _____

9. Are there any other devices included in pressure gauge console (depth, computer, etc.)?

_____

10. Photos taken of:

Primary second stage: ☐ Yes ☐ No ☐ Don't know

Octopus second stage: ☐ Yes ☐ No ☐ Don't know

Inflator hose: ☐ Yes ☐ No ☐ Don't know

High pressure hose for pressure gauge: ☐ Yes ☐ No ☐ Don't know

<u>Bail Out Cylinder (or pony bottle)</u> ☐ Not present ☐ Not used ☐ N/A

1. Manufacturer: _____
2. Date of manufacture: _____
3. Serial number: _____
4. Type (aluminum, steel, etc): _____
5. Capacity: _____
6. Working pressure: _____
7. Number of revolutions to open/close tank valve: _____
8. Other marks: _____
9. Hydrostatic test dates: _____
10. Internal visual inspection history: _____
11. Pressure in tank: _____
12. General condition: _____
13. Boot: _____
14. Photos taken? ☐ Yes ☐ No ☐ Don't know

<u>Cylinder Valve</u> ☐ Not present ☐ Not used ☐ N/A

1. Manufacturer: _____
2. Type of valve (K, J, or DIN valve): _____
3. O-ring condition: _____

4. Operation of valve: _____
5. Photos taken: _____
6. Number of turns to fully open: _____
7. Serial number: _____
8. Photos taken? ☐ Yes ☐ No ☐ Don't know

Buoyancy Control Device ☐ Not present ☐ Not used ☐ N/A

1. Manufacturer: _____
2. Model name: _____
3. Serial number: _____
4. In-service date: _____
5. Bladder type (jacket style or back inflation): _____
6. Is buoyancy compensator bladderless? _____
7. Were any repairs made to the BCD? _____
8. Last service date for BCD? _____
9. Did BCD have weights incorporated (integral)? _____
10. How much weight was in jettison compartments? _____
11. How much weight was in non-jettison compartment (usually located on back of BCD)? _____
12. Condition: _____
13. Size:_____
14. Color: _____
15. Other marks: _____
16. Photos taken: _____
17. Lift capability: _____
18. Corrugated hose attachment: _____
19. Condition of waist belt: _____
20. Condition of chest strap: _____
21. Condition of shoulder straps: _____
22. Condition of cylinder band: _____
23. Contents of right pocket: _____
24. Contents of left pocket: _____

25. Items clipped to buoyancy compensator: _____

26. Strap condition: _____

27. Strap properly threaded: _____

28. Photos taken? ☐ Yes ☐ No ☐ Don't know

29. Buoyancy control device function tests:

    Does BCD hold air? ☐ Yes ☐ No ☐ Don't know

    Does power inflator function properly? ☐ Yes ☐ No ☐ Don't know

    Does manual inflator function properly? ☐ Yes ☐ No ☐ Don't know

    Does overpressure relief work? ☐ Yes ☐ No ☐ Don't know

    Does overpressure relief (dump) valve work? ☐ Yes ☐ No ☐ Don't know

30. Notes:_____

<u>Diver's Harness</u> ☐ Not present ☐ Not used ☐ N/A

1. General condition: _____

2. Snap hook function: _____

3. Jock strap present? ☐ Yes ☐ No ☐ Don't know

4. Photos taken? ☐ Yes ☐ No ☐ Don't know

<u>Power Inflator</u> ☐ Not present ☐ Not used ☐ N/A

1. General condition: _____

2. Manufacturer: _____

3. Number tie-wraps:_____

4. Serial number: _____

5. Other marks: _____

6. Mouthpiece condition: _____

7. Wraps: _____

8. Photos taken? ☐ Yes ☐ No ☐ Don't know

<u>Weight belt (refer to BCD if integrated)</u> ☐ Not present ☐ Not used ☐ N/A

1. Type of belt (nylon or rubber): _____

2. Type of buckle: _____

3. Type of weights (bullet, block, or soft): _____
4. Number of weights: _____
5. Color of weights: _____
6. Total weight: _____
7. Weight keepers condition:_____
8. Clips & accessories: _____
9. Weight distribution:_____
10. Weight release function:_____
11. Photos taken? ☐ Yes ☐ No ☐ Don't know

Mask, Snorkel, and Fins

Mask ☐ Not present ☐ Not used ☐ N/A

1. Manufacturer: _____
2. Model: _____
3. Color: _____
4. Condition (leaks, cracks, scratches, etc): _____
5. Purge valve type/condition: _____
6. Strap condition: _____
7. Does mask have prescription lenses? ☐ Yes ☐ No ☐ Don't know
8. Photos taken? ☐ Yes ☐ No ☐ Don't know

Snorkel ☐ Not present ☐ Not used ☐ N/A

1. Manufacturer: _____
2. Model: _____
3. Color: _____
4. Purge valve type/condition: _____
5. Photos taken? ☐ Yes ☐ No ☐ Don't know

Fins ☐ Not present ☐ Not used ☐ N/A

1. Manufacturer: _____
2. Model: _____

3. Size: _____

4. Color: _____

5. General condition: _____

6. Strap condition: _____

7. Photos taken? ☐ Yes ☐ No ☐ Don't know

Breathing Umbilical (if divers using hookah rig) ☐ Not present ☐ Not used ☐ N/A

1. Manufacturer: _____

2. Manufacture date: _____

3. Model number: _____

4. Serial number: _____

5. Color: _____

6. In-service date: _____

7. Condition: _____

8. Length: _____

9. Photos taken? ☐ Yes ☐ No ☐ Don't know

10. Air hose: _____

11. Follow regulator assembly checklist (above) when looking at hookah rig regulator that is affixed to air hose.

Communications System ☐ Not present ☐ Not used ☐ N/A

1. Manufacturer: _____

2. Manufacture date: _____

3. Model #: _____

4. Serial #: _____

5. General condition: _____

6. Does communications system work? ☐ Yes ☐ No ☐ Don't know

7. Photos taken? ☐ Yes ☐ No ☐ Don't know

Dive Computer ☐ Not present ☐ Not used ☐ N/A

1. Manufacturer: _____

2. Model number: _____

3. Serial number: _____

4. Color: _____

5. In-service date: _____

6. Condition: _____

7. Shop ID marks: _____

8. Battery condition: _____

9. Service information: _____

10. Photos taken? ☐ Yes ☐ No ☐ Don't know

11. Readings

Dive#	Date	Time of Day	Depth	Bottom Time	Ascent Rate	Surface Interval Time
Dive #1						
Dive #2						
Dive #3						
Dive #4						
Dive #5						
Dive #6						
Dive #7						
Dive #8						
Dive #9						
Dive #10						

Instrument Console ☐ Not present ☐ Not used ☐ N/A

1. Manufacturer: _____
2. Depth gauge: _____
3. Depth gauge model: _____
4. Depth gauge serial number: _____
5. Max depth indicator reading: _____
6. Range of depth gauge: _____
7. Does gauge read zero? ☐ Yes ☐ No ☐ Don't know
8. General condition: _____
9. Photos taken? ☐ Yes ☐ No ☐ Don't know
10. Compass: _____

Submersible Pressure Gauge ☐ Not present ☐ Not used ☐ N/A

1. Range: _____
2. Manufacturer: _____
3. Serial number: _____
4. Does gauge read zero? ☐ Yes ☐ No ☐ Don't know
5. Condition: _____
6. Photos taken: ☐ Yes ☐ No ☐ Don't know
7. Slate present (for notes)? ☐ Yes ☐ No ☐ Don't know
8. Markings on slate? _____

Maintenance Records ☐ Not present ☐ Not used ☐ N/A

1. Helmet: _____
2. Air compressor: _____
3. Dry suit: _____
4. Bail-out regulator: _____
5. Buoyancy compensator: _____
6. Cylinder: _____
7. Power inflator: _____
8. Dive computer:_____

9. Other: _____

Investigating officer: _____

Date: _____

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Appendix G:
Diving Requirements Quick Reference

COMMERCIAL DIVING PERSONNEL			
Requirement	**OSHA Regulation**	**USCG Regulation**	**Comments**
Dive team members must be qualified to conduct assigned tasks.	29 CFR 1910.410 (a) 29 CFR 1910.120	46 CFR 197.404 46 CFR 197.410	There is not a “commercial diver certification card” similar to those required by the recreational diving community. The Association of Diving Contractors International offers a certification card or the company can provide proof of experience. Divers provide proof of hazardous waste operations and emergency response (HAZWOPER) training before commencing diving operations in contaminated water.
All dive team members must have current cardiopulmonary resuscitation (CPR) and first-aid certifications.	29 CFR 1910.410		
For surface-supplied and scuba operations, a qualified three-person dive team, consisting of a person-in-charge, dive tender, and line-tended diver, is required.	29 CFR 1910.410 (b)	46 CFR 197.432	The three-person dive team is an OSHA regulation and an accepted industry practice by the Association of Diving Contractors International. The Coast Guard requires a three-member dive team for Coast Guard contracts (ALDIST 228, 1999). The diving supervisor must not serve in a dual role as both supervisor and diver. A standby diver, when required, must be dressed out and ready to dive.
An experienced, designated person-in-charge is on-scene and supervising the operation.	29 CFR 1910.410 (c)	46 CFR 197.208 46 CFR 197.210 46 CFR 197.402 46 CFR 197.404	Under the OSHA regulations, the person-in-charge is the qualified diving supervisor. When diving operations occur on an inspected vessel, under USCG regulations, the person-in-charge (the owner, agent, or master of the vessel) and the diving supervisor are separate individuals; both must be designated in writing.

COMMERCIAL DIVING OPERATIONS			
Requirement	**OSHA Regulation**	**USCG Regulation**	**Comments**
A safe practices manual or operations manual must be available on-site. Note: During salvage operations, do not use welding and burning equipment to open tanks without first assessing contents and explosion risks associated with these types of operations.	29 CFR 1910.410	46 CFR 197.420	OSHA regulations require a safe practices manual that describes the diving activities, while USCG regulations require an operations manual that meets the requirements of the safe practices manual. This is the site-safety plan. In particular, response personnel review emergency procedures, emergency phone numbers, and the directions to the nearest decompression chamber and hospital. For contaminated water diving, a more specific safety plan that addresses the specific contaminant and protective equipment must be available.
The divers must have a plan to obtain emergency assistance, specifically, a two-way communications system.	29 CFR 1910.421(b)	46 CFR 197.420 46 CFR 197.314 (b)	If a decompression chamber is not required on site, ensure that the divers know the location and contact numbers of the nearest facility and hospital. Most importantly, the divers must have the capability to reach emergency services.
First aid equipment, including a handheld resuscitator, must be located on site.	29 CFR 1910.421(c) 29 CFR 1910.423	46 CFR 197.314 46 CFR 197.432	For dives deeper than 100-fsw (feet sea water) or dives outside the no-decompression limits, an operating decompression chamber and supply of breathing gas sufficient to treat for decompression sickness must be located on-site. The chamber must be within 5 minutes of the dive station. Apply the more conservative OSHA limitation of 100-ft depth.
The diving supervisor must conduct a pre-dive safety briefing and inspect equipment.	29 CFR 1910.421(f)	46 CFR 197.410	All members of the dive team must attend. Key personnel of the ship or facility also attend.
A warning signal (dive flag) must be displayed.	29 CFR 1910.421(h)	COLREGS, Rule 27	The warning signal must be a rigid replica of the international code “A” flag at least 1 meter in height.
The person-in-charge and the diving supervisor must maintain a dive log.	29 CFR 1910.440	46 CFR 197.480	The log contains the date, time, and location of the start and completion of dive operations; underwater and surface conditions; name of diving supervisor; and general nature of the work performed.

COMMERCIAL DIVING EQUIPMENT			
Requirement	**OSHA Regulation**	**USCG Regulation**	**Comments**
Air compressors used to supply air to the diver must be equipped with a volume tank with a check valve on the inlet side, a pressure gauge, a relief valve, and a drain valve.	29 CFR 1910.430 (b)	46 CFR 197.310	
Air intakes for air compressors must be located away from areas containing exhaust fumes or other hazardous materials.	29 CFR 1910.420 (b)	46 CFR 197.310 (b)	
The output of the air compressor systems must be tested for air purity every six 6 months and after every repair or modification. An analysis certificate stating the serial number of the compressor and the results of the air test must be available at the dive location.	29 CFR 1910.420 (b)	46 CFR 197.450 46 CFR 197.340	The diving supervisor must provide laboratory results or maintenance records for air quality. Compare the compressor identification number with that noted on the laboratory results or maintenance records. Compressed air used for breathing mixtures must be 20 to 22 percent oxygen by volume, have no objectionable odor, and have no more than 1000 ppm (particles per million) carbon dioxide, 20 ppm carbon monoxide, 5 mg/cubic meter of solid and liquid particulates including oil, and 25 ppm hydrocarbons.
Surface-supplied helmets and masks must have a non-return valve, an exhaust valve, and a two-way voice communications system.	29 CFR 1910.430 (h)	46 CFR 197.322 (a)	
Breathing gas supply hoses must have a working pressure at least equal to the working pressure of the total breathing system, have a bursting pressure at least equal to four times the working pressure, and be tested at least annually to one and one-half (1.5) times their working pressure.	29 CFR 1910.430 (c)	46 CFR 197.312	Ensure the breathing supply line has been pressure tested to one and one-half (1.5) MAWP within the past year. Additionally, ensure all connectors are made of corrosion-resistant material and the umbilical is marked in 10-foot increments from the diver to 100 fsw and is constructed of kink-resistant material.
A depth gauge is required for every diver.	29 CFR 1910.430 (g)	46 CFR 197.318	OSHA and USCG regulations require a depth gauge that can be read on the surface for surface-supplied divers. Additionally, OSHA requires a depth gauge that can be read by the scuba diver.
A diving ladder or stage must be provided to assist entry and exit.	29 CFR 1910.425	46 CFR 197.320 46 CFR 197.432	When using heavy gear in depths greater than 100 fsw, an in-water stage must be provided.
A diver's safety harness, with a positive buckling device capable of distributing the pulling force of the umbilical, is required for surface-supplied divers.	29 CFR 1910.420 (j)	46 CFR 197.324	
When divers wear weights, the belt or assembly must have a quick release.	29 CFR 1910.430 (j)		
Decompression chambers, or "pressure vessels for human occupancy (PVHO)," must be properly equipped and maintained. 1. PVHO must be stamped ASME PVHO-1 or have documentation of USCG approval. 2. PVHO piping must have a shut-off valve within 1 foot of every pressure boundary penetration. 3. The PVHO must have (a) a pressure relief device, (b) two-way communications between compartments and to the outside, (c) a pressure gauge in each compartment, (d) view ports, (e) enough illumination to allow occupants to read gauges, (f) a means of extinguishing an interior fire, and (g) a means of overriding interior breathing and pressure-supply controls.	29 CFR 1910.430 (f)	46 CFR 197.328 46 CFR 197.462	Records must show that the chamber has been examined for mechanical damage or deterioration on an annual basis. Additionally, the pressure vessel and associated piping must be pressure tested every 3 years.

SCUBA DIVING OPERATIONS			
Requirement	**OSHA Regulation**	**USCG Regulation**	**Comments**
Scuba diving must be conducted in depths less than 130 fsw, within the no-decompression limits, and in currents less than 1 knot.	29 CFR 1910.424 (b)	46 CFR 197.430 (a)	OSHA regulations require an operating decompression chamber on-site when diving greater than 100 fsw or outside the no-decompression limits. Scuba diving is not appropriate where there is a risk of oil or toxic chemical ingestion. The NOAA Diving Manual states, “Standard scuba gear offers inadequate protection to divers operating in contaminated water environments” (NOAA, 1991).
A standby diver is available while the scuba diver is in the water.	29 CFR 1910.424 (c)	46 CFR 197.430 (c)	
The scuba diver must be either line-tended or accompanied by another diver with continuous visual contact.	29 CFR 1910.424 (c)	46 CFR 197.430 (d)	
If the scuba diver must work in a physically confining space, another diver must line-tend the diver from the underwater point of entry.	29 CFR 1910.424 (c)	46 CFR 197.430 (e)	During salvage operations and underwater oil recovery operations, divers must often penetrate the hull to conduct damage assessments, connect equipment, and recover floating oil.
Scuba divers must carry a reserve breathing gas supply.	29 CFR 1910.424 (c)		

SURFACE-SUPPLIED DIVING OPERATION			
Requirement	**OSHA Regulation**	**USCG Regulation**	**Comments**
Surface-supplied air diving must be conducted at a depth of 190 fsw or less.	29 CFR 1910.425 (b)	46 CFR 197.432	Dives of 30 minutes or less can be conducted to depths of 220 fsw.
Mixed-gas must be used as a breathing mixture for dives deeper than 220 fsw.	29 CFR 1910.426	46 CFR 197.434	A separate dive team member must tend each diver in the water.
An open bell (Class II) is required for dives deeper than 220 fsw or when the dive involves in-water decompression times greater than 120 minutes.	29 CFR 1910.426 (b)	46 CFE 197.434 (c)	
Surface-supplied air diving must be conducted at a depth of 190 fsw or less.	29 CFR 1910.425 (b)	46 CFR 197.432	Dives of 30 minutes or less can be conducted to depths of 220 fsw.
Mixed-gas must be used as a breathing mixture for dives deeper than 220 fsw.	29 CFR 1910.426	46 CFR 197.434	A separate dive team member must tend each diver in the water.
An open bell (Class II) is required for dives deeper than 220 fsw or when the dive involves in-water decompression times greater than 120 minutes.	29 CFR 1910.426 (b)	46 CFE 197.434 (c)	
A closed bell (Class I) is required for dives greater than 300 fsw.	29 CFR 1910.426 (b)	46 CFR 197.434 (d)	The regulations permit an exception to this rule when diving is conducted in a physically confining space. When closed bell operations are conducted, a diver must be available in the closed bell to assist the diver in the water.
Each diver must be continuously tended.	29 CFR 1910.425 (c)	46 CFR 197.432 (c)	
Divers must carry a reserve breathing gas supply at depths greater than 100 fsw or outside the no-decompression limits.	29 CFR 1910.425 (c) (4) (iii)	46 CFR 197.432 (e)	Note: Coast Guard regulations require a secondary (reserve) breathing gas supply at depths greater than 130 fsw or outside the no-decompression limits. However, the Coast Guard (decision March 5, 2001) and the ADCI recommend that bailout bottles be used for all commercial diving operations, regardless of depth.
An operating decompression chamber must be on-site for any dive outside the no-decompression limits, mixed-gas diving, or for dives deeper than 100 fsw.	29 CFR 1910.425 (b)	46 CFR 197.432 (e) (2)	Note: Coast Guard regulations require a decompression chamber on-site for dive operations greater than 130 fsw or outside the no-decompression limits. Apply the more conservative OSHA limitation of 100 fsw.
When saturation diving is conducted (1) a standby diver must be available when the closed bell leaves the dive location until the divers are in saturation, and (2) a member of the dive team must be able to assist in the recovery of the closed bell or its occupants.	20 CFR 1910.426	46 CFR 197.434 (g)	

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Appendix H:
Contaminated Water Diving

Action	**Sources**	**Comments**
Conduct a hazard evaluation: (a) If contaminant is unknown, conduct a sampling study before diving. (b) Determine degree and extent of contamination. (c) Determine duration of potential exposure to the contaminant. (d) Determine environmental exposure due to geographic location (thermal conditions, depth, current speed, and weather forecast). (e) Establish three zones of contamination based on a sampling study: i. Support or cold zone ii. Contamination reduction zone (CRZ) iii. Exclusion or hot zone	ADC, NOAA, EPA, OSHA	Do not permit diving operations until the pollutant has been characterized and a hazard evaluation is complete. Standard scuba gear does not provide adequate protection in contaminated water environments. Cease diving operations if there is any suspected breach in the watertight integrity of the surface-supplied diving system.
Place commercial divers and topside personnel that could be potentially exposed on an approved medical monitoring program.	OSHA, NOAA, EPA	The medical monitoring program must include a baseline examination and annual physical examinations.
Assign a site safety officer and prepare a site-specific safety plan.	OSHA, EPA	

Action	Sources	Comments
Choose and test commercial diving equipment that prevents contact with contaminated water: (a) Every piece of diving equipment, including umbilical and connectors, must be compatible with the contaminants. (b) Diving system materials must be of matching durability. (c) Conduct a diving system leak test before diving. (d) Consider using a positive pressure diving system to limit exposure. (e) Review diving equipment durability, material permeation rate, and potential breakthrough time. Note: Personal protective equipment is only as strong as its weakest point. Evaluate, inspect, and test diving suit seam construction, potential breach points, and exhaust valves or through-suit penetrations. Though there are no specific regulatory standards for the construction of contaminated water diving equipment, manufacturers use the National Fire Protection Association (NFPA) Standard for Vapor Protective Suits for Hazardous Chemical Emergencies and the American Society for Testing and Materials (ASTM) Standard Guide for Chemicals to Evaluate Protective Clothing Materials to develop test formats.	NOAA, EPA, ADC, OSHA	Scuba diving gear and band-masks are not recommended. NOAA recommends using the "suit-under-suit" concept or the traditional surface-supplied helmet diving system with encapsulated diving suit. The ADC and EPA recommend a helmeted surface-supplied diver with a return-line exhaust system and a mating dry suit with attached boots and gloves. Equipment used in contaminated water must be maintained, repaired, and replaced more frequently than equipment used in unpolluted environments. Air compressors must be located in a clean atmosphere, or divers must use bottled breathing gas compressed in a clean atmosphere.
Ensure that divers and topside personnel are trained to conduct contaminated water diving. Specifically, diving personnel must have the following training or experience: (a) Decontamination procedures. (b) Dry suit diving (donning/doffing and emergency procedures). (c) Leak testing procedures. (d) Maintenance, repair, and proper use of contaminated water diving systems. (e) Sampling procedures. (f)) Emergency procedures. (g) HAZWOPER training (plus annual refresher).	ADC, OSHA, EPA	Base training on the duties and function to be performed by each member of the contaminated water diving team, surface support personnel, and decontamination teams.

Action	Sources	Comments
Backup team or standby divers must be equipped and trained to the same standard as the entry team.	EPA, OSHA, ADC	The backup or standby diver must have equipment that equals or exceeds that of the diver in the water. If the diving mode is surface- supplied, the standby diver's hose must be at least 50 feet longer than that of the diver in the water.
Trained responders must setup and operate a decontamination system. (a) Procedures must be in place to remove the specific contaminant from the surface of the diver, diving system, equipment, the environment, and property. (b) There must be a system in place to measure the effectiveness of the decontamination procedures.	OSHA, ADC, NOAA, EPA	The majority of hazardous materials response injuries are caused by improper decontamination procedures.
The incident commander reviews and approves a disposal plan for contaminated equipment and decontamination wastes.	OSHA, EPA	Contain and properly dispose of wastes per Federal, state, and local regulations.
Maintain comprehensive records: (a) Medical surveillance records. (b) A detailed description of exposures to hazardous substances. (c) Complaints following exposures to hazardous substances. (d) Training records. (e) A complete log of response actions. (f) Equipment maintenance records.	NOAA, OSHA, ADC, USCG	

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