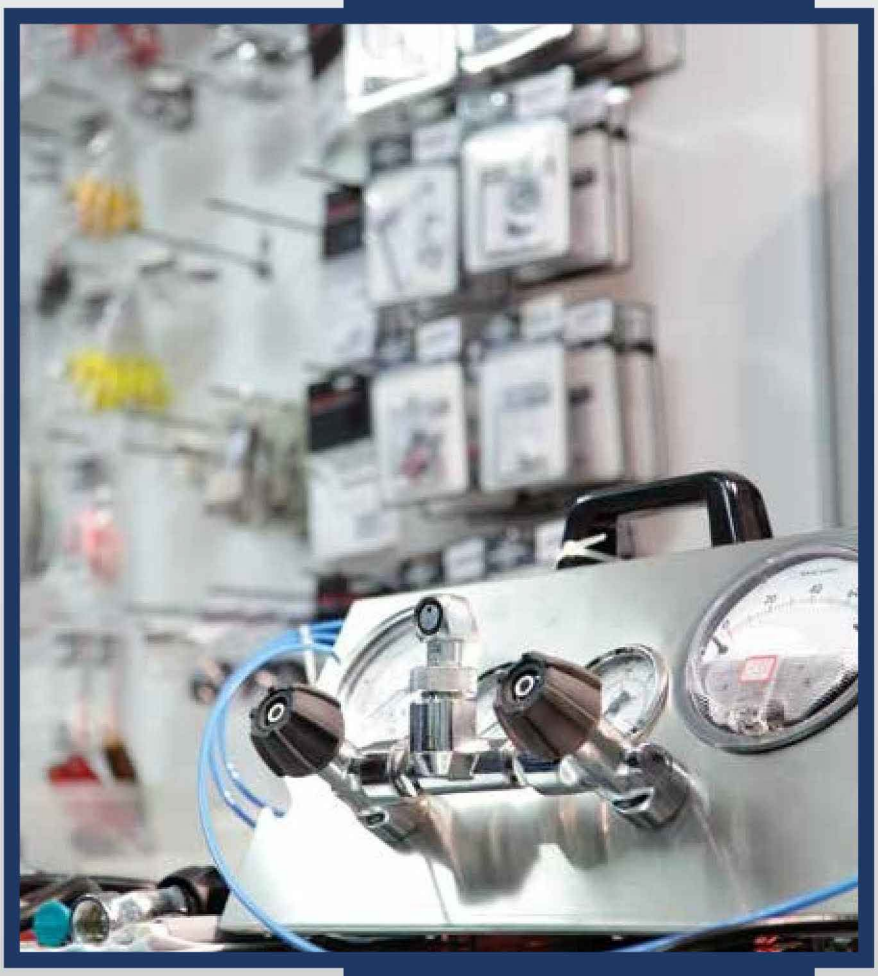
DAN

RISK ASSESSMENT GUIDE

For Dive Operators and Dive Professionals



Divers Alert Network®
2nd Edition

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RISK ASSESSMENT GUIDE FOR DIVE OPERATORS AND PROFESSIONALS

Second Edition

Author

François Burman, IntPE, MSc

Director of Diving and Hyperbaric Safety, Divers Alert Network

Contributors

Morne Christou

Akiko Kojima, BA

John Lippmann, PhD

Jack Meintjes, MD

Matias Nochetto, MD

Cecilia Roberts, MD

Guy Thomas, DMT

Co-Editors

Frans Cronjé, MD

Sheryl Shea, RN

Endorsed for practical application by

DAN

DAN Europe

DAN Japan

DAN Southern Africa

DAN World

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Foreword

The single most effective way to reduce dive injuries is to build a strong and abiding culture of safety in diving. For the last 40 years DAN has led the movement to promote diver well-being, actively campaigning industry stakeholders and engaging communities around the world to advance safe practices. But we cannot do it alone — creating a culture of safety must be a top priority for all in the industry. A “we’ve always done it this way” mentality is neither financially nor operationally viable. It is incumbent upon all industry leaders and professionals to communicate and demonstrate that safety is as an integral part of what we do.

I am proud to present this latest guide to risk management in diving; the Risk Assessment Guide for Dive Operators and Professionals is part of our ongoing work to cultivate a culture of safety in diving. Adapted from best practices in aviation, medicine and manufacturing, the recommendations in this guide meet the unique needs of those who teach divers and operate dive businesses. This guide is designed to assist managers, business owners, dive leaders and all staff identify hazards before they lead to injuries or losses. Focusing on realistic and practical assessments of risks, the guide provides vital information for proactively addressing risks and reducing the severity of incidents.

We encourage you to adopt a culture-of-safety mentality and join DAN in working toward our vision of making every dive accident- and injury-free.

William Ziefle

President and CEO, Divers Alert Network

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Disclaimer:

While this document has been compiled to take account of both local regulations and current international safety guidelines, no responsibility can be assumed by the author, contributors, or publisher for injuries or damage of any nature whatsoever, due to failure, negligence, or the application of any recommendations or ideas contained in this guide.

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Introduction

General overview

This guide covers the assessment of risks related to dive operations, including giving instruction, leading dives or dive excursions, and handling all associated supportive activities.

It is based on key international publications, as well as the combined experience of respected members of the international diving community.

It comprises a list of recommendations that are intended to assure a minimum acceptable level of safety for scuba diving activities.

A glossary on page 111 defines certain terms as they are used in this guide, and a list of abbreviations used in the guide begins on page 113.

Scope of this guide

This hazard identification and risk assessment (HIRA) safety initiative has been specifically developed for dive operators, dive professionals, and all associated services that serve recreational divers.

The scope of the guide includes the technical, operational, and administrative aspects of facilities used to support related diving activities.

Purpose of this guide

The purpose of this guide is to provide a dive operator, dive professional, or dive safety officer (DSO) with a means of assessing whether a dive operation and associated activities comply with minimum safety recommendations for scuba diving.

It can be used as a safety guide to:

- plan for and establish a new dive operation;
- assess the safety level of an established operation; and/or
- provide guidance for any changes to an existing operation.

This guide is intended to be both informative and instructive.

The informative component includes the nature of typical hazards, together with descriptions of actual or likely risks that need to be assessed within associated areas of concern. This provides a framework for further safety assessments and external reviews.

The instructive component includes guidance and recommendations for mitigating the risks and enhancing the safety of a facility. This also provides for ongoing improvement of certain operational aspects of a dive operation, as well as suggestions for possible future safety-based improvements to a facility.

Basis for this guide

The basis for compiling this guide is a thorough analysis of the risks that are inherent to:

- administrative and managerial processes;
- retail and training activities;
- diving activities;
- the provision of appropriate breathing gases;
- the operation of transport vehicles;
- the operation of boats and dive vessels;
- the provision, utilization, servicing, and repair of diving equipment;
- responses to and management of emergencies; and
- the health and safety of staff and the public.

Each potential hazard has been considered in the light of actual, quantifiable risks, and minimum recommendations are offered that could mitigate, remove, or acceptably contain potentially hazardous situations.

Hazards, risks, and mitigation steps can all be located within national statutes or regulations, relevant industry safety standards, and accepted scuba diving practices.

Applicable regulations and guidelines

This guide does not supersede the requirements for compliance with any national or regional statutory or regulatory instruments. Any such statutes and regulations take legal precedence over the recommendations suggested in this guide.

Appendix A contains a framework for suggested compliance with country-specific regulatory documents, as applicable. This framework is by no means complete, nor do all countries have regulations in every area within this framework. In addition, some of these regulations may be contained in documents outside of the suggested framework.

It should be noted that the International Labour Organization (ILO), which most countries have agreed to abide by, requires an occupational health and safety (OHS) framework. This organization offers useful information that will assist dive operators in determining country-specific regulations (see http://www.ilo.org).

In addition, various relevant, international, industry-accepted standards and guidelines have been consulted in the compilation of this guide, for use in an assessment of minimum levels of safety.

As the referenced documents may apply to a much wider scope of services and applications than described here, only the issues and risks relevant to dive operations and activities have been considered.

Please note that this guide does not claim to comply either in part or in full with any of the documents contained in Appendix A.

Explanatory notes

The list of risks contained in this guide is by no means representative of all possible risks. These risks identified are based solely on the experience of the author, the contributors, and those identified in the referenced documents, as well as on generally accepted, industry-specific knowledge.

Each operation will present its own unique risk situations, which may be identified prior to, during, or after an assessment process.

A risk is based on these three factors: the (1) *probability* that (2) an *exposure to a hazard* will result in (3) *harmful consequences*. Each of these three conditions need to be present and evaluated before a risk can be identified and quantified.

The greater the probability that an event will occur, the greater the frequency of exposure to a hazard, and the greater the severity of the consequences, the higher the risk.

A determination of the importance or level of a risk should be made during an assessment, in consultation with the applicable people engaged in the activities. Assessors may disagree with representatives of the operation being assessed; however, the final decision rests with the owner or operator, who takes ultimate responsibility for risk mitigation.

The following table describes suggested risk levels (RLs) that are based, as a general rule, on experience and actual events, and considering each of the three factors listed above.

Table 1: Risk Level and Associated Mitigating Requirements

RL	Rating	Description and Associated Requirements
5	Very high	Attention and risk mitigation are critical and must be given highest priority. A potentially dangerous situation may exist, with the possibility of very serious/catastrophic consequences in the event of an incident. The activity should stop immediately and should not recommence until effective mitigation is in place.
4	High	Attention and risk mitigation are required and must be given high priority. A serious situation may exist that could endanger people or equipment or could seriously disrupt or jeopardize the business. Various solutions or actions may mitigate the risk, but they should be recorded in writing.
3	Medium	Attention is required. Eventual exposure to this risk could likely result in an incident. At the very least, outcomes may include business disruption, financial or liability consequences, injuries, or equipment damage. Mitigation should be accomplished within practical time and cost considerations.
2	Low	Attention is recommended for the optimal functioning of the dive operation. Risk mitigation steps already in place should at least be recorded.
1	Very Low	The risk is acceptable. Note should be taken of the risk, but either it has already been suitably mitigated or its impact is of justifiably low significance.

The risk assessment process

The process begins with an assessment of the risks that affect a given operation or activity. Risks need to be identified as applicable or deemed relevant by the person or persons appointed to undertake the assessment.

In preparation for a safety assessment or an external review, this process should be undertaken in writing, especially as it relates to an assessment of actual or likely risks and to compliance or noncompliance with minimum applicable requirements.

This process should also be followed when any change in the dive operation's activities and equipment is anticipated.

Suggested terms used during a safety assessment to indicate where the risk has been mitigated, or where a risk does not apply to the operation, are indicated in the table below. These should indicate the degree to which a business's operations, practices, facilities, equipment, and so on have been mitigated through meeting a given minimum safety standard or the recommendations provided in this guide.

Table 2: Suggested Assessment Terms

Mitigated	Explanation
Yes	Compliant; indicates either full or applicable conformance and risk mitigation.
No	Non-compliant; indicates an unmitigated risk that represents a danger to people or an operation.
F/A	For Action; indicates that a facility has taken note of a risk and that follow-up action will be taken (it remains the responsibility of a facility's operator to ensure that action is taken).
N/A	Not Applicable (or not required); indicates a risk that is not applicable within the scope of a given assessment, operation, or activity.

The outcome of an assessment makes allowance for:

- the divergent scope, type or nature of the dive operation or business;
- any degree of qualified discretion allowed by local authorities; and
- a determination by the assessor or responsible safety officer as to whether a risk is applicable or not.

The basis for the compilation of this guide, described in this introduction, indicates the potential areas of risks for applicable activities of any dive operation. Only the activities actually undertaken by the operator need to be assessed. However, in preparation of possible future activities, this guide may provide guidance as to how to identify potential risks and how to mitigate these through the recommendations provided.

The following 13 major activities typically undertaken by dive operators indicate elements of possible concern. Potential risks are explained together with the likely impact of each (expressed as a RL), and recommendations provided to assist in mitigating these risks.

As dive operations vary greatly in terms of size, types of activities and exposure to the associated risks, the appointed assessor should only focus on relevant activities and elements. The intention is not compliance but rather the overall awareness of areas requiring attention and the means to address these.

RISK ASSESSMENT GUIDE FOR DIVE OPERATORS AND PROFESSIONALS

Potential Risks in Dive Operations

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Staff Health and Safety			
Element	**Risks**	**RL**	**Recommendations**
Legislation	Noncompliance with relevant laws and regulations may result in punitive actions, fines, or even cessation of a dive operation's activities.	3	Employers should have copies of all relevant laws and regulations applicable to the operation available, up to date, and on file.
Health and safety (H&S) policy	Legal as well as health and safety requirements may apply to employed staff, whether they are under contract, permanent, or seasonal. Injuries, illnesses, and outcomes of long-term exposures need to be managed to avoid claims against an employer.	4	Employers should compile written health and safety policies, containing all elements prescribed by law.
Workers' compensation	Depending on the jurisdiction, workers may have the right to expect or claim compensation for any occupational injuries or illnesses sustained at their workplace. Lack of applicable compliance may leave an employer open to compensatory claims.	4	Employers should register their employees with the compensation authorities applicable to the jurisdiction or take out suitable workers' compensation insurance. Care should be taken to include "casual" employees, such as contract and seasonal workers, in such coverage.
Recordkeeping	Lack of personnel records detailing employees' health, qualifications, and job responsibilities render an employer vulnerable to employee-related actions or claims of discrimination or unfair treatment.	4	Employers should maintain records of all staff members' names and other relevant personal details; their training, qualifications, and experience; any relevant medical certifications; and their roles and responsibilities. Documented hiring and appointment policies may help avoid employment-related disputes.
Dive accident insurance	Workers' compensation or comparable insurance may not cover diving-related work activities.	4	All dive personnel should be covered by current and appropriate dive-accident insurance.
		4	Employers should identify hazards to staff members' health and safety in a structured manner and make the information available in writing. The risk associated with each hazard should be formally assessed. Risk-mitigation measures should be adopted and recorded.
H&S representatives	Failure by staff to comply with relevant laws and regulations and the difficulty of managing safety in a workplace, especially where diverse activities are conducted, represent H&S and legal liability risks to an employer.	3	Employers should appoint H&S representatives in accordance with relevant legislation, following standards that are usually dictated by the number of employees.
Occupational hazards	Exposure to known hazards may have detrimental short- and long-term effects on the health of employees.	4	Employers should mitigate workplace exposure to hazards to prevent or reduce occupational health risks.

Staff Health and Safety			
Element	**Risks**	**RL**	**Recommendations**
Occupational hazards (cont.)	(1) Overexposure to the sun's ultraviolet (UV) rays: Short-term risks include sunburn, exhaustion and heat stroke. Long-term risks include skin cancer and damage to the eyes.	4	Employers should adequately protect staff from exposure to excessive UV radiation, including through policies to ensure and enforce that they wear suitable protective clothing and effective sunglasses. Sunscreen is not an effective long-term solution.
	(2) Noise-induced hearing damage: Risks of exposure to noise include short- and long-term injury; loss of hearing; and the inability to function effectively and safely in the workplace. Appendix C provides recommendations for maximum noise levels and the accepted duration of exposure.		Mitigation requires several steps, all of which are important:
		4	• Employers should provide training and education concerning noise and related harmful effects;
		4	• Employers should identify and clearly demarcate noise zones;
		4	• Employers should provide hearing protection for anyone entering noise zones, as applicable; and
		4	• Employers or accountable persons should actively enforce all mitigation steps.
	(3) Unidentified hearing loss: Newly hired employees may have already suffered hearing loss or age-related degradation in their hearing function, and existing employees may develop such loss over time.	3	Employers should require that all employees who work in noise zones (e.g., compressor operators) undergo formal screening by means of audiograms, both at the time of their hiring and at scheduled intervals. Screening should be done in accordance with applicable requirements or standards.
	(4) Exposure to hazardous substances	4	Employers should ensure that if any staff might be exposed to hazardous substances, the risk is identified, mitigated, and adequately managed.
	(5) Skin conditions	4	Employers should ensure that any staff exposed to chemical substances are medically screened for long-term effects on their skin.
	(6) Respiratory conditions	4	Employers should ensure that any staff who could inhale chemical substances are screened by occupational health personnel.
	(7) Exposure to infections or to infectious diseases.		Employers should provide the requisite personal protection equipment (PPE) and proper training in the use thereof, as well as in infection control practices (handwashing, etc.)
	(8) Decompression stress and decompression illness (DCI)	4	Employers should put in place policies to reduce the likelihood of decompression stress and to prevent decompression-related illness among staff (e.g., a diving-free day after a maximum of three days' diving, no heavy lifting or other strenuous activities after diving, etc.).

Staff Health and Safety			
Element	**Risks**	**RL**	**Recommendations**
Occupational hazards (cont.)	(9) Repetitive strain or lifting injuries	4	Employers should conduct periodic ergonomic evaluations, and any employees who are required to lift heavy objects or to lift objects repeatedly (e.g., cylinders) should be educated in proper lifting techniques. Employers should provide appropriate lifting/carrying equipment to avoid the need for staff to carry heavy objects over long distances.
	(10) Overwork, performance pressure, burnout, workplace accidents	4	Employers should monitor staff workloads and workplace dynamics, limit working hours, and enforce rest periods and rest days.
	(11) Dive gear deficiencies: If staff members' personal dive gear is insufficient or in poor condition, it may render them unable to safely carry out their job duties.	3	Employers should establish, at the time of hire, requirements for the provision, maintenance, and appearance of employees' dive gear and should periodically monitor such gear. Gear in constant use may become corroded, worn, unreliable, or unpresentable.
	(12) Failure to fully implement a risk-mitigation plan	4	Employers should put in place a system to monitor whether staff are complying with all OHS mitigation procedures and policies.
	(13) Other risks not listed above	4	Employers should be attentive to the possibility of other risks, as applicable, during any assessment of their facility.
H&S medical surveillance	Employees may experience longer-term health issues that are age-related, related to decompression exposure, or based on pre-existing conditions or that occur outside of the workplace. If employers do not conduct appropriate medical surveillance for such issues, they may be liable for compensation for illnesses that arose outside of the occupational environment.		Employers should ensure that at-risk employees undergo medical surveillance that encompasses the following factors:
		4	• A fitness for work evaluation, including a diving medical examination for diving staff;
		3	• Monitoring of any exposure to hazards; and
		3	• Monitoring for occupational diseases.
Fitness for duty	Employees may present for work in an unfit state, thereby jeopardizing their own health, as well as that of customers. Lack of fitness for duty may include issues such as excessive fatigue, general ill health, substance abuse, excessive use of alcohol, etc.	4	Employers or their delegated representatives should assess each employee's fitness for duty every day, based on the tasks to be performed. Employees unfit for the planned tasks should be either allocated other tasks, sent home to recuperate, or noted for appropriate disciplinary action. Criteria for fitness for duty should be in writing, should include excessive use of alcohol, symptoms of infection, etc. and should be clearly explained to employees prior to or at the time of hire. This should be applied consistently to all employees.

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Customer Health and Safety			
Element	**Risks**	**RL**	**Recommendations**
Customer induction	Incorrect or unrealistic expectations by dive operators and/or customers may lead to illness or injury, as well as contractual disputes.		Dive operators should provide all customers, prior to any diving services being offered and accepted, with full information regarding the following:
		3	• The scope and outcome of any training courses, as applicable;
		4	• The contractual conditions of services for training and/or diving;
		4	• Qualification prerequisites and medical requirements;
		4	• Information requirements and policies regarding retention of personal data;
		3	• Equipment requirements;
		3	• Insurance requirements;
		4	• Local environmental protection requirements (e.g., related to flora, fauna, artifacts, archaeology, geologic formations, etc.);
		4	• Relevant legal and/or regulatory requirements; and
		4	• Relevant costs.
Qualification to dive	Sometimes customers will consider a dive operator's request for information that is essential to ensuring and enhancing customer safety to be invasive, to infringe on their personal information rights, or to be discriminatory. However, allowing customers to undertake diving activities for which they are physically unfit or not qualified may result in the exposure of customers to health risks, the disruption of the dive operation's services, and/or the exposure of the dive operator to liability. Article 11(k) in Appendix I - References and Additional Resources provides additional information and guidance relating to this topic.	4	Dive operators should put in place policies that provide for consistent, systematic, and specific screening of customers, especially those who will engage in higher-risk activities, to ensure appropriate qualifications and preparedness for the type of diving they will undertake. This screening should include, at a minimum:
		4	• Appropriate proof of certification and of the date of the diver's last dive (e.g., a logbook) to assess the diver's level of experience and possible need for a refresher course;
		3	• Pre-existing medical conditions that may disqualify the individual from diving;

Customer Health and Safety			
Element	**Risks**	**RL**	**Recommendations**
Qualification to dive (cont.)		3	• Language comprehension sufficient to ensure the diver's safety, or appropriate access to an interpreter;
		3	• The diver's age;
		2	• The diver's experience level;
		4	• The diver's state of mind (e.g., nervous, insecure, unprepared);
		4	• The availability of suitable equipment;
		4	• The availability of suitable buddy pairs;
		3	• An assessment of the diver's health (unfit-looking divers, especially those who are older, should be observed closely due to the many health-related risks of diving; particular attention should be paid to divers who become breathless, tire, or perspire easily; this assessment can be made by means of a body mass index [BMI] calculation*, possibly in conjunction with a waistline circumference measurement, plus consideration of the individual's general physical condition);
		4	• An assessment of the diver's confidence level (over-confident divers should be identified for extra monitoring, as they are more likely to push their limits); and
		4	• An assessment of the diver's swimming skills, general aquatic skills, comfort, and endurance, in the context of the dive site conditions.
	* BMI is calculated according to either of these formulas: weight in pounds multiplied by 703 and divided by height in inches squared (BMI = lb x 703/in^2) or mass in kilograms divided by height in meters squared (BMI = kg/m^2). This calculation should be done with the customer present. As a guideline, according to the U.S. Department of Health & Human Services classification of people considered to be at elevated risk of disease, the following BMI calculations may be considered as indicative of a need for concern and close observation: (a) A BMI of 30 or above, plus a waistline circumference of greater than 40 in (102 cm) for males and greater than 35 in (88 cm) for females; or (b) A BMI of 35 or above.		

Customer Health and Safety			
Element	**Risks**	**RL**	**Recommendations**
Dive site risk assessment	Dive sites can range from benign to extremely hazardous. Unless all relevant risks have been identified and suitably mitigated, divers may be exposed to significant or unacceptable risks. Site conditions may vary depending on location, tides, currents, waves, weather, water temperature, visibility, the prevalence of hazardous marine life, pollution, debris, and water quality; conditions can even vary within a short period of time, sometimes abating but often becoming more dangerous.	4	Dive operators should establish a policy calling for formal site risk assessments. Clear criteria should be set for when dive sites are not suitable for certain types of divers and/or what to do if certain hazardous conditions are present, based on these factors:
		4	• Prevailing currents and sea/water conditions;
		3	• Expected visibility;
		4	• Entry and exit considerations;
		3	• Other environmental risks (dangerous sea/water life, sharp protrusions, enclosed spaces, depth, pollution, etc.);
		3	• The availability of diving equipment/gear appropriate for each customer;
		5	• The existence of emergency protocols, including communications capabilities, ease of access, ease of evacuation, and availability of appropriate first aid equipment (e.g., a suitable oxygen unit and first-aid supplies);
		5	• The existence of documented and practiced operating and emergency procedures;
		4	• The existence of a plan to rescue/ retrieve an unconscious diver;
		4	• The presence of restricted zones (hazardous, regulated, or sensitive areas, etc.); and
		4	• The presence of any other hazards that are less predictable, such as poor water quality, severe pollution, debris, bad weather, dangerous wave patterns, surface vessels, cables, pipelines, etc.

Customer Health and Safety			
Element	**Risks**	**RL**	**Recommendations**
Health questionnaire	Divers who are medically unfit to dive or who have physical restrictions that may limit their participation, depending on the nature or difficulty of the planned dive, should be identified prior to being accepted for training or diving. The absence of such screening may endanger an unscreened diver's own life, as well as the lives of others. Unless such a policy is applied consistently — without profiling or discrimination and with due regard for divers' personal privacy - the cancellation or restriction of a diver's activities may open a dive operator to a contractual dispute and/or a legal suit for discrimination.	4	Dive operators should establish a policy requiring that all customers complete a confidential, comprehensive health questionnaire prior to being allowed to dive. The World Recreational Scuba Training Council (WRSTC) recommendations specify that any significant abnormalities reported on such a questionnaire should disqualify an individual from participating in diving activities, unless he or she is cleared by a competent medical practitioner, or a local diving medical advisory service. Consideration should be given to any location-specific diseases or the outbreak of infections, using a supplementary form. Ref. http://wrstc.com/downloads Medical Guidelines
Diving medical insurance	Lack of suitable insurance may entail a delay or denial in the delivery of emergency medical treatment to an injured or ill customer. This may in turn result in the customer considering the dive operator responsible for any exacerbation of the injury or illness, leading to possible legal action.	3	Dive operators should obtain from all customers proof of medical insurance that includes coverage for treatment of diving-related injuries and evacuations, as well as for nondiving accidents. Any customers who do not have such medical insurance should be required to obtain dive-accident insurance. Note: Some common travel insurance packages exclude diving activities from coverage; diving coverage should be verified.
Medical insurance information	Lack of immediate access to information concerning a diver's coverage - including communication and authorization requirements and especially the name of the primary insurer - may delay the diver's access to emergency treatment. A diver may be denied reimbursement for treatment unless the stated insurance access and authorization processes are followed, and the dive operator may be held liable for such a coverage denial.		Dive operators should obtain from all customers detailed medical insurance information and record it as part of the registration process. This may include the following:
		3	• Medical insurer (irrespective of whether the insurance has been obtained through DAN membership or another other dive insurance program) and the selected coverage option;
		3	• Insurance policy number(s) and, if applicable, DAN ID number (of the main member on a family policy; and
		3	• Insurer's contact information and procedures to follow to file a claim.

Customer Health and Safety			
Element	**Risks**	**RL**	**Recommendations**
Emergency contact	Lack of emergency contact information for an injured diver may delay treatment decisions, especially in the event of major trauma or loss of consciousness.	3	Dive operators should require all customers to provide contact details for a reliable person who can be contacted in case of an emergency.
Declaration of indemnity form	Dive operators may have claims or legal actions lodged against them if unfortunate, unforeseen, or unavoidable events occur. Such claims may arise from events that: compromise the intended delivery of services; result in the cancellation or withdrawal of permission to dive, whether or not that decision is based on sound reasons; and/or lead to property damage, injury, or even death.	4	Dive operators should require all customers to sign an indemnity form prior to the acceptance and commencement of any offered services. This first level of protection against claims or legal actions lodged against a dive operator should be a carefully developed and operation-specific indemnity form.
Indemnity insurance	Indemnity forms alone do not protect a dive operator or professional from claims for damages. Negligence on the part of an operator, forms that omit coverage for certain kinds of incidents, or ignorance of an issue's potential to cause harm are a few of the factors that may render forms ineffective or insufficient & lead to the need for insurance coverage.	4	Dive operators should hold adequate business, professional, and public liability insurance coverage. This second level of protection includes a series of suitable indemnity insurance products, which extend to damage, loss, or injury experienced by customers, staff, and/or the public at large.
Restricted access to dangerous areas	If customers and other unauthorized persons are not barred from access to hazardous areas such as: cylinder-filling or gas-boosting stations; compressors, generators, and other operating or moving machinery; areas where hazardous substances and flammable materials are stored; boat launch areas; etc, - their H&S may be endangered.	4	Dive operators should ensure that customers, unauthorized staff, and the public do not enter restricted, hazardous areas. Adequate signage and/or physical barriers should be in place, designating such areas as off-limits to unauthorized persons.
Restrictions to or cancellation of diving	Divers' health and safety may be endangered if dive operators fail to carefully consider situations out of their control in which diving privileges should be restricted or cancelled, such as late discovery of disqualifying health or certification deficiencies due to customer nondisclosure; hazardous marine life; bad weather or water conditions; or lack of necessary medical equipment.	4	Dive operators should develop and enforce a written policy to restrict or cancel dives based on specific risks, such as insurance coverage limitations; age restrictions; qualification restrictions; sea state; presence of hazardous marine life; unavailability of oxygen (e.g., if it was used up during a previous dive); etc. Every such incident should be documented and available for audit.

Customer Health and Safety			
Element	**Risks**	**RL**	**Recommendations**
Customer right to cancellation	Customers' health may be compromised if they are exposed to risks that are declared or evident only after they have purchased dive services. E.g., a customer may be concerned by issues that arise after sign-up, such as carbon monoxide (CO) exposure from brush fires or vehicle exhaust, rough sea conditions, or unexpectedly demanding diving. If these issues are not acknowledged by the dive operator, they may lead to anxiety, distraction, fear, and stress.	3	Dive operators should have a written policy allowing customers to cancel or request alternative dives, as appropriate, based on specific identified risks, such as the following: • suspected gas contamination, unless proven otherwise; • lack of experience to participate in a given dive; • unavailability of basic emergency equipment; • suspicion as to the fitness for duty of boating staff, dive instructors, or dive leaders; and/or • circumstances or conditions unforeseen at the time of booking that may be considered by the dive operator as a valid reason for cancellation.
Post-dive planning	Diving is intended to be enjoyable or to achieve a desired objective, but those goals can be compromised if customers fail to adequately plan for the postdive period and undertake ill-advised travel arrangements or over-strenuous activities.	3	Dive operators should discuss customers' planned diving and travel schedules with them. Flying or driving to altitude too soon after a dive, failure to build in off-gas rest days, and other possible risk exposures should be considered, and customers should be advised accordingly.
Access to emergency service providers	Dive operators remain responsible for the health and safety of all their customers (and employees). Remote dive sites introduce the likelihood of restricted access to appropriate medical services and thus the potential for excessive delays in obtaining treatment, possibly jeopardizing the health of an injured person.	4	Dive operators should ensure that appropriate planning has been accomplished to permit the best possible access to appropriate emergency medical services. Due consideration should be given, when planning for dives at remote sites, to lack of transport resources and/or appropriate medical services and to the time needed to transfer injured people to such services.

Staff Training and Certification			
Element	**Risks**	**RL**	**Recommendations**
First-aid training	Some dive operators may experience high staff turnover. Replacement staff may thus not hold suitable first-aid training. Appropriate training may not be available or accessible on short notice.	2	Depending on an operation's size and needs, dive operators should ensure that instructor(s) holding current DAN first-aid training certification (or its equivalent) are available, on site, to provide such training whenever it may be required.
Dive training	The use of instructors or divemasters who are uncertified or whose certification has lapsed, even though they might otherwise be well-qualified & experienced, presents a legal liability risk in the event of an incident that results in injury or illness.	4	Dive operators should ensure that all instructors and divemasters are trained in and hold current certification for the type of diving they offer.
Dive accident management training	If accident management training is limited to only a few staff members, especially if an operation offers multiple dive excursions or training events at the same time, an insufficient number of first responders may be available to handle emergencies when and where needed.	4	Dive operators should be sure that a sufficient number of staff are trained to provide at least a minimum level of medical support (basic first aid and emergency oxygen, or the equivalent), to ensure that one or more staff members are available on site, on all boats, and at all remote diving locations at all times.
Competence	Competence to offer instruction or dive services requires a declaration of competence by the dive operator. Instructor & dive-leader training is available through several agencies. Thus, the use of incompetent dive staff exposes a dive operator to likely legal ramifications or sanctions in the event of a mishap.	4	Dive operators should establish a policy regarding the means by which competence is determined: • Employers or their delegated representatives should be required to make decisions regarding competence based on training, knowledge, skills, and experience; and • Such a declaration of competence should be required for each category of diving an operation offers.
Certification recordkeeping	An accident investigation may lead to a call for documented proof of staff certification. Lack of such documentation could jeopardize a dive operator's defense in such an instance.	4	Dive operators should ensure that copies of all relevant current training and certification documents are kept on file and can be made be available on demand.
Legislative changes	Ignorance of national and local laws and regulations pertaining to diving and its associated operational activities, or of international standards of care (e.g., suitable oxygen provision), is inexcusable and may lead to legal ramifications or sanctions for a dive operation. This applies equally to changes made to such laws and regulations over time.	4	Dive operators should remain up to date as to all statutory and regulatory requirements and any relevant changes made to them over time. All dive professionals should be aware of such requirements, and new employees should be educated regarding such requirements. And whenever changes are made in such requirements, all staff should be informed about any resulting changes in their organizational duties and responsibilities.

Staff Training and Certification			
Element	**Risks**	**RL**	**Recommendations**
Infection control	Lack of knowledge of infections, biological concerns and location-specific diseases, and of appropriate preventive measures, could leave staff and clients susceptible. This would affect both staff and clients.	4	Staff should be thoroughly trained in infection control procedures and practices, applicable to the location as well as to periods of sporadic diseases or other health-related concerns. Disinfectants should be reviewed in terms of their effectiveness for such concerns and as applicable.
On-site medical courses	The nature of a dive operation will dictate the applicable medical competences required. Whatever those competences may be, if suitable and sufficient on-site medical training is not available, there may not be appropriate numbers of trained staff available to deal with medical emergencies, possibly placing the dive operation in jeopardy. A dive site's remoteness, access to emergency medical services (EMS) personnel, the accessibility of local medical services, the size of the dive operation, the availability of and ease of access to off-site training, and the number of staff who are already suitably trained are among the factors that affect the requirements for on-site training.		Dive operators should make all the following DAN (or equivalent) training courses available to their staff (all can be taught on site):
		2	• First aid;
		2	• Basic life support (BLS);
		2	• Emergency oxygen;
		2	• Neurological assessment;
		2	• Automated external defibrillator/ basic life support and defibrillator (AED/BLSD) training (note that defibrillation should be administered only by a suitably trained person); and
		2	• More-advanced medical training (this may be optional in some settings but required in others, depending on the remoteness of the dive location).

In-Water Training Conditions			
Element	**Risks**	**RL**	**Recommendations**
Confined-water site	Potential risks to students (and instructors) from a confined-water training site include strong or unpredictable currents, overhangs that prevent direct ascent, limited visibility, unsafe entry and exit points due to access limitations, cold temperatures, and obstructions that may render a training dive unsafe.	3	Dive operators should ensure that the training environment, especially for novice students, has calm, clear waters without strong currents; is free of obstructions or structures that might impede or endanger novice students; has safe and easily accessible entry and exit points; and is judged to be safe, suitable, and conducive to effective learning.
Emergency action plans (EAPs)	A rapid and appropriate response is required in the event of an emergency involving divers, especially if they are not used to being in the water or underwater. It thus puts a dive operation in jeopardy if appropriate EAPs are not in place. The responsibility to respond rests on the instructor, who may be alone with students during training. Risk factors to consider include the fact that students may be new to diving and thus more vulnerable to mishaps; that some training sites are open to nondiving swimmers, which can distract both students and instructors; and, of course, that diving and swimming always involve some element of risk.	5	Dive operators should establish EAPs relevant to any emergencies that could potentially occur in a training area; the plans should be documented, and all dive professionals on the staff should be familiar with them. Such plans should address at least the following situations: • aggressive behavior (by customers, staff, or others); • panicking diver or swimmer; • injured student diver (in or out of the water); • nonfatal drowning or water aspiration; • DCI; • unconscious student diver; • transfer of injured student diver or other personnel to the nearest emergency service; and • death of a student diver.
Sun protection	Most diving is done in sunny areas with high UV exposure. Exposure UV radiation by students (or instructors), even just for the duration of one course, can entail short-term risks such as sunburn, exhaustion, and heat stroke. Many sunscreen products are hazardous to marine flora and fauna.	3	Dive operators should ensure that all training sites have sufficient shaded areas to protect students against excessive sun exposure. Students (and instructors) should also be actively encouraged to wear protective clothing, as well as hats and sunglasses. If sunscreen products need to be used, staff and visitors should be educated in ensuring the use of ecofriendly (oxybenzone- and octinoxate-free) sunscreen products.

In-Water Training Conditions			
Element	**Risks**	**RL**	**Recommendations**
Access to training pools	If dive operators either own or lease a training pool, they bear the risk that unauthorized customers or members of the public may gain access to the pool, especially during times when it is unattended, and the attendant liability in case of an injury or drowning.	4	Dive operators should restrict access to a training pool area whenever the pool is not in use by means of a physical barrier (fence) around the pool and/or safety netting over the pool. Appropriate signage should also be posted.
Pool hygiene	Lack of good pool hygiene and/or excessive use of pool chemicals can expose students (and instructors) to health problems. Dive operators assume the risk of ensuring that a pool they own or lease for training is maintained properly.	3	Dive operators should set a strict and regular protocol for cleaning and conducting hygiene checks of training pools. They should also keep a log of all such actions taken. Such a protocol should include the use of pool chemicals (e.g., chlorine). (See also the Exposure to hazardous substances in Staff Health and Safety) *Note: These tasks may be performed by hotel/resort staff; however, the dive operator bears responsibility for confirming this fact and for reviewing the logs from time to time.*
	If students or instructors are infected with communicable diseases, they may be spread to others who swim in the same pool. Or if other users of a training pool are so infected, diseases may be spread to the dive operation's students or instructors.	3	Dive operators should give consideration to administering a medical questionnaire or brief examination to determine whether student divers have any communicable conditions (e.g., foot fungus, lice, diseases spread by saliva such as mononucleosis, etc.).
Cold water temperature	A risk of hypothermia exists in both confined- and open-water areas. Not only is cold a risk in and of itself, but students may not be able to absorb training instructions if they are distracted by being cold.	3	Dive operators should ensure that the water in pools used for training is maintained at a comfortable temperature, or that suitable thermal protection (e.g., wetsuits) is offered.
Hot or cold air temperature	Depending on the location of a training site, students (and instructors) may be at risk or either hyper- or hypothermia, due to either high or low extremes in air temperature. Such a situation can be especially hazardous if the distance from the water back to a shaded or sheltered area is excessive.	3	Dive operators should regularly monitor weather conditions, so that divers can be alerted to the need to seek shade or thermal protection when they leave the water. Such protection may include light-colored or sun-protective clothing if it is hot, or warm clothing if it is cold or windy.

In-Water Training Conditions			
Element	**Risks**	**RL**	**Recommendations**
Slips and falls	Areas around pools, especially when they get wet, may be unacceptably slippery, leading to a risk of students or instructors slipping and/or falling.	4	Dive operators should ensure that the areas surrounding pools have sufficient friction to protect against slips and falls. Where this is not possible, adequate warning signs should be posted.
Supplemental oxygen	Drowning, DCI, injuries, or other medical mishaps are a possibility during any diving activity. If supplemental oxygen is not available at a training site, it may inhibit the instructor's ability to adequately respond to such mishaps.	3	Dive operators should ensure that supplemental oxygen and suitable delivery equipment is available adjacent to any site where in-water training is conducted.
First-aid kit	Students and instructors are exposed to the possibility of slips, falls, abrasions, cuts, fractures, and other injuries in and around in-water training sites. Any resulting injuries may require rapid first aid.	4	Dive operators should ensure that a first-aid kit is available in reasonable proximity to all training areas. Its location should be clearly indicated, preferably with the internationally recognized green cross on a white background, and it should be easily accessible.
AED	Water training areas may be busy or located far from emergency medical services. In the event that a student suffers a cardiac incident, lack of an AED may raise the likelihood of a poor outcome.	3	Dive operators should, if at all possible, have an AED available in reasonable proximity to all training areas (but note that defibrillation should be administered only by a suitably trained person).
Maintenance of safety equipment	Pool chemicals, marine and humid conditions may cause equipment to degrade or fail prematurely. Battery powered devices may discharge. Oxygen cylinders may leak and be emptied over time. See also Appendix E - Oxygen Kit Inspection and Maintenance.	3	Safety equipment kits should be suitably protected against physical damage and the elements. Kits should be subjected to a regular, documented inspection, maintenance and test schedules for content, expiry and function. (Ref. Appendix E - Oxygen Kit Inspection and Maintenance.
Barotrauma and arterial gas embolism (AGE) protocols	The possibility of sustaining barotrauma (either ear or pulmonary) or AGE is present during any diving activity, especially at a depth exceeding 5 ft (1.5 m). Rapid emergency action is required in such situations, so the lack of clear protocols may raise the likelihood of a poor outcome.	4	Dive operators should establish protocols for managing ear and or pulmonary barotrauma and their consequences, including arterial gas embolism. The protocols should be easily available to and known by all personnel involved in training activities — especially in waters deeper than 5 ft (1.5 m).

In-Water Training Conditions			
Element	**Risks**	**RL**	**Recommendations**
Supervision	Water areas require supervision whenever they are in use, by either students or the public. The risk of drowning is always present, but a lack of adequate supervision elevates this risk and the attendant risk of a liability claim.	4	Dive operators should ensure that training areas are used only under the supervision of a person trained in the specific diving procedures being taught and trained in dealing with emergencies associated with the performance of those procedures.
Student:instructor ratio	If the student: instructor ratio is higher than recommended, it increases the risk of mishaps - especially if it's compounded by factors such as student uncertainty, unusually demanding activities, distractions, or instructor inexperience.	3	Dive operators should ensure that the student:instructor ratio does not exceed 6:1 whenever novice divers are being trained. *Note: Some training agencies may suggest a slightly different student:instructor ratio; however, a ratio in excess of 6:1 is discouraged.*
Water entry and exit procedures	Students are more prone to injury during entry and exit than more experienced divers, especially if a site's entry and exit are demanding.	4	Dive operators should ensure that safe entry and exit equipment is provided and that entry and exit procedures are practiced. For example, ladders should be designed so as not to cause finger injuries, and an appropriate bench should be available from which to practice a back-roll technique that avoids head and neck injuries.
Changing rooms	Changing into and out of personal swim gear requires a degree of privacy. If such facilities are too rudimentary, the risk of accidents or infection is elevated.	3	Dive operators should provide suitable, safe, hygienic changing rooms (e.g., with non-slip floors).
Bathroom facilities	Toilets used by the public should be clean and hygienic to avoid the risk of infection.	3	Dive operators should provide hygienic bath-room facilities, including provision instructions for handwashing with soap. If possible, separate facilities should be provided for each gender.
Predive briefing	If students are not properly briefed prior to immersion, their familiarity with safety protocols and proper diving procedures may be deficient, thus increasing the risk of accidents.	4	Dive operators should ensure that a thorough predive briefing is performed before students make any use of a water training site. The predive briefing should contain at least the following elements: • the planned activities; • entry and exit procedures; • the importance of avoiding breath-hold diving due to the risk of barotrauma; • required customer conduct; and • emergency procedures and the location of emergency equipment.

In-Water Training Conditions			
Element	**Risks**	**RL**	**Recommendations**
Buddy checks	Students need to be prepared to take responsibility for the safety of their buddies prior to engaging in any open-water activities. Students may lack familiarity with their equipment and with the importance of performing thorough predive safety and function checks. Student divers are especially vulnerable to neglecting essential safety steps.	4	Dive operators should ensure that buddy checks are performed prior to every dive; the following should be part of all such checks: • buoyancy control device (BCD), including its power-inflator function, is operational (but not prone to auto-inflation); • BCD is partially inflated before entry into the water; • all straps are secured; • weight belt/weight system is secured, but in a position that will allow its release in case of an emergency; • location of release(s) for integrated weights are identified, if applicable; • fins are present; • mask and snorkel are present; • cylinder valve is fully open; • regulator is functioning and mouthpiece is secure; and • an alternative air supply (or octopus) is functional and accessible.
Post-dive briefing	Students and even experienced divers may be unaware of potential postdive health issues. This awareness is of particular relevance after demanding and/or stressful dives. Dismissal or denial of diving-related illnesses is a relatively common occurrence, leading to delayed and thus potentially less effective treatment.	3	Dive operators should always conduct a postdive briefing, discussing any problems that were experienced during the training session or the dive, together with any possible or likely symptoms of postdive injuries or illnesses. Any relevant postdive restrictions should be explained (i.e., no flying, hot showers, driving over altitude, or excessive exercise right after diving). Such briefings should include instruction on the importance of learning from experience. Regular reinforcement of these lessons is an essential part of safe diving.
Cleaning and disinfecting of equipment	Transmission of infectious diseases from one diver to another is possible in cases where equipment is shared, especially if the identification of such diseases is difficult or if privacy requirements prevent the dissemination of such information.	3	Dive operators should instruct students and customers to clean and, as applicable and possible, disinfect all equipment in the following situations: • if the equipment does not belong to the dive training center, and/or • between successive dives on the same day if the equipment is to be interchanged

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Classroom Conditions			
Element	**Risks**	**RL**	**Recommendations**
Ergonomics	Nonergonomic positioning of tables and chairs can lead to discomfort, inattentiveness, poor learning, and poor retention of essential information - all of which can compromise training.	2	Dive operators should ensure that tables are at an ergonomic height, and there should be sufficient space available for each student. Chairs should be comfortable and ergonomic.
Electrical system	Insufficient access to electric outlets can result in poorly laid out classrooms and unsafe electrical connections, leading to both electrical and trip hazards.	3	Dive operators should ensure that there is an adequate electrical system supplying all classrooms; that all appliances have been safely installed and are plugged into outlets with ground fault protection (also known as earth leakage protection); and that all wiring is trip-proof and neat. Dive operators should also comply with all national and/or regional electricity regulations, especially regarding circuit breakers and ground fault protection.
Lighting	Poor lighting can compromise students' ability to concentrate and thus their effectiveness at learning and retaining safety-related information.	2	Dive operators should ensure that classroom lighting is adequate and conforms to the recommended minimum of 200 lux. (See Appendix B.)
Ventilation	Poor ventilation can result in stuffy and excessively warm environments, affecting students' ability to concentrate and learn effectively.	2	Dive operators should ensure adequate ventilation in all classroom spaces. If natural ventilation is used, a policy should be set to ensure that doors, windows, and vents remain open during classes.
Temperature	Classrooms are not conducive to concentration and effective learning if they are not kept at a comfortable temperature. Clearly, geographic location has an impact on this factor. However, very hot or very cold learning environments compromise training effectiveness. It is also of note that relative humidity (RH) - the combined effect of temperature and humidity is a significant factor in discomfort.	2	Dive operators should ensure that all classrooms are maintained at a comfortable temperature. Air conditioning should be considered where necessary. The heat index level should be kept below 90°F (32°C), for example: • 86°F (30°C) at 60% RH; or • 90°F (32°C) at 30% RH.
Noise	Noisy environments reduce students' ability to concentrate and learn effectively. Excessive noise can also lead to headache and other discomforts.	3	Dive operators should ensure that noise levels in training facilities are maintained at a level of less than 65 A-weighted decibels [dB(A)] to ensure that students are able to pay proper attention. However, a short-term elevation in noise level, up to 85 dB(A) for 15 minutes or less, is acceptable. (See Appendix C.)

Classroom Conditions			
Element	**Risks**	**RL**	**Recommendations**
Emergency exits	Classrooms are classified as public spaces. National and local fire safety regulations therefore apply to any spaces used as classrooms. Failure to heed such regulations could result in injury or death, as well as expose dive operators to legal liability.	3	Dive operators should ensure that any classroom spaces can be easily evacuated in case of an emergency, including fire. For classrooms with only one exit, appropriate escape equipment should be provided, as applicable (such as where the exit is not directly to outside the building). Escape routes should be kept clear at all times.
Bathroom facilities	Toilets used by the public should be clean and hygienic to avoid the risk of infection.	3	Hygienic bathroom facilities should be available, including instructions for handwashing with soap or using a suitable hand sanitizer. If possible, separate facilities should be provided for each gender. The actual number of facilities is usually prescribed by local OHS regulations.
Breaks	Students' ability to concentrate and learn effectively is compromised if there are insufficient breaks during instructional presentations.	2	Dive operators should ensure that adequate rest breaks are built into training session schedules.
First-aid kit	Accidents can happen even in a classroom, when demonstrating or participating in activities that involve heavy gear (e.g., disassembled parts can cause cuts and/or abrasions) or high-pressure gases. Any resulting injuries may require rapid first aid.	3	Dive operators should ensure that a first-aid kit is located in or near all classrooms. Its location should be clearly indicated, preferably with the internationally -recognized green cross on a white background, and it should be easily accessible.

Classroom Conditions			
Element	**Risks**	**RL**	**Recommendations**
Fire-safety procedures	The inability to escape from and to at least attempt to control a fire, especially in spaces where students and other members of the public may be located, could exacerbate smoke inhalation, burns, and other injuries and also expose dive operators to legal liability.	4	Dive operators should take the following steps to prevent fires and to mitigate injuries and damage if a fire does occur: • analyze and actively manage all fire risks; • establish appropriate fire-fighting procedures; • place fire extinguishers and other firefighting equipment in easily accessible locations; • select appropriate fire-extinguishing agents based on the situation; • ensure that fire extinguishers are unexpired; • clearly indicate the location of fire extinguishers and exit routes; • consider installing fire detectors, especially in areas where there is a higher risk of fire; • enforce a no-smoking policy; • install appropriate, clearly visible signage to alert instructors and students to fire risks; and • brief students regarding what they should do in the event of a fire.

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Dive Shop Operations			
Element	**Risks**	**RL**	**Recommendations**
Responsive, accessible staff	If dive shop staff are unfriendly, unable to speak the language(s) used by most customers, and/or unfamiliar with their customs, they may not be able to communicate effectively with customers. This can negatively affect safety as well as the financial viability of the business.	2	Dive operators should ensure that all staff are friendly, accessible, able to communicate effectively with most visitors in their primary language (or an appropriate secondary language), and familiar with the customs and mores of their culture so that all visitors feel welcome and all safety information can be effectively communicated.
Appropriate dress code	Customers may be offended if staff do not dress according to standards of common decency and/or in a way that is respectful of relevant cultural practices or sensitivities.	2	Dive operators should establish a dress code requiring professional attire, appropriate to the location and the cultural expectations of customers. Uncovered tops and unsuitable footwear should be prohibited. Customers may also be asked to comply with the code, depending on the location and cultural circumstances.
Information on the site and its surroundings	If customers' expectations are not in alignment with the conditions of the setting, the discrepancy could lead to safety implications and/or contractual disputes.	2	Dive operators should provide all customers with detailed information on the site and its surroundings.
Dive sites	Certain dive site conditions may preclude their use by divers with health or fitness restrictions. Failure to heed such factors can have safety or contractual implications.	2	Dive operators should keep detailed information on all dive sites, including risks and special precautions that may be required.
EAPs	If a facility is accessible to the public, emergency situations must be appropriately mitigated and managed. Failure to plan for such exigencies can expose a dive operator to legal liability.	4	Dive operators should establish EAPs for any relevant situations and locations; all such plans should be on file in the dive shop, and all staff should be informed about their location and contents.
Bad weather or natural disasters	Dive operations may be located in areas that are prone to bad weather and/or natural disasters.	3	Dive operators should establish contingency and/or evacuation plans to manage any type of disaster that their geographical area is prone to, such as hurricanes/cyclones in tropical locations, tornadoes, earthquakes, flooding, and/or tsunamis.
Policies	Inappropriate or inconsistent management of relations with customers, including denial of access to products and services, may expose a dive operator to legal liability.	3	Dive operators should establish and enforce consistent operating procedures. The operating procedures of the company should be available in the dive shop.

Dive Shop Operations			
Element	**Risks**	**RL**	**Recommendations**
Workstations	Poorly designed workstations may result in occupational health issues.	2	Dive operators should ensure that all workstations - computer configurations or other work areas - are comfortable, ergonomic, and well equipped and include sufficient workspace.
Electrical system	Insufficient access to electric outlets can result in an inefficient shop design and unsafe electrical connections, leading to both electrical and trip hazards.	3	Dive operators should ensure that there is an adequate electrical system in the shop; that all appliances have been safely installed and are plugged into outlets with ground fault protection (also known as earth leakage protection); and that all wiring is trip-proof and neat. Dive operators should also comply with all national and/or regional electricity regulations, especially regarding circuit breakers and ground fault protection.
Lighting	Poor lighting can make it difficult for staff and customers to read important paperwork and can reduce the quality of staffers' work. It can also cause occupational health complications, including eye strain, headache, bad posture, and long-term vision problems.	3	Dive operators should ensure that dive shop lighting conforms at least to the recommended minimum of 100 lux. (See Appendix B.)
Ventilation	Poor ventilation can result in stuffy and excessively warm environments, affecting staffers' ability to concentrate and the accuracy of their work. Also, customers may avoid the shop or limit the duration of their visits there if it is uncomfortably stuffy or warm.	3	Dive operators should ensure adequate ventilation in the dive shop. If natural ventilation is used, a policy should be set to ensure that doors, windows, and vents remain open when the shop is occupied, especially during busy times.
Temperature	A dive shop is more appealing to customers if it is kept at a comfortable temperature. Clearly, geographic location has an impact on this factor. However, very hot or very cold environments compromise business effectiveness. It is also of note that RH - the combined effect of temperature and humidity - is a significant factor in discomfort.	3	Dive operators should ensure that the dive shop is maintained at a comfortable temperature. Air conditioning should be considered where necessary. The heat index level should be kept below 90°F (32°C) - for example: • 86°F (30°C) at 60% RH or • 90°F (32°C) at 30% RH.

Dive Shop Operations			
Element	**Risks**	**RL**	**Recommendations**
Emergency contact information	Emergency situations require rapid and appropriate responses. If emergency contact numbers are not readily available, the extra time it may take to locate such information can compromise a dive operation's ability to mitigate an emergency. Such information needs to be accessible not only to staff, but also to customers and the public, as they may need to take emergency action in the event that staff are not available or are injured. Such information should be accessible even when the dive shop is closed, as emergencies may occur after hours, when staff are no longer on site.		Dive operators should clearly display all relevant emergency contact numbers in the dive shop (including in a manner that is visible when the shop is closed, such as in a window), including for the following resources:
		4	• Police;
		4	• Ambulance services;
		4	• The nearest medical facility and recompression chamber (RCC);
		4	• The nearest hospital;
		4	• Appropriate hotlines, such as 911 in the U.S., the nearest EMS, DAN (+1-919-684-9111), etc.;
		4	• Fire department; and
		4	• The dive operation's owner or delegated agent.
Emergency contact information up-to-date	Names and contact numbers for emergency providers may change over time. Incorrect or dated emergency contact information will compromise a dive operation's ability to respond rapidly and appropriately to emergencies.	4	Dive operators should establish a system to ensure that emergency information (including the availability of and contact numbers for local health providers) remains up to date. The DAN hotline (+1-919-684-9111) is also available 24/7 to help deal with medical emergencies. Further information about DAN resources can be obtained from the International DAN website (www.dan.org).
Voicemail message	If customers experience health problems after hours and/or after they have left the business premises, they may call the dive shop. If they are not provided with alternate contacts, it may delay their care and expose the dive operator to legal liability.	2	Dive operators should ensure that the shop's outgoing after-hours voicemail message contains emergency contact numbers and information, especially regarding what to do in the event of any postdive symptoms.
Unobstructed and clean spaces	Clutter in a dive shop raises the risk of injury to staff and customers from tripping or from falling objects. A cluttered and unclean shop also sends a negative message to customers.	3	Dive operators should ensure that the shop, including all storage areas, is kept clean and unobstructed.
Non-slippery surfaces	Injuries from slips and falls on a dive operator's premises are a known liability risk. Slipping risks are especially relevant if the retail shop is located near the path divers take as they return from diving excursions.	3	Dive operators should ensure that dive shop flooring surfaces are made of materials that provide sufficient friction to prevent slips and falls. Any potentially slippery areas should be clearly indicated with appropriate caution signs.

Dive Shop Operations			
Element	**Risks**	**RL**	**Recommendations**
Emergency exits	Public spaces, including dive shops, must have sufficient, clearly indicated emergency exits. Any impediments to rapid evacuation of such spaces can result in injury or death in the event of a fire, as well as expose dive operators to legal liability.	3	Dive operators should ensure that all emergency exits from the dive shop are available, unobstructed, and clearly indicated. For dive shops with only one exit, appropriate escape equipment should be provided, as applicable (such as where the exit is not directly to outside the building).
Fire-safety procedures	Protection primarily of customers and staff, but also of valuable inventory, may depend on effective fire control procedures and equipment. Common ignition sources for unintended fires -including electrical wiring and connections, sparks, and heated surfaces - may be present in dive shops. An inability to escape from and to at least attempt to control a fire raises the risk to people, inventory, and buildings.	4	Dive operators should take the following steps to prevent fires and to mitigate injuries and damage if a fire does occur: • analyze and actively manage all fire risks; • establish appropriate fire-fighting procedures; • place fire extinguishers and other firefighting equipment in easily accessible locations; • select appropriate fire-extinguishing agents based on the situation; • ensure that fire extinguishers are unexpired; • clearly indicate the location of fire extinguishers and exit routes; • consider installing fire detectors, especially in areas where there is a higher risk of fire; • enforce a no-smoking policy; and • install appropriate, clearly visible signage to alert staff and the public to fire risks.
First-aid kit	Customers or staff may experience an injury or illness that requires a rapid response and thus easy access to at least basic first-aid equipment.	3	Dive operators should ensure that a first-aid kit is located in or near the retail shop. Its location should be clearly indicated, preferably with the internationally recognized green cross on a white background, and it should be easily accessible.
Security and/or alarm system	A dive shop's inventory, especially more expensive gear, and its computers may invite theft or vandalism. The ability to respond expeditiously to a fire, especially in a storage area, may depend on the existence of an appropriate alarm system. Such risks are exacerbated when the shop is closed or unattended.	2	Dive operators should install a security system that is maintained in working order and tested on a regular basis and establish security procedures that are actively enforced.

Dive Shop Operations			
Element	**Risks**	**RL**	**Recommendations**
Infection control	Clients shopping for personal equipment, especially masks, second stage regulators, snorkels and even BCDs often wish to test for function and fit. Physical contact implies a degree of infection risk, especially with regard to contact with mouths and noses.	3	Shop owners and dive equipment retailers should consider wiping down surfaces that, when handled by clients, could more easily spread a contagion. This includes mouthpieces, nasal pockets or any devices that a client may breathe into.
Air/gas in cylinders filled by an external service	The quality of the breathing gas in cylinders can be compromised by incorrect maintenance of filling equipment, lack of adherence to warning signs, overheating of compressors, and/or failure to regularly test for expected contaminants and monitor equipment condition. Dive operators are responsible for assuring that divers are provided with safe breathing air, regardless of whether they fill the cylinders themselves or use an external cylinder-filling service.	3	Dive operators should establish and document the air-quality testing regimen of any external filling station they use, and a certificate of air quality should be acquired by any dive operators who use such services. The air-quality certificate should be made available to any dive customers who request it. A policy should be established requiring all customers diving on nitrox or other mixed gases to physically analyze at least the oxygen content of each cylinder they intend to use. The result of these analyses should be recorded on the customers' disclaimer forms and/or on any other individual dive-related recording forms.

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Non-Boat Dive Operations			
Element	**Risks**	**RL**	**Recommendations**
Non-boat dive operations encompass shore-diving; other walk-in or jump-in diving activities initiated from the edge of a body of water; platform-diving (from a fixed or floating platform); cavern-diving; and other diving involving vertical or steep-incline access (which may require hoisting, ladders, or climbing.)			
Assessment of dive site conditions immediately before an excursion	Conditions may change significantly between the time of an initial site risk assessment and the initiation of an excursion. Weather conditions can be especially variable - and in some places, are so unpredictable that changes can occur between the beginning and the end of a dive. This is also true of currents in certain locations.	4	Dive operators should not only make an initial dive-site risk assessment, but they should ensure that conditions are evaluated just before the planned excursion begins and that the projected current, surge, visibility, and access conditions are reassessed during the dive until its completion. The planned entry and exit procedures may need to be adjusted as a result of changing conditions.
Support crew	The planned diving activities, the site conditions, and the divers' experience levels and health and fitness all affect the number of support crew required for a given excursion. Failure to adequately assess those factors and staff an excursion accordingly can raise the risk of injury and thus expose dive operators to legal liability.	4	Dive operators should ensure that the size and experience level of both diving and nondiving support crew are based on the expected diving activities, conditions, and diver criteria. This consideration may extend to including standby divers.
Support equipment	Dive sites with access routes that are restricted, treacherous, or vertically challenging, especially if they're located in remote areas, present particularly demanding entry and exit challenges. Such challenges are exacerbated if divers become injured or incapacitated and require retrieval.	4	Dive operators should assess the need for, and, as appropriate, acquire support equipment such as ropes, ladders, or hoisting devices. The acquisition of such equipment may require specific training to ensure its safe and effective use. Note: In some jurisdictions, specific training for mechanized hoisting of people is required by law.
Communications equipment	In the event of an emergency, rapid assistance may be required at a dive site. The need for such assistance can be affected by the site conditions, the nature of any injuries or illnesses, and the remoteness of the location. These factors may also present challenges to the use of normal communications channels. This can result in a delayed response by emergency personnel and can restrict their capabilities once they do arrive.	4	Dive operators should ensure that all excursions are supplied with communications equipment that is in working order and that allows communication from the site to the dive base and/or to applicable emergency services. No diving excursion should be undertaken without predive notification to an applicable base unit; depending on nature of the diving operation, this may be a dive business control center, the local EMS, DAN, etc.

Non-Boat Dive Operations			
Element	**Risks**	**RL**	**Recommendations**
EAPs	Emergency situations often unfold rapidly and rarely allow those on site to evaluate the situation and decide on a suitable response. The establishment of EAPs covering likely exigencies can mitigate the risks involved. The mere existence of EAPs is not sufficient, however. EAPs that are drafted in theory but never practiced may be ineffective, due to issues such as the complexity of a given emergency, a lack of access to the site, unfeasible or restricted escape routes, inadequate or unfamiliar equipment, unsuitable communications devices or methods, inadequate training, and/or inappropriate reactions due to staff being under pressure. Lack of training and lack of consistency in carrying out EAPs can expose a dive operator to legal liability.	5	Dive operators should establish EAPs that are based on a site risk assessment, the prevailing conditions, the dive plan, and any other variable factors; such plans should be documented and tested by all dive professionals on the staff. Such plans should address at least the following situations: • aggressive behavior (by customers, staff, or others); • bad weather and/or effects of exposure; • injured divers (in-water or onshore); • DCI; • CO contamination; • marine life injuries; • heart attack and other health-related issues; • lost diver; • transfer of an injured diver or staff member to the nearest emergency service; • motor vehicle or other transport-related accidents; and • death of a diver or support-crew member, including retrieval of a body.
First-aid equipment	Diving involves risks that may be exacerbated by the environment, the location, its remoteness, and/or the prevailing conditions. Standard first-aid supplies may not be sufficient for dealing with the likely medical situations in a diving environment. Marine and humid conditions may cause supplies to degrade prematurely.	4	Dive operators should equip all dive sites with suitable first-aid equipment, relevant to the site conditions. The kit should include supplies for treating injuries from hazardous marine life characteristic of the location (e.g., vinegar, hot water, pads, bandages, etc.).
		3	First-aid supplies and equipment should be protected against the elements (e.g., in a robust, waterproof case).

Non-Boat Dive Operations			
Element	**Risks**	**RL**	**Recommendations**
First-aid equipment (cont.)	Supplies that are not used regularly may expire, and those that are used may not be replaced. Rapid access to first-aid equipment may be required, and a quick response may be compromised if the equipment is not clearly visible and readily available.	3	The contents of first-aid kits should be appropriately monitored for content, condition and expiry dates (e.g., by means of regular inspection schedules and checklists).
		3	The location of first-aid supplies and equipment should be clearly indicated, preferably with the internationally recognized green cross on a white background, and they should be easily accessible.
Oxygen kit	The standard of care for a range of diving-related injuries and illnesses is a continual supply of high-concentration normobaric oxygen, administered using a delivery device suitable for divers. The responsibility for providing this amenity rests with the dive operator, instructor, or dive leader. Injured divers may be required to remain on oxygen for extended periods of time, depending on the location and its access to emergency services. Marine and humid conditions may cause equipment to degrade or fail prematurely. Oxygen cylinders may leak and be emptied over time. Rapid access to oxygen may be required, and the health and even life of an injured diver may be compromised if oxygen equipment is not readily accessible and in good order.	4	Dive operators should provide an oxygen kit and suitable delivery equipment at all dive sites, to enable immediate treatment of any suspected or confirmed diving injuries.
		4	The kit should contain sufficient oxygen to supply at least one diver, but preferably two, for the likely duration of an evacuation or of a typical wait for EMS personnel to reach the site with additional oxygen supplies.
		3	The kit should be unexpired; protected against the elements and physical damage; and subjected to a regular, documented maintenance schedule, to ensure that the cylinder is always full and that the kit remains in good repair. Ref. Appendix E - Oxygen Kit Inspection and maintenance.
		3	The location of emergency oxygen equipment should be clearly indicated and easily accessible.
		3	Spare masks and washers should be included in the kit.
AED	Divers are potentially susceptible to cardiac events, both from pre-existing health issues and from diving injuries. A rapid and appropriate response is especially important in such situations, for customers and staff alike, and lack of an AED may raise the likelihood of a poor outcome.	3	Dive operators should, if at all possible, have an AED available in reasonable proximity to all dive sites (but note that defibrillation should be administered only by a suitably trained person).
		3	The AED should be subjected to a regular, documented inspection and function test schedule, in accordance with manufacturer's instructions. Careful attention should be paid to batteries for leakage and remaining charge.

Non-Boat Dive Operations			
Element	**Risks**	**RL**	**Recommendations**
Rehydration fluids	Several elements intrinsic to diving - exposure to the sun, exposure to excessive heat, and especially the breathing of compressed air - elevate the risk of dehydration.	3	Dive operators should provide dive sites with adequate quantities of appropriate oral rehydration fluids (e.g., an isotonic solution and/or clean drinking water).
Rehydration fluids (cont.)	Predive use of alcohol can further exacerbate the risk of dehydration. Dehydration may be a contributory factor in heat stroke, exhaustion, and DCI, so it behooves dive operators to take measures to prevent dehydration and to mitigate it if it does occur.	3	All dive professionals should know how to ensure optimal prophylactic rehydration during diving activities and how to restore fluid loss due to environmental demands, illness, and/or injury. Factors responsible for fluid loss can include excessive heat, diarrhea, and DCI. The key guideline in rehydration is to avoid fizzy, fancy, fruity, and/or fermented drinks (so soda, coffee, sweetened or alcoholic beverages are not recommended for rehydration purposes).
Diving equipment spares	The lack of spares, especially seals and other essential dive-gear parts, may result in a dive excursion being cut short or a diver taking unacceptable risks.	3	Dive operators should stock basic spare gear parts at all dive sites. Based on the remoteness of the dive site, a greater quantity or breadth of spares may be required. Spares may include the following: • marker buoys; • regulators and masks; • weight belts and weights; • o-ring kit(s); • cylinder(s); and • dive computer/depth gauge.
Vehicle spare parts and extra supplies	Vehicle breakdowns may result in the delay or cancellation of an excursion, an inability to respond to an emergency, or even the risk of staff and customers being stranded in a remote location.	3	Depending on the location of the dive site (i.e., the distance to the nearest assistance), dive operators should ensure that sufficient spare vehicle parts and essential tools are available where and when they may be needed. This should include extra fuel, oil, and coolant fluid and spare tire(s).
Sunlight and exposure	Overexposure to the sun's UV rays can result in sunburn, exhaustion, temporary blindness, and/or heat stroke.	3	Dive operators should ensure that customers and staff are adequately protected from excessive sun exposure and sunburn. Adequate eye protection should also be provided, especially to ensure that temporary blindness does not make shore personnel unable to see divers in the water. Depending on the duration of a group's stay at the dive site, and the time of day, provision of a shaded area may be advisable.

Non-Boat Dive Operations			
Element	**Risks**	**RL**	**Recommendations**
DCI	Hyperbaric exposure renders all divers susceptible to DCI. Risk factors for DCI include their dive profile characteristics, such as maximum depth, time at depth, etc. Several physiological and medical factors can also affect DCI risk, but these vary from person to person, day to day, and dive to dive. Since the dive profile characteristics are the most objective criteria, they are given the greatest attention in reducing the risk of DCI.	4	Dive operators should ensure that a dive computer — or a depth gauge, dive-time, and dive schedule (also known as a depth-time plan) — is available for every diver. The maximum dive time and depth should be established prior to the commencement of every dive. Consideration should be given to decompression and safety stops, including the possibility of placing additional gas supplies at such stops. In addition, health factors relevant to DCI risk (such as diabetes) should be noted in the waiver that customers sign.
Pre-excursion briefing and checks	Proper predive planning and briefing are essential - especially for excursions to distant, isolated, or environmentally challenging sites or to locations where communication networks may be compromised. Failure to conduct thorough briefings and checks may expose the dive group to being stranded with restricted access to assistance and expose the dive operator to legal liability.		Dive operators should ensure that staff and crew conduct appropriate checks prior to leaving for a dive site; at a minimum, they should check the following (with relevant adjustments based on the site's location and remoteness):
		4	• That support, medical, emergency, diving, and vehicle equipment, plus spares, are available;
		4	• That communications equipment is in working order);
		4	• That drinking water, food, and shelter are available; and
		4	• That relevant support centers have been notified of the group's departure and expected return time.
Instructor	Students are especially vulnerable to accidents and injuries during qualifying dives. Instructors may be distracted if they have to contend with too many students.	4	Dive operators should ensure that an instructor (plus assistant instructors, if applicable) is present during all dives involving students and that an appropriate student:instructor ratio is maintained.
Dive leader or divemaster	Even experienced divers may not be fully aware of the risks they might encounter, especially at a dive site new to them. All customers, even those who are experienced and proficient divers, remain the responsibility of the dive operator.	3	Dive operators should ensure that all diving groups, even those that do not contain students, are led by a dive leader or divemaster who is familiar with the dive site.

Non-Boat Dive Operations			
Element	**Risks**	**RL**	**Recommendations**
Dive leader or divemaster (cont.)		3	Dive operators should ensure that an appropriate customer:dive leader/ master ratio is maintained; the recommended optimum is 4:1, and the maximum is 10:1. The ratio should be adjusted with due regard for training agency requirements, local regulations, site conditions, the types and qualifications of the customers, and any other relevant factors.
Diver recall procedures	Control of all divers in the water is essential, in case of changing weather or sea/ water conditions, uncontrolled watercraft, the advent of an emergency requiring a return to base, etc.	4	Dive operators should institute a system by which divers can be recalled to the surface in the event of an emergency or a need to leave the area.
Diver count procedures	Diving in busy areas, in rough waters, and/or during inclement weather introduces the risk of not accounting correctly for or retrieving all divers who entered the water.	4	Dive operators should institute a system to ensure that all divers are accounted for back at the dive site after the conclusion of every dive (e.g., by using a diver ID system).
		4	In crowded dive areas, uncertain divers may be advised to join another group and surface with them instead. Dive leaders/masters should thus tell customers before each dive which group they are diving with, so they are sure to return to their designated shore site.
Dive accident management procedures	Accidents are a reality in the sport of diving, and failure to plan for the management of accidents could be considered negligence.	5	Dive operators should establish written, workable emergency plans; should ensure that all staff are familiar with the plans; and should see that they are practiced regularly. The plans should cover any form of anticipated accident, during or after diving.
Lost-diver procedures	Poor group management; confusion regarding the number of divers in the water; or diving in remote areas, rough waters, heavy currents, and/or during inclement weather can increase the risk of losing divers.	5	Dive operators should establish written procedures and ensure that all staff members are familiar with them, regarding how to deal with a lost-diver situation. The procedures should include rapid notification of search and rescue services, and of any nearby vessels, especially if it is late in the day.

Non-Boat Dive Operations			
Element	**Risks**	**RL**	**Recommendations**
Predive briefing	A comprehensive predive briefing is an important element in mitigating site- and excursion-specific risks. Some dive sites or excursions may be complicated by a variety of factors — poor conditions, limited access, size of the diving group, limited communications capabilities, etc. Even uncomplicated excursions may be compromised by missing, excluding, or forgetting certain risks or essential cautions and instructions. Failure to adequately prepare divers for the circumstances they will meet may exacerbate the risks inherent in any diving excursion.	4	Dive operators should ensure that a predive briefing is performed before each dive. Checklists reduce the likelihood of omitting important, risk-mitigating information. All predive briefings should contain at least the following elements: • identification and roles of the dive staff and shore crew; • hand signals to be used to communicate with the shore crew; • emergency procedures (for lost-diver, buddy-separation, or out-of-air circumstances, etc.); • location of emergency equipment and procedures for its use; • information about the dive site (description, name, specific risks, etc.); • water conditions (visibility, current, surge, etc.); • local hazardous marine life; • specific access, entry, and exit procedures, especially if they are demanding and/or conditions are treacherous; • dive leader roles; • buddy pairs; • diver-recall system; • features of the dive (depth, time, safety stop, suggested air reserves, descent/ascent procedures, etc.); • hand signals to be used between divers, the dive master and/or the instructor, as applicable; and • expectations regarding customer conduct.

Non-Boat Dive Operations			
Element	**Risks**	**RL**	**Recommendations**
Self- and/or buddy-checks	Divers always need to take responsibility for their own safety. But self-checks are not always sufficient, especially if distractions are present or divers are experiencing personal issues, such as apprehension or lack of recent diving experience. Also, divers with new or rental equipment, or equipment that they're unfamiliar with may feel confusion or anxiety that can result in their missing important steps in a self-check. Divers thus rely on their buddies while in- and underwater to help ensure their safety. If divers experience equipment problems, it jeopardizes both their own safety and their buddy's safety.	4	Dive operators should ensure that buddy-checks are performed before every dive. Such checks should include the following elements: • BCD, including its power inflator function, is operational (but not prone to auto-inflation); • BCD is partially inflated before entry into the water; • all straps are secured; • weight belt/weight system is secured, but in a position that will allow its release in case of an emergency; • the location of release(s) for integrated weights is identified, if applicable; • fins are present; • mask and snorkel are present; • cylinder valve is fully open; • regulator is functioning and mouthpiece is secure; and • an alternative air supply or octopus is functional & accessible.
Monitoring of buddy-checks	Divers' experience level and mindset may affect their concentration and attention to detail, including during the buddy-check process. Novice divers are especially vulnerable to inattention. Dive professionals remain responsible for the safety of all divers in their group, including in preparation for a dive.	4	Instructors or divemasters should ensure that buddy-checks are performed by and on all divers and that the divers report back that the checks have been conducted properly. Novice divers should be physically double-checked by the instructor or divemaster.
Diver-below flags or markers	Members of a dive group's support crew, and/or other parties on the surface (including those in boats), may not be aware of where divers are at any given time unless appropriate visual signals are in place. Failure to place flags or markers to signal the presence of divers below the surface can increase the likelihood that members of a dive party may stray from their expected positions, enter riskier areas, and/or be struck by a boat.	4	Instructors or divemasters should place readily visible diver-below signals appropriate for the location, to indicate where divers are and will be located, so that the shore crew can monitor and supervise the dive, as applicable. Such signals also serve as an important warning to any boats or other watercraft (such as paddleboards) in the vicinity, to alert them to the presence of divers so they know to keep a safe distance away.

Non-Boat Dive Operations			
Element	**Risks**	**RL**	**Recommendations**
Entry procedures	The process of entering the water can be made riskier by issues such as vertical drop to the water, water conditions (such as the presence of a surge or current), access conditions, submerged objects, slippery surfaces, etc. Especially in such situations, careful planning, instruction, and management can be key to preventing injury.	4	Instructors or divemasters should coordinate and manage divers' entry into the water to ensure that they don't slip and fall, don't get caught in surges or currents, and are able to clear any obstacles (rocks, platforms, hoisting equipment, other divers, etc.).
Exit procedures	The process of exiting the water can be made riskier by vertical distance from the water, water conditions (such as the presence of a surge or current), restricted access, slippery surfaces, etc. Such situations may increase the risk of a diver being injured, swept away, or unable to exit the water if careful exit procedures have not been stablished.	4	Instructors or divemasters should manage divers' exits to ensure that they are able to get out of the water and get clear of all obstacles, and that they don't get caught in surges, surf, or currents.
Equipment recovery	In some circumstances, divers may not be able to exit the water with their gear - for example, if site access is restricted, water conditions are rough, or a diver's capabilities are compromised. Recovery of a diver's gear may prove challenging and even risky if conditions are especially rough.	3	Dive operators should plan for safe recovery of a diver's gear from the water by staff or dive professionals. Careful planning is especially important if exit conditions are treacherous.
Returning to shore or base	Divers may experience difficulty returning to base due to distance, terrain, surface conditions, and/or restricted physical abilities. Such situations may require excessive effort, which can increase the risk of divers' experiencing DCI, exhaustion, or other health problems.	3	Dive operators should establish plans for assisting divers who experience difficulty returning to shore or base, including helping them with their dive gear.

Non-Boat Dive Operations			
Element	**Risks**	**RL**	**Recommendations**
Postdive briefing	Divers face an increased risk of experiencing DCI or other postdive medical problems if they undertake certain activities too soon after the completion of a dive. Dive operators may be exposed to legal liability if they fail to offer a thorough postdive briefing, including warnings about the activities known to cause postdive medical issues and the symptoms associated with those issues. Notes More rigorous postdive guidelines are required for technical divers. (Recreational compressed-air scuba diving is typically done in less than 130 ft [4 m] of sea water.) Also, the regulations and/or guidelines applicable to pilots or air crew members who dive may differ from those for airline passengers, due to operational demands and the potential for exposure to a wider range (drop) in altitude, especially on private rather than commercial aircraft.[1] During a typical flight on a commercial plane, the cabin pressure does not drop more than 30% below sea-level atmospheric pressure, i.e., no less than 0.7 atmospheres absolute (or 690 millibars). [1]https://www.icao.int/publications/Documents/8984_cons_en.pdf	4	Instructors or divemasters should perform a postdive briefing immediately after each dive and upon reaching the shore following the last dive of the day. A postdive briefing will typically contain the following elements: • inquiry as to whether any divers went into decompression mode; • inquiry as to whether there were any unforeseen or unexpected events, such as rapid or uncontrolled ascents, excessive exercise due to currents, or any other issues that could be risk factors for DCI; • a reminder about not flying for a specific period (DAN guidelines call for a minimum of 12 hours after a single, no-decompression dive, a minimum of 18 hours after multiple dives in a day or multiple days of diving, or a minimum of 24 hours after a decompression dive); • a reminder about also waiting before driving over high mountain passes; • a reminder about the residual nitrogen implications of repetitive dives; • instructions regarding the need for adequate rehydration; • a reminder to avoid hot showers and strenuous exercise for at least 24 hours; • specific inquiry as to whether any divers have possible DCI symptoms, plus encouragement that if such symptoms do develop to report them early and not ignore them; and • phone numbers for and the location of nearby emergency facilities and confirmation that all divers in the group have the ability to contact those services.
	If a briefing is only oral, many divers may not record or remember key facts, especially emergency contact information.	2	Dive operators should consider augmenting the oral briefing by providing divers with a card or handout containing the most important information above.

Non-Boat Dive Operations			
Element	**Risks**	**RL**	**Recommendations**
Snorkeling precautions	Certain in-water postdive activities, especially snorkeling during required surface intervals, may elevate divers' risk of experiencing DCI.	3	Dive operators should restrict swimming and/or snorkeling during surface intervals and after the completion of dives. Divers should be briefed to remain on the surface and not to perform significant breath-hold dives.
Bends-watch surveillance	The first several hours after a dive, especially a demanding dive, is the period of greatest risk for DCI.	3	Dive operators should enforce a 6-hour period of DCI surveillance (also known as bends-watch) whenever divers' no-decompression limits are exceeded. Divers who leave the dive site or shop after their last dive and who are still within the bend-watch period should be alerted as to potential symptoms to watch for.

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Dive Boat Operations			
Element	**Risks**	**RL**	**Recommendations**
Maritime registration and transnational considerations	If maritime registrations are lacking, inappropriate, or expired, or if mandated equipment is lacking, dive operators may be subject to punitive actions. In certain nations' waters, operators face risks that include seizure of boat(s), detention of crew, confiscation of equipment, fines, or even aggressive action. These risks cannot always be mitigated by diplomatic or governmental intervention. Dive operators should be aware that certain boating activities may be restricted in some locales, including access to reserves or parks, diving at night, or being at sea or on the water during bad weather or treacherous sea/water conditions.	4	Dive operators should ensure that all boats are registered with the appropriate regulatory authorities and have on board all required equipment for both normal and emergency operations.
		4	When traveling outside of territorial waters, dive operators should be prepared for any emergencies, including evacuation, by ensuring that all required permissions and/or immigration/customs documents are in order.
		4	Separate permissions may be required for specific access, activities, weather, sea and/or water conditions. These should be obtained in advance.
Vessel care	Breakdowns and lack of seaworthiness during launching and on water, especially where far from the shore or the nearest point of assistance, places the crew and passengers at risk of being stranded, lost or even sinking.	4	Dive operators should regularly inspect the vessel to ensure its mechanical and structural integrity and that the vessel is in good working condition.
Vessel insurance	All vessels are potentially at risk from weather, sea, and/or water conditions; breakdowns; fire; capsizing; sinking; human intervention; or other situations that may lead to damage, destruction, or endangerment of human lives. It is of note that some insurance policies may be restricted as to certain activities, access to certain areas, distance from the shore, equipment on board, and/or crossing of national borders.	4	Dive operators should procure appropriate insurance for the vessel, excursions, activities, passengers and crew, and comply with all related requirements regarding maintenance, equipment and inspections.
Captain and crew trained, certified, and formally appointed	Depending on the jurisdiction a vessel will be operating in, there may be legal requirements that apply to the training, competence, and licensing of the crew on sea-going vessels or other watercraft. If boat crew members are insufficiently trained, uncertified, or inadequately appointed, the owners and/or operators of the vessel may be held accountable in the event of any damage to the boat or injuries to anyone aboard the boat. This risk may extend to accountability for pollution of the environment, the effects of an extensive sea rescue, and/or other unexpected events.	4	Dive boat operators should ensure crew are trained and, if applicable, licensed to manage: • planned or expected diving activities; • weather and water conditions; • customer experience levels, health and safety; and • onboard and in-water emergencies. Only well-trained and appropriately licensed and certified personnel should staff dive vessels, and a suitable support crew should be in place.

Dive Boat Operations			
Element	**Risks**	**RL**	**Recommendations**
Training and certification information on file	If dive operators do not have ready access to appropriate training and certification documentation, upon demand from relevant officials, they may find themselves in legal jeopardy in the event of an untoward event.	4	Dive operators should ensure that training and certification paperwork for a vessel's captain and crew is actively monitored and kept on file in a readily accessible location. Attention should be paid to licenses' expiration dates, the scope of their validity, and any renewal requirements.
Policy regarding alcohol and drug use	The use of alcohol and/or drugs likely to cause impairment of any sort presents a serious risk to the safety and health of all dive boat occupants, crew and customers alike. Furthermore, a failure to ensure that alcohol- and drug-use screening procedures are applied fairly and consistently - without profiling, victimization, or privacy invasion - may also open a dive operator the liability.	4	Dive operators should establish an appropriate and consistent alcohol- and drug-use policy. It should specifically cover boat captains and crew members, as well as dive professionals, and it should include processes for evaluation, testing, management, and retention of records.
Safety kill-switch	Unattended boats may strand crew, injure people in the water, or cause other accidents.	4	Dive operators should ensure that safety kill switches are installed on all boats, so their engines will cut out in the event that the captain falls overboard.
Weather and sea conditions	Inclement or adverse weather conditions, or rough or dangerous seas may result in loss at sea, flooding, capsizing or sinking, man overboard, or loss of divers or crew in the water.	4	Dive operators should be aware of weather and sea conditions before loading the boat while also being prepared to call off the dive due to unforeseen weather conditions.
Dive site conditions	Overcrowding and other unsafe conditions may lead to lead to confusion, loss of control of divers, or place them at risk.	3	Dive operators should be aware that popular dive sites may be overcrowded and have contingency plans for alternative destinations.
Predive boat preparation*	Failure to adequately prepare for being offshore may compromise both dive excursions' safety and dive operators' ability to fulfill their contractual obligations. Such a failure may increase an excursion's vulnerability as a result of untoward events. If vessels are dirty, cluttered, and/or improperly or inadequately provisioned; are not carrying the required emergency and repair equipment; and have insufficient supplies of drinking water and food, the safety of all those on board may be compromised.	4	• Dive operators should establish checklists to ensure that dive boats are ready before the customers board. • Such checklists should contain at least the following items, as applicable:
		3	• The boat should be clean (e.g., there should be no evidence of oil or fuel leakage) and hygienic (e.g., stocked with ice-filled coolers, adequate hand sanitizing supplies and toilets);
		4	• Sufficient fuel should be loaded (including an emergency supply);
		4	• Regular inspection and maintenance of diving gear should be undertaken if this equipment is part of the vessel's supply.

Dive Boat Operations			
Element	**Risks**	**RL**	**Recommendations**
Predive boat preparation* (cont.)	A boat breakdown due to inadequate predive preparation may result in delays, trip cancellations, an inability to respond to emergencies, or even crew and divers being stranded in remote areas.	4	• The GPS, communication system, and radar should be in working order;
		4	• Emergency and first-aid equipment (including appropriate oxygen-delivery equipment and an oxygen supply sufficient to last until more oxygen can be accessed) should be on board;
		4	• A boating emergency kit (including flares, etc.) should be on board;
		3	• A tool kit (including a spark plug wrench, an adjustable wrench, pliers, etc.) should be on board;
		4	• A sufficient supply of drinking water should be on board; and
		3	• Appropriate boat spares (including lubricants, coolants, extra spark plugs, etc.) should be on board.
	* See Appendix D - Recommended Safety Equipment for Small Vessels for the recommended minimum safety equipment that should be carried aboard a dive boat; the minimum list may need to be augmented as required by relevant maritime authorities, the size and type of vessel, the area in which it will operate, and the extent of the planned excursion.		
Communications	In the event of an emergency, a dive boat may need to call for rapid assistance. However, boats operating in remote areas may encounter problems using normal communications channels. In addition, failure to notify shore authorities regarding an excursion's planned route may delay rescuers' response times and/or restrict the capabilities of emergency services personnel.	4	Dive operators should ensure that appropriate communications equipment, including sufficient backups, are available and in working condition to allow communication with the operation's shore or beach control unit, as well as with maritime rescue personnel and applicable emergency services, such as EMS providers and DAN. No excursion should depart, and no diving should be undertaken without prior notification to the applicable shore unit, depending on nature of the excursion (e.g., the dive operation control center, local emergency services, DAN, the local coast guard or harbormaster, etc.). Contact details should be available in writing.

Dive Boat Operations			
Element	**Risks**	**RL**	**Recommendations**
Boating EAPs	Dive boat excursions face a number of risks, such as bad weather and diving injuries. The potential need to transport injured divers may generate additional risks. Even if boat crews are appropriately trained to handle untoward events, emergencies often unfold quickly enough that they do not have sufficient time to evaluate the situation and develop a suitable and effective response. Thus, the lack of appropriate EAPs may result in a less than optimal outcome in an emergency situation. Furthermore, EAPs that are drafted in theory but never practiced may be as ineffective as no EAP. Among the issues that can add complexity to an emergency situation are onboard visitors, a breakdown in communications, inadequate training, and inappropriate response reactions when crew are placed under pressure. Lack of appropriate EAPs and lack of training in or consistency in carrying out those plans may expose boat owners and dive operators to legal liability.	5	Dive operators should establish EAPs based on a risk assessment of the location, the surrounding area, the prevailing weather, and the sea/water conditions; expected launch and recovery requirements; the condition and fit-out of the boat; the onboard emergency equipment; and any other relevant considerations. The plans should be documented and tested by boat owners/operators and crew members. EAPs may include procedures for handling the following situations: • lost or incapacitated vessel; • loss of or breakdown of communications; • fire on board (must be drilled monthly and logged); • injuries on board; • man overboard (must be drilled monthly and logged) • weather-related situations; • beach-launch accidents; • beach-recovery accidents; • capsize or collision damage; • abandon ship (must be drilled monthly and logged); • hijack or piracy; • encounters with maritime authorities; • aggressive behavior by crew, dive staff, or customers; and • emergency evacuations of divers or crew. Conduct a risk assessment to determine if there are any other emergency situations that could occur, based on specific circumstances, vessel, location, crew compliments and types of divers that may be accommodated.
Slips and falls	Some risk of slips and falls exists on boats in the best of circumstances. Those risks - and thus the potential for injury to crew or customers, as well as damage to the boat - are increased by unstable seas, deck clutter, spills, and/or slippery surfaces.	3	Dive operators should minimize the risk of slips and falls on dive boats through engineering controls (e.g., by installing high-friction surfaces); administrative controls (e.g., by prohibiting certain types of slippery-soled shoes); and/or or provision of personal protective equipment (e.g., by providing nonslip shoes).
		3	Also, any oil or fuel spills or leaks should be cleaned and washed prior to divers coming aboard.

Dive Boat Operations			
Element	**Risks**	**RL**	**Recommendations**
Propeller safety	Boat propellers are a potential cause of accidents that can cause damage, injuries, or even fatalities. Propeller accidents may be caused by dive boats, as well as by other boats in the vicinity of diving activity.	4	Dive operators should install engineering controls (e.g., propeller guards and surface marker buoys) and establish administrative controls (e.g., standard entry and exit procedures) that are designed to prevent propeller accidents. Such controls are especially important in situations where boats are not anchored during a dive. A diver-below flag should be raised into a visible position, so all nearby boats will be able to observe it. Engine(s) should be disengaged, and the propeller should be still whenever divers are being picked up or dropped off.
Ladder safety	Slippery and/or poorly designed boat ladders moving with the sea can cause pinching injuries, lacerations, contusions, or even amputation injuries. Inappropriate or unsupported ladders, as well as poorly designed rungs or hand rails, may lead to slips or falls, which can also cause injuries.	3	Dive operators should install appropriately designed ladders for entry into and exit from the water. Slips, bumps and pinching, especially during rougher seas, and challenging access are some of the typical risks encountered in some boat ladder designs. Reiterate safety instructions and verbal reminders where hand-holds are located when guests are using dive ladders, especially in inclement weather.
First-aid equipment	Diving involves risks that may be exacerbated by the environment, the location, its remoteness, and/or the prevailing conditions. Standard first-aid supplies may not be sufficient for dealing with the likely medical situations in a diving environment. Marine and humid conditions may cause supplies to degrade prematurely. Supplies that are not used regularly may expire, and those that are used may not be replaced. Rapid access to first-aid equipment may be required, and a quick response may be compromised if the equipment is not clearly visible and readily available.	4	Dive operators should equip every boat with a suitable first-aid kit, relevant to the boat and the site conditions. The kit should include supplies for treating injuries from hazardous marine life characteristic of the location (e.g., vinegar, hot water, pads, bandages, etc.).
		3	First-aid supplies and equipment should be protected against the elements (e.g., in a robust, waterproof case).
		3	The contents of first-aid kits should be appropriately monitored for content, condition and expiry dates (e.g., by means of regular inspection schedules and checklists).
		3	The location of first-aid supplies and equipment should be clearly indicated, preferably with the internationally recognized green cross on a white background, and they should be easily accessible.

Dive Boat Operations			
Element	**Risks**	**RL**	**Recommendations**
Oxygen kit	The standard of care for a range of diving-related injuries and illnesses is a continual supply of high-concentration normobaric oxygen, administered using a delivery device suitable for divers. The responsibility for providing this amenity rests on the boat captain, as well as the dive operator. Injured divers may be required to remain on oxygen for extended periods of time, depending on the location and its access to emergency services. Marine and humid conditions may cause equipment to degrade or fail prematurely. Oxygen cylinders may leak and be emptied over time. Rapid access to oxygen may be required, and the health and even life of an injured diver may be compromised if oxygen equipment is not readily accessible and in good order.	4	Dive operators should provide an oxygen kit and suitable delivery equipment on all dive boats, to enable immediate treatment of any suspected or confirmed diving injuries.
		4	The kit should contain sufficient oxygen to supply at least one diver, but preferably two, for the likely duration of the excursion's return to shore or of a typical wait for EMS personnel to reach the injured diver(s).
		3	The kit should be unexpired; protected against the elements and physical damage; and subjected to a regular, documented maintenance schedule, to ensure that the cylinder is always full and that the kit remains in good repair. Ref. Appendix E - Oxygen Kit Inspection and Maintenance. (Appendix D - Recommended Safety Equipment for Small Vessels).
		3	Spare masks and oxygen washers should be included in the kit.
		3	The location of onboard emergency oxygen equipment should be clearly indicated and easily accessible.
AED	Divers are potentially susceptible to cardiac events, both from pre-existing health issues and from diving injuries. A rapid and appropriate response is especially important in such situations, for customers and crew alike, and lack of an AED may raise the likelihood of a poor outcome.	3	An AED should preferably be available on the dive boat (but note that defibrillation should be administered only by a suitably trained person). This is especially necessary for dive operations that may serve older and/ or less fit divers.
		3	The AED should be subjected to a regular, documented inspection and function test schedule in accordance with manufacturer's instructions. Careful attention should be paid to batteries for leakage and remaining charge.

Dive Boat Operations			
Element	**Risks**	**RL**	**Recommendations**
Rehydration Fluids	Several elements intrinsic to diving - exposure to the sun, exposure to excessive heat, and especially the breathing of compressed air - elevate the risk of dehydration. Predive use of alcohol can further exacerbate the risk of dehydration. Dehydration may be a contributory factor in heat stroke, exhaustion, and DCI, so it behooves dive operators to take measures to prevent dehydration and to mitigate it if it does occur.	3	Dive operators should outfit all boats with adequate quantities of appropriate oral rehydration fluids (e.g., an isotonic solution and/or clean drinking water). All dive professionals should know how to ensure optimal prophylactic rehydration during diving activities and how to restore fluid loss due to environmental demands, illness, and/or injury. Factors responsible for fluid loss can include excessive heat, diarrhea, and DCI. The key guideline in rehydration is to avoid fizzy, fancy, fruity, and/or fermented drinks (so soda, coffee, sweetened or alcoholic beverages are not recommended for rehydration purposes).
Spares	The lack of spares, especially seals and other essential dive-gear parts, may result in a dive excursion being cut short or a diver taking unacceptable risks.	3	Dive operators should stock basic spare gear parts on all dive boats. Based on the distance to or remoteness of the dive site, a greater quantity or breadth of spares may be required. Spares may include the following: • marker buoys; • regulators and masks; • weight belts and weights; • o-ring kit(s); • cylinder(s); and • dive computer/depth gauge.
Equipment secured	There is a risk that unsecured equipment can move or fall, causing injury or damage - especially during sailing, launching, recovery operations, or conditions of bad weather and/or high seas.	4	Dive operators should ensure that all equipment on dive boats is properly secured, to prevent it from falling onto and potentially injuring crew or customers, as well as to prevent equipment loss.
Sunlight and exposure	Overexposure to the sun's UV rays can result in sunburn, exhaustion, temporary blindness, and/or heat stroke.	4	Dive operators should ensure that customers and crew are adequately protected from excess sun exposure and sunburn. Adequate eye protection should also be provided, especially to ensure that temporary blindness does not make crew members unable to see divers in the water. Depending on the duration of the excursion, and the time of day, provision of shade may be advisable.

Dive Boat Operations			
Element	**Risks**	**RL**	**Recommendations**
DCI	Hyperbaric exposure renders all divers susceptible to DCI. Risk factors for DCI include their dive profile characteristics, such as maximum depth, time at depth, etc. Several physiological and medical factors can also affect DCI risk, but these vary from person to person, day to day, and dive to dive. Since the dive profile characteristics are the most objective criteria, they are given the greatest attention in reducing the risk of DCI.	4	Dive operators should ensure that a dive computer - or a depth gauge, dive timer, and dive schedule (also known as a depth-time plan) - is available for all divers. The maximum dive time and depth should be established prior to the commencement of every dive. Consideration could be given to decompression and safety stops, including the possibility of placing additional gas supplies at such stops. In addition, health factors relevant to DCI risk (such as diabetes) should be noted in the waiver that customers sign.
Boat briefing	Divers, especially dive customers, may be unfamiliar with general boating procedures, the risks of being at sea and in a potentially restricted situation, the importance of getting kitted up, the need to avoid moving around and causing a potential risk to others, etc. A lack of proper preparation and education may result in damage or injury, for which the captain or dive operator may be held liable.	4	Dive operators should ensure that a thorough boat briefing is performed before the boat gets under way and that it contains at least the following elements: General boating safety pointers; • the location of emergency equipment; • positions on the boat; • proper use of the head; • boarding and disembarking the vessel • entry and exit procedures; • stowage and use of life jackets • the importance of securing all divers (foot straps, remaining seated, etc.); • the preparation of divers for any risks of physical injury when they navigate surf, rough waters, or areas with restricted access; • the importance of securing all personal gear, including diving gear, dive bags, and other personal items, to prevent items from moving during transit and to minimize the risk of tripping; • the prohibition against nonstaff standing during launching; • propeller safety procedures; • diver-recall procedures; and • how to get safely back onto the boat after a dive.

Dive Boat Operations			
Element	**Risks**	**RL**	**Recommendations**
Positioning on the boat	Boats may have very restricted space. Moving about when at sea or on the water may result in accidents, trips, or falls. Equipment can easily be mixed up, especially among novice divers.		Dive staff should ensure that all divers are properly positioned on the boat, taking into consideration these factors:
		2	• Divers should be positioned close to their own equipment; and
		2	• Divers should be positioned next to their buddy.
Boat engine warm-up	Launching - especially from a beach, into a strong current, or in other hazardous situations - requires a boat's engines to be fully functional and unlikely to cut out, so its crew can respond to avoid hazardous situations.	3	Before launching a boat, the captain and/or crew should check the engines to ensure that they are functioning properly.
		3	The engines should be adequately warmed up to prevent engine cut-out in the surf or during launching, as applicable.
Launching procedures	Launching a boat, whether from a beach, dock, or mooring point, requires care, attention, and skill to prevent the following: • injuries to customers or staff while boarding or leaving a vessel in the water; • damage to the boat or equipment; • injuries from acceleration, braking, or instability; and/or • capsizing.	4	Dive operators should ensure that boats are operated within both the boat and the crew's limits and communicate appropriate warnings to all crew and passengers.
		4	Launching should be done in such a way as to ensure that no person is injured, with specific attention paid to:
		4	• Persons falling or slipping while boarding;
		3	• Bumps and bruises while boarding;
		4	• A person being behind the boat in the surf, especially clear of the boat's engines;
		4	• A person falling off the boat; and/or
		4	• Capsizing.
		2	Dive operators should monitor any incidents, including near-miss situation in order to ensure that appropriate corrective action is taken in order to reduce the incidence of such events.
Instructors	Students are especially vulnerable to accidents and injuries during qualifying dives. Instructors may be distracted if they have to contend with too many students.	4	Dive operators should ensure that an instructor (plus assistant instructors, if applicable) is present during all dives involving students and that an appropriate student:instructor ratio is maintained.

Dive Boat Operations			
Element	**Risks**	**RL**	**Recommendations**
Dive leader or divemaster	Even experienced divers may not be fully aware of the risks they might encounter, especially at a dive site new to them. All customers, even those who are experienced and proficient divers, remain the responsibility of the dive operator.	3	Dive operators should ensure that all diving groups, even those that do not contain students, are led by a dive leader or divemaster who is familiar with the dive site.
		3	Dive operators should ensure that an appropriate customer: dive leader/ master ratio is maintained; the recommended optimum is 4:1, and the maximum is 10:1. The ratio should be adjusted with due regard for training agency requirements, local regulations, site conditions, the types and qualifications of the customers, and any other relevant factors.
Diver recall procedures	Control of all divers in the water is essential, in case of changing weather and/or sea/water conditions, hazardous marine life, uncontrolled watercraft, the advent of an emergency requiring a return to base, etc.	4	Dive operators should institute a system by which divers can be recalled to the surface in the event of an emergency or a need to leave the area.
Diver count procedures	Diving in busy areas, in rough waters, and/or during inclement weather introduces the risk of not accounting correctly for or retrieving all divers who entered the water.	4	Dive operators should institute a system to ensure that all divers are accounted for back on the boat after the conclusion of every dive (e.g., by using diver ID system).
		4	In crowded dive areas, uncertain divers may be advised to join another group and surface with them instead. Dive leaders/masters should thus tell customers before each dive which group they are diving with, so they are sure to return to their designated dive boat.
Dive accident management procedures	Accidents are a reality in the sport of diving, and failure to plan for the management of accidents could be considered negligence.	5	Dive operators should establish written, workable emergency plans; should ensure that all staff are familiar with the plans; and should see that they are practiced regularly. The plans should cover any form of anticipated accident, whether on the boat or during or after diving.
Lost-diver procedures	Poor group management; confusion regarding the number of divers in the water; or diving in remote areas, rough waters, heavy currents, and/or during inclement weather can increase the risk of losing divers.	5	Dive operators should establish written procedures and ensure that all staff members are familiar with them, regarding how to deal with a lost-diver situation. The procedures should include rapid notification of search and rescue services, and of any other nearby vessels, especially if it is late in the day.

Dive Boat Operations			
Element	**Risks**	**RL**	**Recommendations**
EAPs	Emergency situations often unfold rapidly and rarely allow those present to evaluate the situation and decide on a suitable response. The establishment of EAPs covering likely accident scenarios can mitigate the risks involved. The mere existence of EAPs is not sufficient, however. EAPs that are drafted in theory but never practiced may be ineffective, due to issues such as the complexity of a given emergency, a lack of access to the location of the emergency, inadequate or unfamiliar equipment, unsuitable communications devices or methods, inadequate training, and/or inappropriate reactions due to staff being under pressure. Lack of training and lack of consistency in carrying out EAPs can expose a dive operator to legal liability.	5	In addition to establishing boating EAPs, dive operators should establish EAPs covering dive-specific accidents and emergencies; they should be based on a site risk assessment, the prevailing conditions, the dive plan, and any other variable factors. Such plans should be documented and tested by all dive professionals on the staff. Such plans should address at least the following situations: • aggressive behavior (by customers, staff, or others); • bad weather and/or effects of exposure; • injured divers (in-water or aboard the boat, including retrieving unconscious divers and bringing them aboard the boat); • DCI; • CO contamination; • marine life injuries; • heart attack and other health-related issues; • lost diver; • transfer of an injured diver or crew member to the nearest emergency service; • boat-related emergencies that affect divers; and • death of a diver or boat crew member, including retrieval of a body.
Dive site conditions immediately before an excursion	Conditions may change significantly between the time of an initial site risk assessment and the initiation of an excursion. Weather conditions can be especially variable - and in some places are so unpredictable that changes occur between the beginning and the end of a dive. This is also true of currents in certain locations.	4	Dive operators should not only make an initial dive-site risk assessment, but they should ensure that conditions are evaluated just before the planned excursion begins and that the projected current, surge, visibility, and access conditions are reassessed during the dive until its completion. The planned entry and exit procedures may need to be adjusted as a result of changing conditions.
Postdive boat-approach procedures	Divers are at risk of injury if a dive boat makes a poorly planned or visually impaired approach to in-water divers.	4	A dive boat should always approach in-water divers heading into the wind. The boat engine(s) should be disengaged, and the propeller should be still whenever divers are being picked up or dropped off. Depending on the size of the group, divers may be split in two groups - one to port and one to starboard - during the dive boat's approach.

Dive Boat Operations			
Element	**Risks**	**RL**	**Recommendations**
Predive briefing	A comprehensive predive briefing is an important element in mitigating site- and excursion-specific risks. Some dive sites or excursions may be complicated by a variety of factors — poor conditions, limited access, size of the diving group, limited communications capabilities, etc. Even uncomplicated excursions may be compromised by missing, excluding, or forgetting certain risks or essential cautions and instructions. Failure to adequately prepare divers for the circumstances they will meet may exacerbate the risks inherent in any diving excursion.	4	Dive operators should ensure that a predive briefing is performed before each dive. Checklists reduce the likelihood of omitting important, risk-mitigating information. All predive briefings should contain at least the following elements: • identification and roles of the crew and dive staff; • hand signals to be used to signal or communicate with the boat crew; • emergency procedures (for • lost-diver, buddy-separation, or out-of-air circumstances, etc.); • location of emergency equipment and procedures for its use; • information about the dive site (description, name, specific risks, etc.); • sea/water conditions (visibility, current, surge, etc.); • local hazardous marine life; • dive leader roles; • buddy pairs; • water entry and exit procedures; • limitations on moving around the boat with fins on; • diver-recall system; • features of the dive (depth, time, safety stop, suggested air reserves, descent/ascent procedures, etc.); • hand signals to be used between divers, the dive master and/or the instructor, as applicable; and • expectations regarding customer conduct.

Dive Boat Operations			
Element	**Risks**	**RL**	**Recommendations**
Self- and/or buddy-checks	Divers always need to take responsibility for their own safety. But self-checks are not always sufficient, especially if distractions are present or divers are experiencing personal issues, such as apprehension, lack of recent diving experience, or uneasiness in the confines of the boat. Also, divers with new or rental equipment, or equipment they're unfamiliar with may feel confusion or anxiety that can result in their missing important steps in a self-check. Divers thus rely on their buddies while in- and underwater to help ensure their safety. If divers experience equipment problems, it jeopardizes both their own safety and their buddy's safety.	4	Dive operators should ensure that buddy-checks are performed before every dive. Such checks should include the following elements: • BCD, including its power inflator function, is operational (but not prone to auto-inflation); • BCD is partially inflated before entry into the water; • all straps are secured; • weight belt/weight system is secured, but in a position that will allow its release in case of an emergency; • the location of release(s) for integrated weights is identified, if applicable; • fins are present; • mask and snorkel are present; • cylinder valve is fully open; • regulator is functioning, and mouthpiece is secure; and • an alternative air supply (or octopus) is functional and accessible.
Monitoring of buddy-checks	Divers' experience level and mindset may affect their concentration and attention to detail, including during the buddy-check process. Novice divers are especially vulnerable to inattention. Dive professionals remain responsible for the safety of all divers in their group, including in preparation for a dive.	4	Instructors or divemasters should ensure that buddy-checks are performed by and on all divers and that the divers report back that the checks have been conducted properly. Novice divers should be physically double-checked by the instructor or divemaster.
Diver-below flags or markers	The dive-boat crew, and/or other parties on the surface, may not be aware of where divers are at any given time, unless appropriate visual signals are in place. Failure to place flags or markers to signal the presence of divers below the surface can increase the likelihood that members of a dive party may stray from their expected positions, enter riskier areas, and/or be struck by a boat.	4	Instructors or divemasters should place readily visible diver-below signals appropriate for the location, to indicate where divers are and will be located, so that the boat crew can monitor and supervise the dive, as applicable. The use of floats and floatlines throughout a dive is advised to minimize the risk of lost divers, especially if currents are strong and/or squalls are likely. Such signals also serve as an important warning to other boats or watercraft (such as paddleboards) in the vicinity, to alert them to the presence of divers so they know to keep a safe distance away.

Dive Boat Operations			
Element	**Risks**	**RL**	**Recommendations**
Water entry procedures	The process of entering the water can be made riskier by issues such as vertical drop to the water, water condition (such as the presence of a surge or current), access conditions, submerged objects, slippery surfaces, etc. Especially in such situations, careful planning, instruction, and management can be key to preventing injury.	3	Instructors or divemasters should coordinate and manage divers' entry into the water to ensure that they don't slip, fall, or otherwise injure themselves or another diver. They should also inform divers about the presence of currents or any obstacles. And they should take steps to prevent entanglements (e.g., ensuring that an octopus does not get tangled with ropes on the boat).
Surface supervision	There is a risk of losing or injuring divers during their ascent or when they're on the surface if the boat crew does not monitor the diver-below markers or the planned surfacing area.	4	The captain or another crew member should monitor the position of the buoy and of diver bubbles to determine the speed of the current and ensure that the boat stays clear of the area where divers are likely to surface.
Lookout	If visual contact is not maintained with all divers in the water, there is an increased likelihood of a lost-diver incident.	4	The captain should appoint a formal lookout on the boat, especially if seas are rough or highly reflective, if the number of divers is higher than usual, if customers' diving experience is limited, or if strong currents are present.
Equipment recovery	In some circumstances, divers may not be able to exit the water with their gear - for example, if access to the boat is restricted, water conditions are rough, or a diver's capabilities are compromised.	3	Depending on the size and configuration of the boat, gear-recovery (starting with the diver's weight belt) should be accomplished by the crew, so the diver can avoid postdive straining or heavy lifting.
Exiting the water and getting onto the boat	Various factors — such as the height of the boat, the design of the ladder, currents, surface conditions, or restricted access — may increase the risk of divers being injured, swept away, or unable to exit the water.	3	The boat crew should manage divers' exit from the water to ensure that they clear any obstacles, avoid getting caught by currents, and can get out of the water.

Dive Boat Operations			
Element	**Risks**	**RL**	**Recommendations**
Postdive briefing	Divers face an increased risk of DCI or other postdive medical problems if they undertake certain activities too soon after the completion of a dive. Dive operators may be exposed to legal liability if they fail to offer a thorough postdive briefing, including warnings about the activities known to cause post-dive medical issues and the symptoms associated with those issues. Notes More rigorous postdive guidelines are required for technical divers. (Recreational compressed-air scuba diving is typically done in less than 130 ft [40 m] of sea water.) Also, the regulations and/or guidelines applicable to pilots or air crew members who dive may differ from those for airline passengers, due to operational demands and the potential for exposure to a wider range (drop) in altitude, especially on private rather than commercial aircraft[1]. During a typical flight on a commercial plane, the cabin pressure does not drop more than 30% below sea-level atmospheric pressure, i.e., no less than 0.7 atmospheres absolute (or 690 millibars). [1]https://www.icao.int/publications/Documents/8984_cons_en.pdf	3	• Instructors or divemasters should perform a postdive briefing immediately after each dive and upon reaching the shore following the last dive of the day. • A postdive briefing will typically contain at least the following elements: • Inquiry as to whether any divers went into decompression mode; • Inquiry as to whether there were any unforeseen or unexpected events, such as rapid or uncontrolled ascents, excessive exercise due to currents, or any other issues that could be risk factors for DCI; • A reminder about not flying for a specific period (DAN guidelines call for a minimum of 12 hours after a single, no-decompression dive, a minimum of 18 hours after multiple dives in a day or multiple days of diving, or a minimum of 24 hours after a decompression dive); • A reminder about also waiting before driving over high mountain passes; • A reminder about the residual nitrogen implications of repetitive dives; • Instructions regarding the need for adequate rehydration; and • A reminder to avoid hot showers and strenuous exercise for at least 24 hours;
		3	• Specific inquiry as to whether any divers have possible DCI symptoms, plus encouragement that if such symptoms do develop to report them early and not ignore them; and • Phone numbers for and the location of nearby emergency facilities and confirmation that all divers in the group have the ability to contact those services.
	If a briefing is only oral, many divers may not record or remember key facts, especially emergency contact information.	3	Dive operators should consider augmenting the oral briefing by providing divers with a card or handout containing the most important information above.

Dive Boat Operations			
Element	**Risks**	**RL**	**Recommendations**
Snorkeling precautions	Certain in-water postdive activities, especially snorkeling during required surface intervals, may elevate divers' risk of experiencing DCI.	3	Dive operators should restrict swimming and/or snorkeling during surface intervals and after the completion of dives. Divers should be briefed to remain on the surface and not to perform significant breath-hold dives.
Bends-watch surveillance	The first several hours after a dive, especially a demanding dive, is the period of greatest risk for DCI.	3	Dive operators should enforce a 6-hour period of DCI surveillance (also known as bends-watch) whenever divers' no-decompression limits are exceeded. Divers who leave the dive boat or shop after their last dive and who are still within the bend-watch period should be alerted as to potential symptoms to watch for.

Compressor and Cylinder-Filling Operations

See Appendix F for a checklist of general safety considerations.

Element	Risks	RL	Recommendations
Legal compliance	Working with equipment involving gas under pressure - including filling, mixing, boosting, and storage activities - is subject to OHS, factory, and/or commercial workplace laws and regulations. Dive business owners face the possibility of legal and financial sanctions if they do not comply with all relevant legal requirements. They are also responsible for ensuring the safety of their staff, all dive customers, and the public.	4	Dive business owners should be aware of all legal requirements pertaining to: • compressed gases, storage cylinders, and their use aboard vessels; • handling of any items that contain gas under pressure; • gauge calibration and intervals; • gas quality testing; and • any other related occupational health and safety matters.
EAPs	Emergency situations often unfold rapidly and rarely allow those on site to evaluate the situation and decide on a suitable response. The establishment of EAPs covering likely pressurized gas emergencies can mitigate the risks involved. The mere existence of EAPs is not sufficient, however. EAPs that are drafted in theory but never practiced may be ineffective, due to issues such as the complexity of a given emergency, a lack of access to the site, unfeasible or restricted escape routes, inadequate or unfamiliar equipment, unsuitable communications devices or methods, unfamiliarity with equipment, inadequate training, and/or inappropriate reactions due to staff being under pressure. Lack of training and lack of consistency in carrying out EAPs can expose a dive business owner to legal liability.	5	Dive business owners should establish EAPs that are based on potential risks; such plans should be documented and tested by all dive center staff. The plans should address at least the following situations: • contamination of breathing gas • rupture of a cylinder or other high- pressure (HP) component; • fire; • destruction of equipment (e.g., a compressor or booster-pump explosion, which damages surrounding equipment and infrastructure); • injury to staff and/or customers, including transfer to the nearest emergency services; and • unauthorized access to and/or interference with HP equipment.

Compressor and Cylinder-Filling Operations See Appendix F for a checklist of general safety considerations.			
Element	**Risks**	**RL**	**Recommendations**
Electrical system	The equipment in cylinder-filling stations, including compressors, presents a risk of fire and electrocution (including shocks and/or thermal burns). Poorly laid-out electrical cabling presents a risk of tripping. Electrical overloads, short circuits, and other sparking hazards present a risk of fire and equipment damage. Legal standards for commercial electrical equipment exist in most jurisdictions; dive business owners who do not meet those standards expose themselves to legal liability and financial loss.	3	Dive business owners should ensure that there is an adequate, secure, and safe electrical system supplying the compressors and the cylinder-filling and -blending areas. They should ensure that all cabling is secured, out of the way, and, as appropriate, contained in conduits. All electrical connections should be suitable for their intended purpose and secure from accidental disconnection. Dive business owners should be aware of and comply with all national and/or regional requirements regarding electrical equipment, isolators, overloads, ground fault protection, and any other related safety measures.
Safety shoes	If staff who work with compressors and cylinders are bare-footed or wear sandals or open-toed shoes, they will be afforded no protection from falling objects and thus may experience serious foot injuries. Staff not wearing appropriate shoes also run a greater risk of slipping on lubricating oils or fluids discharged from filter housings and thereby injuring themselves.	3	Dive business owners should supply all compressor/filling/blending operators with safety shoes and should enforce the wearing thereof. The supplied footwear should be compliant with national and/or regional OHS requirements.
Restricted access to dangerous areas	Ensuring customer and public safety requires controlling unauthorized access to risky areas, such as compressor or cylinder-filling/blending stations.	3	Dive business owners should restrict access to the compressor or cylinder-filling/blending areas; only authorized operators of the equipment should be permitted in those areas. Those authorized personnel should receive specific training, including in risk awareness, before they are allowed access to those areas. No other employees, no customers, and no members of the public should be allowed to enter the compressor or cylinder-filling/blending areas. Such areas should be cordoned off and/or clear warning signs should be posted, as applicable to the setting.

Compressor and Cylinder-Filling Operations

See Appendix F for a checklist of general safety considerations.

Element	Risks	RL	Recommendations
Machine guards	Machinery with rotating parts (such as belt-driven compressors) and mechanically driven booster pumps may cause injury or damage if an operator's body part (finger, hand, etc.) or personal item (clothing, hair, etc.) or another piece of equipment gets caught in a belt, flywheel, or linkage or if a belt or linkage fails.	4	Dive business owners should ensure that all moving/rotating machine parts are adequately protected with belt or machine guards.
Railings	There is a risk of falls if elevated platforms, stairways, or multilevel facilities are not equipped with railings. The presence of lubricating oils and other slippery fluids exacerbates this risk.	4	Dive business owners should ensure that all elevated areas and stairways have railings to prevent falls.
Trained and competent personnel	Safely operating potentially dangerous machinery and equipment requires specific training, experience, and competence. Competence cannot be assumed without a formalized training and certification process. This is usually a regulatory requirement for personnel working with HP gases.	4	Dive business owners should ensure that all compressor or cylinder-filling/ blending staff are comprehensively trained, certified, and competent. Such staff should be formally appointed to their positions, in writing, and assigned specific responsibilities.
Hearing protection	Noise levels in compressor areas can be high enough to cause hearing damage. Those levels, and the duration of staff members' typical exposure to them, should be evaluated and controlled to meet applicable OHS regulations. Noise levels above those stipulated by OHS regulations mandate the provision of adequate hearing protection for equipment operators and other staff who work in the affected areas.	4	Dive business owners should provide compressor operators with hearing protection and should enforce the wearing thereof. Note: See the requirements in the Staff Health and Safety chapter and the typically acceptable noise and exposure levels listed in Appendix C.

Compressor and Cylinder-Filling Operations See Appendix F for a checklist of general safety considerations.			
Element	**Risks**	**RL**	**Recommendations**
Cylinder inspection procedures	National standards and/or regulations mandate regular inspection and testing of HP cylinders. Cylinders made from certain alloys may require additional inspections or usage restrictions or may no longer be allowed in service. Operators who fill out-of-date cylinders expose the dive business to the risk of cylinder failure, legal liability, and/or sanctions for noncompliance.	4	Dive business owners should ensure that all cylinders are unexpired; subjected to a regular, documented maintenance schedule; and compliant with all relevant requirements. Older aluminum cylinders, or those made of certain alloys, may require additional inspections or may even need to be withdrawn from service. Customer cylinders should not be accepted for filling unless they are certified as being unexpired. Customer cylinders made of certain alloys that have been prohibited from further use should not be accepted for filling, regardless of their inspection status. These recommendations apply to both scuba tanks and other HP gas storage cylinders.
Cylinder storage procedures	Carelessly stored cylinders may fall and be damaged, cause damage to personnel or other equipment, or even rupture.	4	Dive business owners should ensure that all cylinders are stored securely (e.g., with a chain or in a rack) to prevent them from falling over.
Cylinder top-ups	Partially filled customer cylinders may contain just breathing gas, but if they have been boosted or oxygen-enriched, they may also contain fire-risk contaminants. If a filling accident occurs, it can be very difficult to allocate blame after the fact. Thus, accepting partially filled customer cylinders for top-ups exposes dive business owners to safety risks and liability.	4	Dive business owners should establish a policy that cylinders previously filled by another filling service may not be topped up; rather, all the contents of such a cylinder should be emptied before it is refilled. If any doubt exists, customer cylinders should not be accepted for filling.
Clean, safe environment	If a compressor or cylinder-filling facility has restricted physical access or sight lines, contains fire or contamination hazards, is unclean, and/or is inadequately lit, it presents a risk to operators.	4	Dive business owners should ensure that all compressor and filling stations are kept free of unnecessary items, litter, flammable materials, and contaminants. The area should also be suitably lit. (See Appendix B for specific recommendations.)

Compressor and Cylinder-Filling Operations See Appendix F for a checklist of general safety considerations.			
Element	**Risks**	**RL**	**Recommendations**
Prefilling inspections	Attempting to fill cylinders clearly not appropriate for filling, or filling cylinders using an improper method, creates a risk of fire, explosion, damage, or noncompliance with statutory requirements.	4	Dive business owners should set standards for visual inspection of cylinders before they are filled, including checks for the following: • maximum working pressure; • hydrostatic and visual inspection expiration date; • material of construction; • appropriate color marking; • intended contents; • positive pressure; • valve outlet connector; and • lack of any obvious damage.
Filling procedures	All processes involving HP equipment involve potentially hazardous elements. Incorrectly connected, poorly maintained, or overpressurized hoses, if they are separating or failing, may cause considerable damage or injury or may even result in fatalities. Damaged or incorrect thread types, if they are connected and pressurized, may fail. Oxygen fires may result from contaminated fittings, cylinders, or hoses, as well as from too-rapid filling rates. Filling a cylinder beyond its rated pressure may result in an explosion. Handling cylinder valves and filling whips provides an opportunity for any microorganisms to enter a cylinder during filling.	4	Dive business owners should establish cylinder-filling procedures that specify required safety measures, including the following: • safe coupling and uncoupling; • safe rates of filling, especially with oxygen; • proper handling of cylinders, including oxygen safety and cleanliness requirements; • knowledge of appropriate fittings and thread types; • knowledge of maximum pressure ratings for cylinders, hoses, fittings, etc.; • identification of damage to hoses, cylinders, valves, and fittings; • analysis of oxygen content; • ensuring that operators wash their hands with soap and water prior to handing breathing gas interfaces when connecting and disconnecting charging whips – the use of clean cylinder valve caps or clean tape may assist in maintaining infection control on filled cylinders; however • prohibiting the use of any form of alcohol hand sanitizer when filling cylinders; and • proper recordkeeping.
Nitrox and trimix filling procedures	The use of gas with an oxygen level that exceeds 23.5% is considered an oxygen-service application. Such a use of oxygen presents several significant fire risks.	4	Nitrox and/or trimix cylinders should never be filled with normal air, unless they are specifically marked for such use and the air is compatible with oxygen, i.e., oxygen-compatible air (OCA).

Compressor and Cylinder-Filling Operations

See Appendix F for a checklist of general safety considerations.

Element	Risks	RL	Recommendations
Nitrox and trimix filling procedures (cont.)	Great care must also be taken to ensure that a cylinder actually contains the specified percentage of oxygen; if it is lower than indicated, it may negatively impact the recovery of divers being treated for DCI, and if it is higher than indicated it could cause oxygen toxicity.	4	Dive business owners should establish a policy requiring that all customers diving on nitrox or other mixed gases physically analyze the oxygen content of each cylinder they intend to use. The result of these analyses should be recorded on the customers' disclaimer forms and/or on any other individual dive-related recording forms.
Cylinder-filling records	A lack of accurate records regarding inspections, fills, and final pressures can exacerbate a dive business owner's exposure to liability in the event of an accident or a dispute with a customer. A dive operation's compliance with best practices can be key in defending against a liability claim, but proving compliance after the fact, without good records, is difficult.	4	Dive business owners should ensure that records are kept of all the following processes: • pre-filling inspections; • the number of cylinders filled; • final fill pressures; • final oxygen content levels; and • final inspections prior to dispatch from the filling area. These records should be readily available.
Air-filtering procedures	If compressed air is inadequately filtered, it may contain contaminants that elevate the risk of various untoward events, as follows: • fire (from flammable compounds, including oils and hydrocarbons); • equipment malfunctions (from freezing of regulators, corrosion of cylinders, corrosion of pneumatic controls, etc.); or • health consequences (from particulates, oil vapor, CO, etc.). Carbon dioxide (CO_2) is not usually filtered out of breathing gas, but excessive levels may cause breathing-related health issues. The air at some sites may contain hazardous contaminants beyond those normally filtered out of breathing gas.		Dive business owners should ensure that compressed air is filtered through a system that contains the following filtration elements, as determined by the process used and any contaminants that may be present in the air at the particular site:
		4	• Intake particulate filter;
		4	• Mechanical water/oil separator (preferably one that is drained automatically; if it is manually drained, an auditable quality control system should be in place);
		2	• Refrigerant dryer, if high levels of humidity exist or very dry air is needed;
		2	• Regenerative dryer, if very dry air is needed;
		4	• HP chemical filter (molecular sieve or activated charcoal or activated alumina);

Compressor and Cylinder-Filling Operations

See Appendix F for a checklist of general safety considerations.

Element	Risks	RL	Recommendations
Air-filtering procedures (cont.)	It is the responsibility of the dive operator to test for and filter out any such contaminants. (See Appendix G for a list of purity levels mandated in certain regions.)	4	• Additional drying element, if 300-bar fills are provided;
		4	• Post-compression particulate filter;
		4	• Catalytic filter (e.g., a Hopcalite filter), if an internal-combustion compressor is used in the potential presence of CO (and in such a case, the site should be regularly monitored for the presence of CO);
		4	• Double filtration (an additional oil-absorbent filter) if oxygen compatibility is needed (e.g., for nitrox or trimix fills);
		3	• CO_2 filtration, if high levels of CO_2 are anticipated or detected (in such cases, the site should be regularly monitored for the presence of CO_2); and
		3	• Any additional filtration systems that may be required, based on the results of a site risk assessment to determine whether any other hazardous contaminants could be drawn into the compressor intake.
Filter changing procedures	Contaminants can be controlled only if filters are maintained in proper working order and are replaced at appropriate intervals. Failure to follow manufacturers' instructions or appropriate monitoring procedures could result in filtering failures, breathing gas contamination, fire, mechanical failures, and/or health problems for divers.	4	Dive business owners should ensure that filters are changed at regular, prescribed intervals and that all filter changes are recorded. The prescribed schedules for filter changes should be based on the filling equipment's age and reliability, the particulars of the environment, and the potential sources of contamination. An air-quality analysis should be conducted if any doubt exists regarding the effectiveness of the filtration system.

Compressor and Cylinder-Filling Operations

See Appendix F for a checklist of general safety considerations.

Element	Risks	RL	Recommendations
Gauges	The accuracy of a filling operation's pressure gauges is essential, in order to prevent under- or overfilling of cylinders or pressurized systems. Poorly maintained gauges may read pressures inaccurately. In addition, if a nonoxygen-compatible liquid-filled gauge (e.g., a glycerin-filled gauge) fails, unsafe fluids may enter an oxygen clean system. This represents a fire risk.	3	Dive business owners should ensure that all compressor outlets at filling and blending stations are fitted with accurate and appropriately located pressure gauges, so operators can read the gauges from their normal working position. Compressor outlets should usually be fitted with liquid-damped gauges, so they are easier to read and are preserved from premature failure due to vibration. As far as practicable, the liquids used should be oxygen-safe. Dry gauges identified as being oxygen cleaned and oil-free should be used at all oxygen-enriched gas filling stations.
Checklists	The operation of compressors and filling and blending stations involves several crucial preparatory and shutdown steps. If operators overlook or skip important steps, there may be pressure-related, machinery-failure, or fire risks. The lack of checklists increases the chance that an operator may overlook a key step and thus the risk of an accident occurring.	4	Dive business owners should establish checklists enumerating the critical steps that must be taken before and after using compressors and/or filling and blending stations, and they should ensure that the checklists are used consistently. Dive business owners should also see that regular inspections are conducted to confirm the use of checklists for maintenance procedures, filling processes, and the repair of any damage.
Unattended equipment	The machinery and gas-transfer systems used at cylinder-filling stations require regular supervision to ensure early fault detection. Potential faults include contaminants in intakes, overfilling of cylinders due to shut-off errors, overheating of compressors, unauthorized entry, etc.	3	Dive business owners should ensure that compressors are never left unattended while they are running. Compressor attendants should be trained to be aware of fault warning signs.

Compressor and Cylinder-Filling Operations

See Appendix F for a checklist of general safety considerations.

Element	Risks	RL	Recommendations
Maintenance	If compressors, boosters, filling stations, and especially flexible hoses (whips) are poorly maintained, they may be prone to failure, with potentially severe consequences for the health and safety of staff members and customers. Poorly maintained filters may result in contaminated air.	3	Dive business owners should ensure that all compressors, boosters, gas mixers, HP hoses, and gas filters are serviced in accordance with set schedules. The schedules should be based on recommendations from equipment manufacturers, service agents, or someone specifically trained and competent to make such recommendations.
Maintenance log	Postaccident investigations often focus on equipment maintenance procedures. The lack of an accurate log recording all maintenance work undertaken increases the likelihood of a presumption of negligence in case of an accident. Lack of attention to the root causes of equipment failures and to required corrective maintenance may affect the reliability of the equipment and increase the likelihood of accidents or unnecessary failures.	3	Dive business owners should ensure that thorough and accurate logs are kept of all maintenance activities performed on every piece of HP equipment. The logs should include information such as the following: • date; • nature of the service or reason for the repair; • actions taken; • replacement parts/consumables used; • post maintenance inspections/ checks; • name of service technician; and • date of next service, inspection, or other activity.
Air-intake placement	If air intakes are placed where contaminants can enter the system, there are potential health and safety risks for both staff and customers. CO poisoning is one of the most common such contaminants. Others include CO_2, methane (CH_4), nitrogen-based combustion products, volatile hydrocarbons or organic compounds, hydrogen sulfide, and other toxic fumes.	5	Dive business owners should ensure that compressor air intakes are placed in a safe location, where contamination is not likely. Intakes should not be located near parking lots, drop-off areas, areas where there is significant vehicle movement, boat docks, electric generators, internal-combustion pumps, or other internal-combustion equipment. Intakes should also be placed away from other sources of contamination, especially CO, including cooking areas, outside grills, landfills, biomass areas, smoke, cleaning fluids, other volatile fluids, space heaters, kitchen vents, other building vents, etc. If any doubt exists regarding the quality of the air at the intake point, it should be monitored for potential contaminants. Monitors should preferably be connected to automatic compressor shut-down devices.

Compressor and Cylinder-Filling Operations See Appendix F for a checklist of general safety considerations.			
Element	**Risks**	**RL**	**Recommendations**
Air-intake hose extension	Inappropriate location and inadequately sized air intake piping may lead to excessive air intake resistance or starving of the compressor. This may result in reduced air output and pressure, overheating, excessive oil consumption, and damage to the compressor.	4	Any forms of resistance to air-flow, including remote location of modified inlet filtration systems, should be done in accordance with the installation manual specifications, or where lacking, with approval of the compressor manufacturer. Extensions of intake hoses should account for added flow resistance. In general: • the intake hose internal diameter should be increased by at least • ¼" (6.35 mm) for each 10 feet (3 m) of extension, applied to the complete length of the hose; • where 90° bends or other similar flow restrictions need to be used, the internal diameter of the complete intake hose, including bends and other restrictions, should be increased by ¼" (6.35 mm) for each bend, and no more than 4 bends are recommended • provision should be made at the connection to the existing compressor intake to drain any condensate that might accumulate in the hose and run into the compressor intake; • the inlet to the extension hose should be covered with a mesh to prevent insects or debris from being drawn in, and should be located face down to avoid any direct rain from entering the hose; • the use of any form of filter at the inlet to the extended hose should be avoided; and • manufacturer's recommendations, if available, would always take precedence.
Air-intake notice	There is a risk of contamination being introduced into an air intake due to lack of awareness of the presence of the intake or ignorance regarding relevant sources of contamination.	4	Dive business owners should post warning signs that signal the position of all air intakes and that prohibit keeping motors running or otherwise introducing toxic gases into the immediate area.

Compressor and Cylinder-Filling Operations See Appendix F for a checklist of general safety considerations.			
Element	**Risks**	**RL**	**Recommendations**
Air-intake security	Signage does not always have the desired effect; some people either deliberately or unintentionally may ignore warning signs.	4	Dive business owners should restrict the public's access to the air-intake area, either by installing physical barriers or by placing the intake high enough that it is well out of reach.
Air (breathing gas) quality-testing regimen	The quality of breathing gas can be compromised by incorrect maintenance of equipment, failure to monitor the condition of equipment, lack of adherence to warning signs, overheating of compressors, and/or failure to regularly monitor for expected contaminants. Some countries or jurisdictions mandate specific air-quality testing intervals and processes. The lack of a regimen to monitor and control for contamination of breathing gas, including in cases of suspected contamination, may expose the filling operation to financial or legal liability or even to criminal prosecution. A failure to secure and protect any evidence in the event of a breathing gas contamination injury or fatality may expose the filling station staff, dive operator, and/or dive business owner to civil and/or criminal liability.	4	Dive business owners should prescribe and document an air-quality testing regimen. The documentation should be available for audit or inspection purposes or upon the request of any customer. The regimen should specify the frequency with which various actions should be taken to ensure the quality of breathing air (e.g., how often filters should be changed, how often testing should be conducted for contaminants, etc.). The effectiveness of these actions should be documented (e.g., with air-quality–test certificates). While the minimum frequency of air quality testing may be mandated, additional testing should be conducted whenever there is reason to suspect that contamination may have occurred, whenever work has been performed on a compressor, or in response to any complaints from divers. Cylinders should be quarantined whenever contamination is suspected. If gas contamination is suspected as the cause of a diving illness, the cylinders in question should be secured to allow for a proper forensic investigation. A root cause analysis should be conducted prior to the recommencement of filling operations. (See Appendix G for guidance on elements to include in an air-quality testing regimen.)

Compressor and Cylinder-Filling Operations See Appendix F for a checklist of general safety considerations.			
Element	**Risks**	**RL**	**Recommendations**
HP hose (whip) procedures	Corrosion; exposure; rough handling; and hose length, quality, and/or age can combine to cause the rupture of an HP hose. The failure of an HP hose can cause severe damage and/or trauma.	4	Dive business owners should ensure that all HP hoses are carefully assessed on a regular basis, taking these factors into account: • Length - HP hoses should be kept as short as practicable; - rigid piping should be considered to reduce the length of flexible hoses; - the use of flexible hoses longer than 6.5 ft (2 m) should be considered carefully (such hoses should be subject to stringent visual inspections and maintenance regimens; they should also include anti-whip characteristics and should be specifically designed for use in extensive, unsupported lengths); and - consideration should be given to installing longer HP hoses within suitable protective conduits or pipes, in order to limit the potential for damage in case of a hose failure. • Material - the material should be appropriate for the application, the maximum allowable system pressure, and the expected operating conditions; and - the material's kink- and abrasion-resistant properties should be maximized.

Compressor and Cylinder-Filling Operations See Appendix F for a checklist of general safety considerations.			
Element	**Risks**	**RL**	**Recommendations**
HP hose (whip) procedures (cont.)		4	• Hose ends - hose ends should be made of suitable products that are corrosion-resistant, rated to at least the maximum allowable system pressure, and appropriate for the gas that will be used; - certain hose ends (e.g., clamped, barbed fittings) should not be used in HP applications; - swivel ends should be considered if stress due to twisting is likely; and - hose-end connections should be fitted with whip-restraint devices designed to reduce whipping action in case hose ends fail or hoses are not properly vented while being connected or disconnected. • Condition - the condition of all hoses should be assessed periodically, as hoses can deteriorate due to exposure, rough handling, poor-quality materials, age, abrasion, etc.; - hoses and hose ends should undergo regular, at least annual visual inspections and leak-checks, and the results should be logged; and - as a general rule, flexible hoses used for HP gas transfer should be replaced every 5 years.

Compressor and Cylinder-Filling Operations

See Appendix F for a checklist of general safety considerations.

Element	Risks	RL	Recommendations
Oxygen-handling procedures	The highly concentrated oxygen present at filling stations represents a risk of fire and/or explosion, if fuel comes in contact with an ignition source. Gas containing an oxygen level exceeding 23.5% is considered an oxygen-service application. The cylinders and equipment used for gas blending and the oxygen used to treat DCI present the greatest risk. Rapid operation of valves, high flow velocities, flow restrictions due to kinked hoses or damaged piping, and contamination of oxygen with flammable compounds (e.g., hydrocarbons, dust, etc.) are all known causes of oxygen-related fires and explosions.	4	Dive business owners should ensure that safe oxygen-handling procedures are followed; that requires at least the following: • appropriate equipment should be selected; • staff should be trained in the safe handling of oxygen — including as to the need for cleanliness, for opening and closing valves slowly, for maintaining a consistent flow rate, for keeping equipment away from external sources of heat or sparks, for regular inspections for equipment damage, etc.; • adherence to these procedures should be documented; • all forms of volatile compounds should be kept away from oxygen-handling areas; • maintenance of oxygen cleanliness should be ensured whenever system components are disassembled or serviced; and • oxygen cleaning should be done only by persons competent to do so and only in a documented and safe manner.
Fire-safety procedures	Fire is a known risk in compressor, filling, and blending facilities due to the presence of the following elements: • HP systems, including compressors, blenders, cylinders, gas piping, and gas control equipment; • electrical and/or internal-combustion power sources; • oxygen and enriched-air generators; and • potentially, storage areas for cleaning fluids and flammable solutions.	4	Dive business owners should take the following steps to prevent fires and to mitigate injuries and damage if a fire does occur: • analyze and actively manage all fire risks; • establish appropriate firefighting procedures; • place fire extinguishers and other firefighting equipment in easily accessible locations; • select appropriate fire-extinguishing agents based on the situation; • ensure that fire extinguishers are unexpired; • clearly indicate the location of fire extinguishers and exit routes; • consider installing an overhead deluge or dry-agent fire-control system in the compressor, filling, and blending areas; • consider installing fire detectors, especially in areas where there is a higher risk of fire; • enforce a no-smoking policy; and • install appropriate, clearly visible signage to alert staff and the public to fire risks.

Compressor and Cylinder-Filling Operations See Appendix F for a checklist of general safety considerations.			
Element	**Risks**	**RL**	**Recommendations**
Customer complaints	Customer complaints may involve serious issues, such as breathing-gas quality, safety breaches, careless handling of cylinders, and/or lack of cleanliness. Failure to address issues raised by such complaints may expose dive business owners to legal liability in the event of an accident.	3	Dive business owners should ensure that all customer complaints regarding matters such as air and gas quality; the handling, labeling, and condition of equipment; or other serious issues are appropriately logged. Such complaints should be investigated by a suitable person; the outcome of the investigation should be recorded; and, as needed, relevant rectifications should be made.
Waste management procedures	Certain waste products are subject to environmental regulations regarding their handling and disposal. Improper disposal of such products may result in the pollution of water, soil, flora, and/or fauna and may expose dive business owners to fines.	3	Dive business owners should ensure that any industrial waste is stored in an appropriate, demarcated area. Such waste should be disposed of according to relevant environmental control requirements.

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Rental Equipment Storage Area			
Element	**Risks**	**RL**	**Recommendations**
Lighting	Poor lighting represents a safety risk to staff (e.g., they may trip or drop items) and compromises their ability to detect bacterial or fungal contamination and/ or deteriorating equipment.	3	Dive operators should ensure that the lighting in storage areas conforms at least to the recommended minimum level of 150 lux. (See Appendix B.)
Ventilation	Poorly ventilated, humid, and excessively warm environments accelerate the deterioration of equipment and encourage the growth of bacteria and mold.	3	Dive operators should ensure adequate ventilation in equipment storage areas. If natural ventilation is used, a policy should be set to ensure that doors, windows, and vents remain open as much as possible.
Fall-prevention procedures	Staff (and/or customers, if they are allowed in the equipment area) may be injured if unsecured objects, especially heavy items, fall on them. They also face a risk of injury if they trip and fall themselves. Fall injuries may represent a liability risk.	4	Dive operators should ensure that all equipment (especially heavy items) is well secured to limit its risk of falling and that the area is maintained in an orderly state to minimize the risk of trips and falls by staff (and/or customers, if they are allowed in the equipment area).
Sun protection	Equipment that is sensitive to UV light may fade, degrade, and fail if it is exposed to direct sunlight.	3	Dive operators should ensure that all diving equipment is protected from exposure to direct sunlight.
Temperature extremes	Very hot and/or very cold temperatures may hasten the deterioration of equipment and contribute to early, unpredictable equipment failures.	3	Dive operators should ensure that all diving equipment is protected from exposure to temperature extremes.
Infection-control procedures	Dive operators may not know if customers have communicable diseases. If they do, the risk of their transmitting the condition to others is especially high if they use rental gear. Mouthpieces are especially vulnerable to transferring infections. Disinfectants may not always be effective in the case of some diseases. Customers who contract an infectious condition from a dive operation may focus on their rental equipment as the source of the disease, thus exposing the dive operator to liability.	3	Dive operators should ensure that all equipment is adequately cleaned and disinfected, so that transmissible pathogens are killed; among the procedures that should be followed are the following: • regulators and snorkels should be washed in a separate basin from wetsuits and other equipment, using an antiseptic solution; • the disinfectant(s) used should be appropriate given the kinds of infectious conditions typical of the circumstances; • disinfectants should be sufficiently fresh and used at the recommended concentrations; and • recommended submersion times should be observed.

Rental Equipment Storage Area			
Element	**Risks**	**RL**	**Recommendations**
Rental equipment	Customers unfamiliar with their rented gear or not appropriately equipped (e.g., gear that is too tight or too loose) may become anxious or even confused when they get in the water.	2	Whenever possible, dive operators should encourage customers who are renting equipment to try on at least the BCD, regulator, and mask in the shop and/or do a test dive in a pool or at a shallow shore area.
Postdive equipment assessments	Customers may experience problems with their rental equipment, including with its quality, function, comfort, or cleanliness. However, they may not mention such problems unless asked. Failure to address issues raised by such problems may expose the dive operator to legal liability in the event of any future blame.	3	Dive operators should inquire about and document any customer concerns regarding the function, condition, and/or other aspects of rental equipment they used. Such concerns should be investigated by a suitable person; the outcome of the investigation should be recorded; and, as needed, relevant rectifications should be made.
Routine equipment inspections	Failure to identify faulty, damaged, broken, or worn-out rental equipment may lead to a malfunction during a subsequent rental and thus to legal liability for the dive operator.	4	Dive operators should ensure that all rental equipment is inspected and tested on a regular basis.
Fire-safety procedures	Stored equipment may represent a significant investment, which may be compromised in the event of a fire. Storerooms may be confined spaces, in which fire can spread rapidly. Smoke inhalation, burns, and other injuries may result if a fire is not rapidly controlled.	4	Dive operators should take the following steps to prevent fires and to mitigate injuries and damage if a fire does occur: • analyze and actively manage all fire risks; • establish appropriate firefighting procedures; • place fire extinguishers and other firefighting equipment in easily accessible locations; • select appropriate fire-extinguishing agents based on the situation; • ensure that fire extinguishers are unexpired; • clearly indicate the location of fire extinguishers and exit routes; • consider installing fire detectors, especially in areas where there is a higher risk of fire; • enforce a no-smoking policy; and • install appropriate, clearly visible signage to alert staff and the public to fire risks.

Equipment Repair Workshop			
Element	**Risks**	**RL**	**Recommendations**
Equipment repair capability	Life-support diving equipment must be kept in a good state of repair, must be adjusted correctly, and must be regularly maintained to reduce the likelihood of its failure during use. Dive operators bear responsibility for the reliability and functionality of any equipment that has undergone repair or maintenance — whether the servicing has been done in-house or has been contracted out.	3	Based on the scope and size of the operation, dive operators may choose to establish a separate, dedicated (even if small) instrument workshop to repair, service, and maintain the more complex pieces of diving equipment (e.g., demand valves, first-stage regulators, inflators, BCDs, etc.). In such cases, the workshop should be run in accordance with the recommendations outlined below. Dive operators may instead choose to contract out repair services. In such cases, the recommendations outlined below should be used in assessing and selecting an external service center.
Trained personnel	Specific knowledge and skills are required to correctly and safely service diving equipment. Dive operators are responsible for ensuring that any personnel appointed to do such work are competent to perform it. Competence cannot be assumed without a formalized training and certification process.	4	Dive operators should ensure that only technicians who are adequately trained and competent are allowed to repair, service, and maintain diving equipment. Technicians should be appointed in writing, and their roles and responsibilities should be clearly spelled out. Dive operators may want to consider the use of an external service for the repair or servicing of especially complex equipment.
Infection control	Equipment delivered for servicing may be contaminated with microorganisms, especially at times when infections are prevalent.	3	Technicians should receive appropriate training in Infection control, be provided with the required PPE, and follow the required procedures developed for safe equipment servicing activities.
Access to restricted areas	Ensuring customer and public safety requires controlling unauthorized access to risky areas, such as the equipment repair workshop.	3	Dive operators should restrict access to the workshop; only authorized technicians should be permitted to enter the area. Technicians should receive specific training, including in risk awareness, before they are allowed to enter the workshop. The workshop should be secured, and/or clear restricted-access signs should be posted, as applicable to the setting.
Clean and orderly workspaces	It is easy to make mistakes, damage equipment or machinery, or be unable to complete repairs properly if work spaces are unclean, cluttered, and/or filled with irrelevant gear or materials.	2	Dive operators should ensure that the repair workshop is always clean and orderly and that all tools and materials are allocated to specific places.

Equipment Repair Workshop			
Element	**Risks**	**RL**	**Recommendations**
Lighting	Poor lighting in a workshop represents a safety risk as follows: • repairs, assembly work, or adjustments on life-support diving equipment may be done improperly, potentially resulting in diving accidents or mishaps with HP equipment; • staff may be injured due to mishaps with tools and/or chemicals; • staff may be more prone to tripping or dropping tools or dive gear; and • staff may experience occupational injuries, including eye strain, poor posture, and/or headaches.	3	Dive operators should ensure that repair workshop lighting is conforms at least to the recommended minimum level of 250 lux. In shops where especially complex or precise work is performed, lighting levels may need to be at 750 lux or even higher. (See Appendix B.)
Ventilation	Poorly ventilated, humid, and excessively warm environments reduce staff members' ability to concentrate, potentially leading to mistakes in their work. Tools and materials in the workshop may also corrode or deteriorate more rapidly in a poorly ventilated space.	3	Dive operators should ensure adequate ventilation in workshop areas. If natural ventilation is used, a policy should be set to ensure that doors, windows and vents remain open as much as possible.
Ergonomic workbench	An unergonomic workbench may cause long-term posture or health issues for staff, compromising their ability to complete tasks that require focus and thus leading to poorly serviced or improperly repaired equipment.	3	Dive operators should ensure that the workbench is set at an ergonomic height and conforms to the standards of a standing workstation.
First-aid kit	Accidents can occur whenever people are working with tools, chemicals, machinery, and/or pressurized equipment, as is the case in an equipment repair workshop. Any resulting injuries may require rapid first aid.	3	Dive operators should ensure that an appropriate first-aid kit is available in or near the workshop. Its location should be clearly indicated, preferably with the internationally recognized green cross on a white background, and it should be easily accessible.

Equipment Repair Workshop			
Element	**Risks**	**RL**	**Recommendations**
Hazardous chemicals	Cleaning materials and other chemicals used in a workshop may contain toxic, corrosive, or flammable elements. The use of such substances involves a risk of fire, as well as of injuries or diseases due to either excessive one-time exposure or cumulative exposure to staff members' skin, eyes, or airways.	4	Dive operators should ensure that manufacturers' warning notices for all chemical substances used in the workshop - together with the relevant (Material) Safety Data Sheets [(M)SDSs] - are readily available. These documents should be reviewed to identify any relevant hazardous effects. Workshop staff should comply with all applicable regulations regarding the use of hazardous chemical substances in the workplace.
Personal protective equipment (PPE)	Workshop activities may include the use of various hazardous tools and materials, including the following: • sharp hand tools; • machine tools; • heavy equipment (e.g., cylinders); • noisy equipment; • corrosive and toxic substances; and • flammable substances.	3	Dive operators should ensure that a workshop risk assessment is conducted to determine what PPE is required. Such equipment may include, as appropriate: • eye protection (safety glasses, guards, and/or goggles); • hearing protection (ear muffs or plugs); • skin protection (gloves); • foot protection (safety shoes); • respiratory protection (respirators or protective inhalators); and/or • protective clothing (coveralls).
Implementation of PPE	Inconsistent use or misuse of PPE - whether due to a lack of knowledge regarding its correct use and/or a lack of understanding about the reasons for PPE - may negate the potential protective effects of such equipment. Yet providing staff with education and training regarding PPE is not sufficient; dive operators should also enforce its consistent use. If staff suffer injuries and/or chronic health problems due to inconsistent use or misuse of PPE, the dive operator may be held responsible and be subject to compensatory actions.	3	Dive operators should ensure that all staff receive adequate education and instruction in the correct use of PPE, including the reasons for its use. The use of PPE for all relevant activities should be mandatory. In addition, regular inspections should be conducted to confirm the consistent use of PPE. Personnel found not using PPE should be counseled, retrained, and reinstructed. If noncompliance with PPE use continues, dive operators should take appropriate disciplinary action and should carefully document those actions.

Equipment Repair Workshop			
Element	**Risks**	**RL**	**Recommendations**
Electrical system	Poorly laid out and inappropriately connected electrical devices and tools represent a risk of electrocution. Untidy wiring and/or excessive use of extension cords represent a risk of tripping. An electrical system prone to sparking represents a fire risk, due to the presence in workshops of flammable solvents and cleaning solutions.	3	Dive operators should ensure that the workshop's electrical system has been safely installed, that all out lets are equipped with ground fault protection, and that all wiring is trip-proof and neat. The use of multiple adaptors and extension cords should be reduced as far as practicable. Dive operators should also comply with all national and/or regional electricity regulations, especially regarding circuit breakers and ground fault protection.
Oxygen-safety procedures	The elevated levels of oxygen present in workshops represent a fire risk. Any sparking, heat source, or chemical reaction may trigger combustion more easily in the presence of elevated levels of oxygen. Any gas containing more than 23.5% oxygen is considered to be oxygen-enriched and should be considered as if it were pure oxygen (i.e. more than 99% oxygen). Equipment that is exposed to elevated levels of oxygen - if it is contaminated with hydrocarbons or other flammable substances, or dust or other particulate matter - may trigger combustion. Certain materials may degrade, give off harmful gases, or oxidize more rapidly in the presence oxygen.	4	Dive operators should ensure that safe oxygen-handling procedures are followed in the workshop and that oxygen is regarded as a potential source of fire and health issues. Appropriate cautions include the following: • cleaning of equipment for use with oxygen use should be done according to approved procedures; • equipment that may be exposed to oxygen should be handled appropriately so it does not become contaminated; • care should be taken to use only materials, lubricants, and cleaning solutions that are compatible with oxygen; • oxygen cleaned equipment should be suitably packaged in protective material; • the release of oxygen in any area should be done with care, taking the risk of fire into consideration; • the area should be well ventilated; • open flames (also known as naked flames) or heated surfaces (typically above 140°F [60°C]) should be avoided in the presence of oxygen; • any volatile compounds or combustible materials should be removed from the area; and • if any doubt exists regarding the workshop's capabilities, the maintenance, servicing, and/or repair of oxygen-handling equipment should be contracted out to an appropriate external service.

Equipment Repair Workshop			
Element	**Risks**	**RL**	**Recommendations**
Fire-safety procedures	Equipment, spares, and tools in the workshop are at risk in the event of a fire; particular care should be taken with protecting customers' equipment. The presence of volatile cleaning chemicals elevates the fire risk. If the workshop is located in a small or confined space, staff may suffer smoke inhalation, burns, and/or other injuries if a fire is not controlled quickly.	4	Dive operators should take the following steps to prevent fires and to mitigate injuries and damage if a fire does occur: • analyze and actively manage all fire risks; • establish appropriate fire-fighting procedures; • place fire extinguishers and other firefighting equipment in easily accessible locations; • select appropriate fire-extinguishing agents based on the chemicals used in the workshop; • ensure that fire extinguishers are unexpired; • clearly indicate the location of fire extinguishers and exit routes; • consider installing fire detectors, especially in areas where there is a higher risk of fire; • enforce a no-smoking policy; and • install appropriate, clearly visible signage to alert staff and the public to fire risks.
Compressed-air procedures	Cleaning equipment or surfaces using compressed air may be convenient but can result in injuries to the eyes or other body parts and/or damage to machinery or equipment. The quality of compressed air may not be appropriate for use near enriched-oxygen equipment.	3	Dive operators should ensure that care is taken with the use of compressed air in cleaning equipment or workshop surfaces. Particular caution should be taken regarding the potential presence of hydrocarbons in the compressed air, to avoid contaminating enriched-oxygen equipment. Only oxygen-compatible air (OCA)* should be used on oxygen-enriched equipment or in any oxygen-enriched environment (e.g., for drying such equipment after it has been cleaned). * The allowable concentration of oil in OCA is less than 0.1 mg/m^3. (See Appendix G.)
Eating and drinking procedures	The presence of food and drink in the workshop, especially any foods containing oil or other oleaginous products, may contaminate equipment and/or tools. If staff eat or drink in the workshop, there is also the potential that they may accidentally ingest cleaning chemicals, adhesives, lubricants, or other substances that may be toxic, even in small amounts.	2	Dive operators should prohibit any eating or drinking in the workshop. Staff should always wash their hands well after working on equipment, prior to eating or drinking. Similarly, they should always wash their hands well after eating or drinking, prior to working on equipment.

Equipment Repair Workshop			
Element	**Risks**	**RL**	**Recommendations**
Workshop log	Without detailed workshop records, it is difficult to attest to the state of equipment that has been serviced, repaired, or maintained once it has left the workshop. Dive operators may be exposed to liability for damage or injuries incurred using equipment serviced in the workshop, if sufficiently thorough records are lacking. Inappropriate recording or handling of failure reports, or of complaints about the performance of equipment serviced in the workshop, may expose dive operators to legal or financial liability.	2	Dive operators should ensure that thorough and accurate logs are kept regarding all equipment that is repaired, serviced, oxygen cleaned, or inspected. The logs should include information such as the technician's name, the date, the work done, any parts replaced, and any cleaning processes undertaken. Dive operators should also institute a system to ensure that the failure of any equipment serviced in the workshop is reported immediately and addressed promptly. All logs and failure reports should be retained and be available for review or audit purposes.

Vehicle Safety			
Element	**Risks**	**RL**	**Recommendations**
Registration or licensing	The use of vehicles for transporting customers or for other business-related purposes requires compliance with all relevant national or regional regulations. The safety of staff and customers should be the top priority. If all relevant regulations are not followed, dive operators may be subject to legal sanctions and/or claims for injuries or damages.	4	Dive operators should ensure that all regulations pertaining to the commercial use of vehicles are clearly understood by anyone who drives vehicles owned by the business. All vehicles, including trailers, should be registered and licensed in accordance with the jurisdiction's regulations.
Roadworthiness	Registration and/or licensing standards may require vehicles to be inspected for roadworthiness and to be maintained in a roadworthy state. Any damage or injuries involving unroadworthy vehicles may expose the driver and/or the dive operator to legal and/or financial liability.	4	Dive operators should be aware of their jurisdiction's requirements for roadworthiness and should ensure that all the business's vehicles are maintained according to those requirements.
Vehicle insurance	The use of uninsured or inadequately insured vehicles may expose the driver and/or the dive operator to liability for any damage, injuries, or fatalities if the vehicle is involved in an accident. Many jurisdictions have mandatory insurance requirements; failure to comply with such requirements may expose the driver and/or the dive operator to criminal prosecution.	4	Dive operators should ensure that all vehicles are appropriately insured for their intended use, including, as applicable, off of public roads or thoroughfares. Liability coverage should be regarded as mandatory, whereas coverage for physical damage may be regarded as optional.
Licensed drivers	The use of an unlicensed driver could subject both the driver and the dive operator to penalties. Many jurisdictions require that any person who conveys paying passengers, whether the payment is rendered directly or indirectly, must possess a valid for-hire license (known in some jurisdictions as a transport license). Any person who drives vehicles that are over a certain size; designed to transport heavy loads; intended to pull boats or trailers; or used in off-road, beach, or other recreational settings may also need to have a specific driver's license (known in some jurisdictions as a commercial license).	4	Dive operators should ensure that all drivers of vehicles owned by the business have a valid driver's license, compatible with the intended use of the vehicle. Dive operators should also: • copy all such licenses and keep the copies on file; • assess the validity of all licenses; and • regularly monitor the expiration dates of all licenses.

Vehicle Safety			
Element	**Risks**	**RL**	**Recommendations**
Policy regarding alcohol and drug use	Without a specific policy prohibiting staff from driving vehicles owned by the business when under the influence of alcohol or performance-affecting drugs, dive operators may be held accountable for any accidents that occur while a driver is under the influence. The mere existence of such a policy is not sufficient, however. Dive operators may also be held accountable if the policy is not enforced, and any transgressions are not dealt with duly and consistently.	4	Dive operators should establish and enforce a policy prohibiting staff members from operating vehicles owned by the business while they are under the influence of alcohol or drugs. Anyone found to be under the influence of alcohol or drugs should be prohibited from using any vehicles owned by the business. Anyone found to be under the influence of alcohol or drugs while driving a vehicle, either as they are operating the vehicle or within a specified period of time afterward, should be disciplined appropriately. In settings where driving under the influence is prevalent, the policy should specify that the dive operator has the right to periodically screen staff for alcohol or drugs.
EAPs	Emergency situations often unfold rapidly and rarely allow those present to evaluate the situation and decide on a suitable response. The establishment of EAPs covering likely vehicle accident scenarios can mitigate the risks involved. The mere existence of EAPs is not sufficient, however. EAPs that are drafted in theory but never practiced may be ineffective, due to issues such as the complexity of a given emergency, the number of injured passengers or pedestrians, the severity of their injuries, a lack of access to police or emergency medical services, the remoteness of the setting, etc. Lack of training and lack of consistency in carrying out EAPs can expose a dive operator to legal liability.	5	Dive operators should establish EAPs covering vehicle-specific emergencies; the plans should be based on an assessment of the relevant risks and should be documented and drilled. Emergencies covered by such plans may include the following: • accidents that result in injuries or death; • vehicular fires; • aggressive behavior by customers, staff, or outsiders (including hijackings); • arrests for legal transgressions; • seizures of vehicles; and • procedures for communications and recoveries in remote areas.
Passenger-safety procedures	If passengers are inappropriately situated in or on vehicles, they are more likely to be injured if vehicles make sudden movements or are involved in an accident. In many jurisdictions, regulations govern where passengers must sit in motor vehicles. If regulations as to where passengers must be seated are not enforced, dive operators may be subject to legal or financial liability.	4	Dive operators should require all passengers in vehicles owned by the business to sit on an appropriate seat. No passengers should be allowed to: • be transported on a trailer; • sit on the edge of an open vehicle or in the back of a pickup truck; and/or • stand in or on a vehicle while it is in motion.

Vehicle Safety			
Element	**Risks**	**RL**	**Recommendations**
Use of seat belts	The use of seat belts is mandatory in most jurisdictions. Even though many dive sites are located away from public roads, the protection of passengers remains the responsibility of the dive operator. Failure to enforce relevant seat belt laws may subject operators to legal liability.	4	Dive operators should ensure that passengers in vehicles owned by the business use their seat belts in the following circumstances: • if the vehicle is being driven on a public road or in public areas; or • if the vehicle is capable of being driven faster than 15 miles an hour (20 kilometers an hour). Noncompliant passengers should be instructed to use their seat belts. Drivers should be allowed to refuse to transport any passenger who does not comply with seat belt instructions.
Servicing of vehicles	Accidents or other untoward events caused by improper or deficient vehicle maintenance may place dive operators at risk of claims for damages.	3	Dive operators should ensure that all vehicles owned by the business are serviced regularly and in accordance with the manufacturers' requirements. If a given locale subjects vehicles to conditions more severe than is typical, dive operators should consider instituting additional maintenance procedures. Vehicles should be cleaned regularly.
Cylinder-transport procedures	If HP cylinders are handled improperly or roughly during loading, transport, or unloading, there is a risk of rupture and uncontrolled release of compressed air. If damage or injury occurs as a result of such a breach, dive operators may be subject to legal or financial liability.	4	Dive operators should ensure that cylinders are transported in a suitable vehicle, such as a truck; are placed outside the driver/passenger compartment; and are secured so as to minimize cylinder movement and damage to valves. Care should be taken to avoid dropping, banging, or otherwise abusing cylinders. Cylinders should not be exposed to extreme heat or stored in a vehicle for long periods.

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Travel and Health Advice for Customers			
Element	**Risks**	**RL**	**Recommendations**
Dive operators should advise customers (and other visitors) about health, safety, financial, and other relevant considerations before they make reservations and travel plans for a dive excursion. Excessive advisories may deter some customers from making a reservation; however, insufficient advisories may expose operators to liability claims for nondisclosure of known or expected risks. Dive operators should strike a suitable balance between over- and under-admonishments, being mindful of the health and safety of all parties and of the risks and benefits involved in any course of action.			
Health and Safety			
Insurance	Dive operators may be exposed to liability, as well as potential negative publicity, if injured customers cannot be treated or evacuated because they have neither sufficient insurance coverage nor the financial resources to pay directly for their medical care and/or evacuation. Operators may face the prospect of business disruption if they have to cease activities while evacuating an injured customer. Operators may also be liable for the cost of emergency medical services if a customer receives care but is unable to pay for it. These considerations may be especially applicable if a dive excursion to a remote area or a liveaboard excursion is sold as a package deal.	2	Dive operators should advise all customers to carry adequate insurance and to specifically check these factors of their coverage: • that their health insurance policy covers injuries incurred while diving (and whether that coverage is subject to depth restrictions); • that their health insurance policy or a separate policy covers medical evacuations; • that they also consider carrying general travel insurance; and • that none of their policies include geographical limitations relevant to their intended excursion - especially regarding evacuations, which may be very expensive or even impossible in some remote areas. Some dive operators may need to purchase special insurance products to cover their customers, such as if their operation is vulnerable to specific risks that may not be covered by typical dive and travel insurance products.

Travel and Health Advice for Customers			
Element	**Risks**	**RL**	**Recommendations**
Vaccinations and endemic diseases	Dive operators have a responsibility to be aware of vaccination requirements for diseases endemic in their region and to inform customers of those requirements. If a traveling diver makes travel plans or arrives in a country without having received such notification, the dive operator could be subject to cancellation claims if the customer is denied entry or asked to leave prematurely.	3	Dive operators should advise customers of applicable vaccination requirements (as well as recommended prophylactic measures) for diseases endemic in their region — such as hepatitis, typhoid, cholera, yellow fever, malaria, etc. Customers should be advised to carry documentation of their vaccinations with them while they are traveling. Visitors to some regions may need proof of having been vaccinated against yellow fever to be allowed to re-enter their own country. Customers should also be advised to consult with their home country's national health agency (e.g., the Centers for Disease Control and Prevention [CDC] in the United States) regarding vaccinations and medications either required or advised given their travel plans. (See Appendix H for a partial list of relevant diseases, carriers of those diseases, and available vaccinations.)
Travel health advice	Some remote and/or undeveloped regions may have limited, unacceptable, or even no health-care facilities. Certain medications (e.g., for chronic conditions) may be hard to obtain or completely unavailable in some locales. Traveling divers may be debilitated by high-altitude travel, flights in unpressurized aircraft, or turbulent flights, especially while traveling to remote areas. Visitors (as well as staff) may be exposed to variety of conditions — including water-borne illnesses, allergies, insect bites, rabies, and/or sexually- transmitted diseases — that can cause discomfort or illness. Dive operators may be subject to liability if they fail to inform their clientele about the possibility of such exposures.	2	Dive operators should advise customers about the status of the local health infrastructure, the availability of medications, and the proximity of medical practitioners. They should encourage customers to bring with them a supply of any medications they use regularly in a quantity sufficient for the entire trip, including in the event of delays due to weather or transportation problems. If applicable, they should also advise customers to bring medication for altitude sickness and motion sickness. Any documentation or written advisories about the excursion should clearly note any health issues prevalent in the locale.

Travel and Health Advice for Customers			
Element	**Risks**	**RL**	**Recommendations**
Vector-borne diseases	Animal and insect bites may be prevalent in certain regions. Dive operators may be subject to liability if they fail to inform traveling divers about appropriate precautions.	2	Dive operators should inform customers to bring with them insect repellents, clothing, and insect nets appropriate for the locale. Customers with certain allergies and/ or subject to reactions from bites should be advised to bring with them any relevant emergency response medication(s).
Local dangers, annoyances, and security concerns	Criminal activities, the need to secure personal possessions, the prevalence of street hawkers, the busyness of public thoroughfares, and related annoyances such as noise are more common in some locales than others. Such concerns may be especially prevalent in remote and/or undeveloped locales. There is a risk of traveling divers becoming disgruntled if they do not receive sufficient prior notice about such concerns, allowing them to arrive informed and prepared. Additional on-site warnings may also be advisable. There is also a risk of dive operators being held liable for any theft or discomfort that their customers may experience as a result of being unprepared.	2	Dive operators should inform customers in advance about the prevalence of theft in the region; brief them thoroughly about security upon their arrival; and recommend that they take the following actions, as applicable: • pay especially careful attention to their personal possessions; • use their room safe; • keep the doors and windows of their room locked when they are not in the room; • secure their dive gear when it is unattended (e.g., while it's drying on a balcony or in a public area); and/or • avoid bringing expensive items (e.g., jewelry or electronic devices) with them. Dive operators should also consider the use of secure transportation services, fencing, and/or guards if any aspects of the dive site's locale represent a risk to customers' safety.
Sunburn and dehydration	Traveling divers may underestimate or even ignore the repercussions of being outdoors for extended periods in regions with intense sunshine and high UV levels. If visitors do not protect themselves adequately from the sun, there is a risk that they may experience sunburn, heat-stroke, and/or dehydration severe enough to require evacuation to a medical facility. However, some means of sun protection entail other risks. For example, certain lotions and chemical ingredients in sunscreens may be toxic to particular environments, both in and out of the water (e.g., coral reefs).	3	Dive operators should inform customers about the need to protect themselves from the sun, including as follows: • that it is important to stay hydrated; • that the most effective sun protection may include long-sleeved shirts, long pants, hats, and sunglasses; • that they should be sure not to forget to protect their feet; • whether a sunscreen with an especially high SPF is advisable in that locale; and/or • if sunscreen products need to be used, staff and visitors should be educated in ensuring the use of ecofriendly (oxybenzone- and octinoxate-free) sunscreen products. Dive operators should also consider providing free, conveniently placed drinking water to ensure customers' compliance with hydration advisories.

Travel and Health Advice for Customers			
Element	**Risks**	**RL**	**Recommendations**
Availability and cost of health-care services	If a locale's health-care facilities are limited or unreliable, injured or ill traveling divers, including those with pre-existing conditions, may face delays and/or high costs in accessing care. In the event of such delays, dive operators may be subject to business disruptions and/or legal liability. Dive operations with an international customer roster are subject to the risk that language barriers may impede the provision of medical care.	2	Dive operators should inform customers, before they make a reservation, as to the availability and cost of health-care services in the region. Customers with pre-existing medical conditions should be advised to take particular note of any deficiencies in the medical infrastructure before they make their travel plans. Customers should also be told the typical cost at local facilities for treatment of common dive medical conditions and other common health concerns. If familiarity with a particular language is required to obtain medical services, this fact should be disclosed to customers in advance. They should be informed that staff may be able to help with translation, but that such assistance cannot be guaranteed.
Access to EMS and/or evacuation services	Even if dive operators have established appropriate and well-considered in-house medical and safety measures, external emergency medical care and/or evacuation may still be needed on occasion. Difficulties in overcoming limitations due to a site's remoteness or other challenges, especially if those limitations have not been disclosed to customers, may expose dive operators to liability.	3	Dive operators should inform customers, before they make a reservation, as to the availability of EMS and evacuation options in case of an emergency. Operators should also inform customers about in-house resources, such as either capabilities or limitations in providing supplemental oxygen while an injured diver awaits evacuation. Customers with known medical issues should be specifically informed about any EMS or evacuation limitations. Customers with known medical issues should also be advised to dive more conservatively, as befits their circumstances, and any operator-organized dive plans should be adjusted accordingly.

Travel and Health Advice for Customers			
Element	**Risks**	**RL**	**Recommendations**
Local food and water supply	Food and water are common sources of health issues experienced by travelers, including so-called “traveler’s diarrhea” and food poisoning. Considerable national and regional variations exist in the safety of water supply systems and foodstuffs, in accepted cleanliness levels, and in public health and sanitation practices. Dive operators who fail to inform their clientele about any local deficiencies in these areas may face liability claims as a result — especially since the local populace may have developed immunity to indigenous pathogens, which could lull visitors into a false sense of safety regarding local food and water.	3	Dive operators should inform customers whether it is safe to drink local tap water. If it is not safe to drink local tap water, dive operators should provide customers with bottled water. Dive operators should inform customers what foods it is advisable to avoid (e.g., fresh produce, mussels or clams affected by red-tide toxins, fish species apt to cause ciguatera or scombroid poisoning, etc.). The affected foods may vary daily or seasonally. If it is not safe to drink local tap water, customers should be advised to avoid any fresh produce unless they can be certain that it was washed using potable water. If any doubt exists as to whether ice might have been made from unsafe tap water, customers should be advised to avoid iced drinks.
		3	This information should be a part of the standard orientation for all customers and other visitors — before as well as upon their arrival. Dive operators should also stock a suitable supply of medications for treating food- and water-borne illnesses and should train staff in how to administer such treatments, as part of their risk-mitigation preparedness.

Travel and Health Advice for Customers			
Element	**Risks**	**RL**	**Recommendations**
Post-excursion health advisories	Some medical conditions (e.g., parasites) may remain dormant or otherwise not be evident until a period of time has passed. This may mean customers have returned home by the time symptoms are apparent. If traveling divers have not been advised about symptoms to watch for, dive operators may be held responsible for any subsequent medical problems.	3	Dive operators should advise customers that if they feel unwell after returning home, they should visit their local travel clinic or medical practitioner or consult with an appropriate advisory service (e.g., DAN's medical information line or their home country's equivalent of the U.S. CDC). This is especially important for customers who may have been exposed to any tropical or endemic diseases or who may have consumed water or foodstuffs of an uncertain or potentially toxic nature. Customers should be informed that seeking expert advice as early as possible will maximize their likelihood of a positive outcome. Operators should consider also providing customers, upon their departure, with written information on the symptoms of any endemic diseases that they might have been exposed to. This will not only be useful to customers in deciding whether to seek medical advice, but it may also assist medical personnel in diagnosing the problem if it involves conflicting symptoms or symptoms unfamiliar in the customer's home country.
Monetary and connectivity information			
Overall costs	Traveling divers may have mistaken expectations about the overall costs they are likely to incur, especially if they want to undertake side excursions. Dive operators who do not inform their clientele about such costs risk having unhappy customers.	1	Dive operators should inform customers about the typical costs of all amenities not included in their excursion fee — including taxis, food, restaurants, shopping, and side excursions.
Tipping customs	If traveling divers are unfamiliar with local tipping customs, they may tip inappropriately. If their tips are below local expectations, visitors may receive poor service; on the other hand, excessive tips may set up inappropriate expectations locally for the future.	1	Dive operators should inform customers about local customs for tipping waiters, hotel and dive staff, taxi drivers, etc.

Travel and Health Advice for Customers			
Element	**Risks**	**RL**	**Recommendations**
Currency matters	Traveling divers may not be aware that in some regions, all transactions are in cash. Visitors from other countries may not have ready access to a money-changing service upon their arrival and thus may need to bring with them a certain amount of the local currency. Some money-changing services or practices may take advantage of visitors unfamiliar with local practices. Dive operators who do not inform their clientele about such matters risk having unhappy customers.	1	Dive operators should inform customers about relevant local monetary matters, including the following: • what currency to use; • typical exchange rates (or typical ranges, if they fluctuate regularly); • how much cash to arrive with; • the best places to exchange money; • typical money-changing commissions; • typical currency-conversion practices; and/or • advisable safety practices when obtaining and dispensing cash.
Automated teller machines (ATMs)	Many travelers may expect that they can easily obtain cash from an ATM. However, this may not be possible in some locales for various reasons - including because ATM use is not efficient with certain currencies; because there may be few ATMs in the vicinity; and/or because withdrawing cash from an ATM may pose a security risk. Dive operators who do not inform their clientele about such matters risk having unhappy customers.	1	Dive operators should inform customers about the availability of, the recommended use of, and limitations on using ATMs.
Cash	The use of credit and debit cards, traveler's checks, money orders, and money wiring services can vary widely from one country to another; in some locales, noncash options may not be available at all, while in others they may be restricted or costly. Dive operators who do not inform their clientele about such matters risk having unhappy customers.	1	Dive operators should inform customers about local practices regarding the use of cash, including how much cash they are likely to need for expenditures such as snacks, restaurant meals, fuel, vehicle rentals, and other services.
Credit cards	Not all credit card types may be accepted by the dive business. Dive operators who do not inform their clientele about such matters risk having unhappy customers.	1	Dive operators should inform customers in advance about the business's credit card policy, including any related charges.

Travel and Health Advice for Customers			
Element	**Risks**	**RL**	**Recommendations**
Local electrical system	Ignorance about or ill-informed use of devices that are incompatible with the local electrical system may result in destruction, damage, fire, or injuries. Also, travelers who are unaware of local electrical standards may be unhappy by their inability to use devices they brought with them.	1	Dive operators should inform customers in advance about the local electrical system, including its voltage, for example: • 100/120 volts, as in the U.S., or • 220/240 volts, as in Europe) and • frequency (e.g., 60 hertz (Hz), as in the U.S., or 50 Hz, as in Europe). Customers should be told what type of power adapters and/or plug adapters they will need in order to access the local power system and safely use their electrical devices.
Cellular data and/ or wi-fi service	Modern travelers expect reasonable access to the internet via either or cellular data or wi-fi service. Dive operators who do not inform their clientele about any connectivity deficiencies risk having unhappy customers.	1	Dive operators should inform customers about the existence of or potential for any of the following: • lack of internet service; • restricted access to internet service; • charges for internet service; • need for an adapter or enabling device to obtain internet service; and/or • any other internet restrictions.

Travel and Health Advice for Customers			
Element	**Risks**	**RL**	**Recommendations**
Documentation (visas, passports, etc.)			
Visa, passport, and length-of-stay requirements	Visa requirements* vary greatly between countries - based on travelers' passport/citizenship, as well as the country(ies) they plan to visit - and are subject to change.	2	Dive operators should be familiar with relevant visa and length-of-stay requirements, so they are able to advise customers on such matters before they book and pay for a trip. Operators should review these requirements regularly, as visa specifications especially are subject to change. Operators should also establish a clear policy specifying under what circumstances they will offer no refunds or limited refunds to customers who fail to heed visa and other travel-document regulations or who are prohibited from traveling upon their departure or denied entry upon their arrival as a result of visa-related problems.
	*Visa considerations: Some travel connections may require specific visas. Travelers may need specific documents issued by the dive operator in order to obtain some visas. Some visas may take a week or more to obtain. Some visas involve very specific conditions, including regarding lengths of stay. Some visas may be costly. Some passports require a certain number of pages to still be blank upon travelers' arrival. Some passports require a certain number of months of validity remaining upon travelers' arrival and/or departure. Some countries have specific rules about travel documentation for accompanying minors. Travel agents and airlines do not always advise travelers regarding required documentation before they make their reservations and sometimes will even allow travelers to depart without the correct documentation in hand. If customers must cancel their trip due to travel-document problems, they may incur financial penalties and may be unhappy with the dive operator as a result. In such cases, the right of dive operators to refuse to issue refunds may depend on their having provided customers with the correct information about required travel documentation.		
Drivers' licenses	Driver's license requirements vary from country to country*.	1	Dive operators should advise any customers who intend to rent a motor vehicle about local driver's license requirements, including whether they need to obtain an International Driving Permit to drive and/or to obtain valid insurance coverage.
	*Driver's license considerations: Countries may have different age restrictions on driving privileges. Licenses from one country may not be accepted in another country. Specific license endorsements may be required in some countries, to avoid insurance restrictions and/or increased liability exposure.		

Travel and Health Advice for Customers			
Element	**Risks**	**RL**	**Recommendations**
Vaccination cards	Entering certain countries may require an up-to-date vaccination/inoculation card. Returning to certain countries from specific other countries may require proof of vaccination/inoculation against particular disease(s).	3	Dive operators should advise customers if they will be required to present a certificate of vaccination (e.g., for yellow fever) upon entering the country or upon returning to their home country.
Customs	Every country has its own customs requirements; the type, value, and amount of goods allowed to enter or leave a country may vary. A country's declaration process may require either advance permission to bring certain equipment into the country (e.g., laptop computers, cameras, and/or dive gear), or proof of its prior purchase. Impermissible, excessive, or illegal goods may be subject to seizure and forfeiture and/or may subject the traveler to a fine or even imprisonment. Dive operators who do not inform their clientele about relevant customs matters risk having unhappy customers.	2	Dive operators should inform customers about any restrictions on goods or consumables (e.g., fresh produce) that may be brought into or out of the country. They should also inform customers of any restrictions on the amount of currency that may be brought into or out of the country.
Baggage and personal effects	Diving destinations generally allow travelers to temporarily import their scuba gear. However, some modes of transportation, especially small planes, may impose weight limits on travelers' baggage. Personal effects are usually permitted, but restrictions may apply in some locales to certain medications or equipment. Travelers who must carry certain drugs with them may be required to present a doctor's prescription upon request. Dive operators who do not inform their clientele about relevant baggage regulations risk having unhappy customers.	2	Dive operators should attempt to determine well in advance what travelers plan to bring with them. They should advise customers about baggage restrictions or limitations on domestic and international flights to the destination — especially with regard to scuba gear. They should advise customers of any restrictions on items that visitors might consider "personal effects," especially with regard to sedative or pain-relief medications such as codeine and other opioids. As relevant, they should advise customers to bring with them substantiating documentation, such as certificates or prescriptions.

Travel and Health Advice for Customers			
Element	**Risks**	**RL**	**Recommendations**
Transportation			
Boat travel	Traveling divers may have limited knowledge or expectations as to how they will travel to the dive destination. Visitors' ability to access local surroundings by boat for nondiving activities may be restricted; if they are not aware of such restrictions, they may suffer dashed expectations. Dive operators who do not inform their clientele about boating requirements and options risk having unhappy customers.	2	Dive operators should inform customers in advance if getting to the dive destination requires traveling by boat, and if so what type of watercraft to expect and whether there is any additional cost involved. They should also inform customers about any restrictions on access by boat to surrounding areas and explain any requirements for renting boats or other watercraft.
Cars and motorcycles	Traveling divers may have limited knowledge or expectations as to how they will travel to the dive destination. Visitors' ability to access local surroundings by motor vehicle for nondiving activities may be restricted; if they are not aware of such restrictions, they may suffer dashed expectations. If visitors wish to drive on their own, a lack of familiarity with local road usage and driving practices may increase their risk of an accident.	2	Dive operators should inform customers in advance if getting to the dive destination requires traveling by road, and if so what type of vehicle to expect and whether there is any additional cost involved. They should also inform customers about any restrictions on motor vehicle access to surrounding areas and explain any requirements for renting cars and other vehicles. Dive operators should advise any customers who rent motor vehicles about appropriate safety measures, local driving practices, and likely motoring risks.
	The use of motorcycles, mopeds, or scooters may be especially hazardous, and insurance coverage for such vehicles may be difficult or impossible to obtain. Dive operators who do not inform their clientele about motor vehicle requirements and options risk having unhappy customers.	2	If the use of motorcycles, mopeds, and/or scooters is prohibited by customers' insurance coverage, dive operators should discourage them from using such vehicles.
Air travel	Traveling divers may have limited knowledge or expectations as to how they will travel to the dive destination. Visitors' ability to access local surroundings by plane for nondiving activities may be restricted; if they are not aware of such restrictions, they may suffer dashed expectations. Dive operators who do not inform their clientele about air travel requirements and options risk having unhappy customers.	2	Dive operators should inform customers in advance if getting to the dive destination requires air travel, and if so what type of aircraft to expect and whether there is any additional cost involved. They should also inform customers about any restrictions on access by plane to surrounding areas and explain any requirements for traveling by air to other areas.

Travel and Health Advice for Customers			
Element	**Risks**	**RL**	**Recommendations**
Vehicle-rental options	Traveling divers may have limited knowledge or expectations as to local options for renting a motor vehicle, if they wish to get around by themselves. Dive operators who do not inform their clientele about vehicle-rental options risk having unhappy customers.	1	Dive operators should advise customers about local options for renting cars or motorcycles, and the costs involved, in case they wish to explore the surrounding area. See the Documentation section above for recommendations involving driver's licenses.
Local weather information	Traveling divers may have limited knowledge or expectations as to the local weather and climate and as a result may bring inappropriate clothing with them.	1	Dive operators should inform customers about the locale's general climate, as well as typical weather conditions during the period of their visit, and should recommend what clothing is advisable for both protection and comfort (e.g., windbreakers, rain gear, warm clothing, sun-protective clothing, hats, jackets, etc.).
Best times of year to travel	Variations in weather conditions may affect traveling divers' options for diving and/or touring. Travelers' preferences regarding acceptable weather conditions may vary, especially if the timing of their vacation is limited. Dive operators who do not inform their clientele about the pros and cons of traveling at various times of year risk having unhappy customers.	1	Dive operators should inform customers about the best times of year to meet their stated intentions, as well as at what times of year it would be advisable to avoid traveling to the destination. Operators should clearly explain the likelihood of typhoons, hurricanes, cyclones, tropical storms, high winds, rough seas, and/or heavy rains at various times of year. Operators should establish a policy covering situations in which diving or a dive excursion (e.g., a liveaboard) must be canceled, curtailed, or changed as a result of weather conditions.
History and culture			
Local history	Traveling divers may have limited knowledge or expectations as to local laws and customs; expected behavior at local sights and religious structures or other places of worship; and expected attitudes toward local populations. If travelers fail to heed local conventions, whether willfully or due to ignorance, they may be confronted, abused, or even arrested.	1	Dive operators should inform customers about the history, laws, and customs of their destination. The reasons for local customs should be explained, so visitors will understand the rationale for locally acceptable behavior. Visitors should be informed how to behave respectfully toward local sights, populations, and religious structures or other places of worship. If the use of alcohol is restricted or prohibited in the jurisdiction, customers should be advised accordingly.

Travel and Health Advice for Customers			
Element	**Risks**	**RL**	**Recommendations**
Language	Traveling divers may have limited knowledge about the wide variety of languages spoken within the diving world. If visitors have unrealistic expectations about their ability to communicate with personnel at local restaurants, shops, rental agencies, transport services, and even at the diving operation, it may lead to restrictions or limitations on their activities.	1	Dive operators should inform customers what languages are spoken in the area. They should explain how customers may access translators or receive diving instruction in language(s) they can communicate in. In locales where significant language restrictions exist, operators should prepare alternative instructions as to how customers can access diving amenities, as well as local transportation options, restaurants, and other services.
Clothing customs	In some regions, religious or cultural practices restrict or govern the types of clothing permitted to be worn in public, and in some regions dress restrictions may even be enforced by law. Such restrictions may involve headgear and footwear, may affect what parts of the body can be exposed, and may include different requirements for men and women. Restrictions may apply only to public places outside the dive operation but may also apply to the operation's accommodations and pool and restaurant areas. If traveling divers are unprepared, they may lack proper clothing.	1	Dive operators should inform customers about appropriate dress for the destination. Compliance with local mores should be encouraged, with warnings offered to visitors who choose not to abide by local laws and/or customs.

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Glossary

The following key terms are defined here in the context of their use in this guide:

bar — a unit of pressure equivalent to 14.5 psi (100 kilopascals)

competent — having the knowledge, training, and experience specific to the work or task being performed; being declared competent by an accredited assessor, institution, and/or business owner; holding certified qualifications and training acquired under specific, accepted industry norms; or being locally registered according to relevant licensing regulations or statutory provisions

dive business, dive operator, operator, dive professional, dive instructor, dive leader, divemaster — terms used interchangeably within this guide, as appropriate; in general, the terms dive business, dive operator, or operator refer to dive-related business actions or activities, and the terms dive professional, dive instructor, dive leader, and divemaster to diving-related actions or activities

dive professional — a term that encompasses dive instructors, dive leaders, and divemasters

employer — an individual who hires the services of another person in order to gain direct or indirect financial gain for themselves or for the business, whether the person hired is an employee, a contract worker, a self-employed dive professional or dive leader, a seasonal worker, a temporary worker, or a stand-in; employers have an obligation to provide a safe working environment for anyone working under their control or utilizing their facilities; the use of someone's facilities — whether through renting, leasing, or simply using the facilities — may exempt an owner from responsibility if a specific contract, or a suitable release from obligation, is agreed to and recorded prior to the use; this suggests that there is no implied employment and therefore that no employer exists; the terms dive operator, dive business owner, and employer may be used interchangeably in this guide

hazard — a situation or agent with the potential to cause or result in harm, including injury, illness, or damage or loss to property, equipment, or the business

kilopascal — 1,000 pascals, a unit of pressure equivalent to 0.145 psi

responsible person — an individual who bears overall responsibility for all of a dive business's equipment, operations, maintenance, and safety-related matters; detailed safety-related matters should fall under the responsibility of a person delegated as the dive safety officer or dive safety coordinator

recommendations[1] — appropriate risk-mitigation actions taken in the context of an assessed risk present at and applicable to any activities of a dive business, to reduce the risk to a more acceptable level, if not to remove it entirely

risk — a state of uncertainty determined by a combination of three factors: the probability of an adverse event occurring, the frequency of exposure to a hazard that may cause such an event, and the severity of the consequences if such an event does occur; a hazard is a potentially harmful situation or agent, while a risk results from exposure to a hazard; one sometimes sees the terms hazard and risk used interchangeably, but in this guide risk refers to the probability and magnitude of an adverse event, whereas hazard refers to the harmful situation or agent itself.

[1] Note that developing countries often do not promulgate regulatory documents, potentially resulting in a lower level of regulatory protection. Such countries may need to be rated at a higher risk level (RL) to ensure mitigation of relevant risks.

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Abbreviations

AED	automated external defibrillator
AGE	arterial gas embolism (see also DCI)
AS/NZS	Australian/New Zealand Standard
ASTM	American Society for Testing and Materials
ATM	automated teller machine (note that the abbreviation “atm” is also used in the dive community as an abbreviation for “atmosphere,” a unit of pressure; it is not used in that sense within this guide, however)
BCD	buoyancy control device
BLS	basic life support
BLSD	basic life support and defibrillator
BMI	body mass index
CDC	(U.S.) Centers for Disease Control and Prevention
CGA	Compressed Gas Association
CH_4	methane
cm	centimeter(s)
CO	carbon monoxide
CO_2	carbon dioxide
DAN	Divers Alert Network
dB	decibel (a measure of the height of a sound wave, perceived as loudness or sound power)
dB(A)	an A-weighted decibel (a measure of sound as it’s perceived by the human ear)
DCI	decompression illness (a condition that encompasses both DCS and AGE)
DCS	decompression sickness (see also DCI)
DNV	Det Norske Veritas
DPT	dew point temperature (the temperature at which water vapor condenses in air at atmospheric pressure)
DSO	dive safety officer
EAP	emergency action plan
EMS	emergency medical services
EN	European norm
ft	foot/feet
GPS	global positioning system
HIRA	hazard identification and risk assessment
HP	high pressure
H&S	health and safety
Hz	Hertz (a measure of the pitch of a sound, in waves per second)
ILO	International Labour Organization
ISO	International Organization for Standardization
m	meter(s)

mg/m^3	milligrams per cubic meter
mm	millimeter(s)
(M)SDS	(Material) Safety Data Sheet
NIOSH	(U.S.) National Institute for Occupational Safety and Health
nm	nanometer
OCA	oxygen-compatible air (air with a condensable hydrocarbon limit of less than 0.1 mg/m^3)
OEM	original equipment manufacturer
OHS	occupational health and safety, as overseen by programs such as the U.S. Occupational Safety and Health Administration (OSHA), the U.K. Health and Safety Executive (HSE), and other nations' agencies and/or regulations pertaining to health and safety at work
PPE	personal protective equipment
ppm_v	parts per million by volume
psi	pounds per square inch
RCC	recompression chamber
RH	relative humidity
RL	risk level
SANS	South African National Standard
USCG	United States Coast Guard
USN	United States Navy
UV	ultraviolet (rays from the sun with a wavelength shorter than visible light; UV radiation causes sunburn and cellular damage is especially harmful in the 100 nm to 315 nm range)
WRSTC	World Recreational Scuba Training Council

Appendix A - Applicable Regulations and Guidelines

Statutory documents

- National (or other jurisdictional) occupational safety and health requirements pertaining to Health and safety at work;
  - Occupational noise exposure;
  - Personal protective equipment;
  - Fire protection;
  - Exposure to hazardous substances;
  - Medical services and first aid;
  - Compressed gas and equipment;
  - Electrical safeguards;
  - Requirements for recreational dive instructors and dive guides;
  - Compensation for occupational injuries and illnesses;
  - Safe operation of machinery; and
  - Minimum hygiene requirements (as to ventilation, lighting, restrooms, etc.).
- Regulations pertaining to boating, including boat safety, registration, and requirements for the use of boats.
- Regulations pertaining to public health and safety, specifically including requirements for the use of compressed air for breathing.
- Regulations pertaining to marine parks, sanctuaries, beaches, and protected and ecologically sensitive areas.
- Regulations pertaining to employment and labor relations.

Other mandatory or advisory documents

- Handbook of Compressed Gases, Compressed Gas Association (CGA), Chantilly, Virginia, USA, 2013.
- Commodity Specification for Air, CGA G-7.1-2018.
- Respiratory equipment — Compressed gases for breathing apparatus, BS EN12021:2014, European Committee for Standardization (CEN), Brussels, Belgium, 2014, as amended.
- Occupational Diving Operations, AS/NZS 2299.1:2015, Standards Australia, Sydney, Australia, 2015.
- Cleaning Equipment for Oxygen Service, CGA G-4.1, 2009.
- Standard Practice for Cleaning Methods and Cleanliness Levels for Materials and Equipment Used in Oxygen-Enriched Environments, American Society for Testing and Materials (ASTM), West Conshohocken, Pennsylvania, USA, G93-03(2011).
- Recreational diving services — Requirements for recreational diving providers, International Organization for Standardization (ISO), Geneva, Switzerland, ISO 24803:2017.
- “Recommendations for Recreational Diving Operations Occurring from Commercial Passenger Vehicles,” United States Coast Guard (USCG), Washington, DC, USA, Marine Safety Advisory 01-12, updated October 3, 2018 as Safety Alert 15-18.
- “Don’t Let Your Divers Down!”, United States Coast Guard (USCG), Washington, DC, USA, Marine Safety Alert 15-18.
- U.S. Navy Diving Manual, Naval Sea Systems Command, Washington, DC, USA, Revision 7, 2016.

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Appendix B - Acceptable Lighting Levels

Areas	Recommended minimum[1]	Suggested ranges[2]
Classrooms	200 lux	200–500
Retail shops	100 lux	100–150
Offices	300 lux	300–500
Compressor, filling, and blending areas	200 lux	200–500
Storage rooms	150 lux	150–500
Instrument workshops	250 lux	250–500
Precision work areas	750 lux	750–1,500
Changing rooms	100 lux	100–150
Equipment washing areas	100 lux	100–150
Halls (passages)	75 lux	75–100
Video labs	100 lux	100–150
Photo labs	150 lux	150–200

Notes:

There are two primary factors and units of measure used when quantifying light:

- The amount of visible light falling on an area, known as "*illuminance*," measured in lux or foot-candles.
- The amount of light that humans can see, known as "*brightness*" or "*intensity*," measured in lumens.
- The relationship of these factors to each other is as follows: 1 Lux = 1 lumen per m^2 and 1 foot-candle = 1 lumen per ft^2

The unit "watt" does not relate to either of these units.

- The unit of power known as a watt is a measure of how much energy is needed to produce the light.
- The watt is actually misleading as an indicator of the amount or intensity of light, as two different types of lamps - say, a halogen lamp versus an LED lamp - can produce a vastly different number of lumens for a given wattage of energy consumed.

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[1] Source: See Appendix I, References used, #10.

[2] Selected sources: See Appendix I, References used, #11–14, and Additional resources, #1.

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Appendix C - Acceptable Noise Level

	Recommendations[1]	
Areas or sources	**dB(A)**	**Duration**
Quiet rooms (e.g., sleeping areas)	40	Indefinite
Classrooms, retail areas, offices	65	Eventual fatigue
Compressor, filling, and blending areas	85	8 hours
Large, unsilenced compressors	95	1 hour
Noisy areas (e.g., generator areas)	100	15 minutes
Safety valves, venting HP lines	110	1.5 minutes
Unacceptably “noisy” areas	120	9 seconds

Notes:

Sound energy travels in waves. A sound wave has the following characteristics:

- Height, which is experienced as loudness level; its unit of measurement is the decibel (dB);
- Frequency, which is experienced as pitch; its unit of measurement is the Hz, or waves per second; and
- Length, an indication of transmission; its unit of measurement is the meter (m), centimeter (cm), or millimeter (mm).

When a sound wave’s height (or amplitude) is correlated to its intensity (or loudness), the resulting ratio is a unit of measurement known as A-weighted decibels, or dB(A). This unit is a relative loudness level, based on the threshold of human hearing, as follows:

- 0 dB(A) is the threshold of human hearing, or the softest level that a human can hear;
- 65 dB(A) is the approximate level of normal human speech; and
- 120 dB(A) is the level a rock concert can rise to.

Very short-duration noises can actually be tolerated up to as high as 140 dB(A), the threshold for invoking pain.

The durations listed in the table above are a general guide, but maximum durations should be avoided unless approved hearing protection is worn.

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[1] Primary source: See Appendix I, References used, #15.

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Appendix D - Recommended Safety Equipment for Small Vessels

National or jurisdictional requirements always take precedence.[1]

No.	Safety equipment[2]	Recommendations
1	Life jackets	• Boats should have at least one life jacket per person on board; • The jackets' condition should be monitored periodically; • Written donning procedures for the use of life jackets should be posted; and • All passengers should be adequately briefed as to the location and donning procedures of life jackets prior to departure, and that they may wear a life jacket if they so request (unless local laws dictate otherwise such as that life jackets may only be used in emergencies and must remain stowed until required).
2	Visual distress signaling devices	Boats should have a combination of dedicated signaling devices, including flares, flags, and electric lights. There should be at least three devices that can be used night and day. Some pyrotechnic devices may meet both night and day use. For nighttime use: (parachute) flares or distress lights. For daytime use: distress flags, combination flares, or smoke markers. Expiration dates should be strictly monitored.
3	Portable fire extinguishers	Portable extinguishers, of an appropriate class for dealing with flammable liquids, vapors, and other combustible materials (such as li-ion batteries), are required. At a minimum, there should be one per engine, one for each living space, and one at the helm within reach of the captain. Local regulations may dictate the exact numbers and types of extinguishers required. Monthly maintenance inspections should be done by the owner. Regular inspections, on an annual or other basis as required, should be done by an approved service company. Service date expirations must be monitored.
4	Sound signaling devices	Sound signaling devices are needed for periods of reduced visibility.
5	Flashlights and portable spotlights	If the vessel is not fitted with navigation lights, portable lighting should be carried on board. Spare batteries and bulbs should be stowed aboard in sealed containers. Portable spotlights for searches may be powered from the boat's electrical system.
6	Flags or day shapes	An Alpha signal flag, or another appropriate day shape, should be displayed if the vessel is stationary, such as during diving. A diver-down flag should be displayed whenever divers are in the water.
7	Radio	Boats should have a marine radio (VHF-FM or equivalent) with at least two spare channels appropriate to the area of operation and with a selective calling system.
8	Nautical charts, magnetic compass, and/or GPS device	Manual, or digital and manual, navigation aids should be carried. Charts need to be updated regularly, as may be required. Onboard illumination is necessary for operation after sunset.

No.	Safety equipment[2]	Recommendations
9	Non-slip surfaces	A plan should be in place to minimize risk of slips and falls via engineering controls (such as non-slip surfaces), administrative controls (such as verbal cautionary instructions during each activity) or protective equipment (such as providing non-slip shoes).
10	Ladder safety	Suitably and appropriately designed ladders should be installed for safe exit from the water.
11	Emergency oxygen	All dive operators should have an emergency oxygen kit onboard. The occupant capacity of the vessel should be considered to ensure that there is enough oxygen to last the duration of emergency travel between the dive site and nearest qualified care. Note than more than one diver may be injured. Kits should be inspected prior to each outing to ensure the oxygen cylinder is full and all components are operational. Kits should be regularly serviced, monitored for expiration dates and have sufficient spares of important components (masks, seals, etc.). See Appendix E - Oxygen Kit Inspection and Maintenance below**.**
12	Emergency medical equipment	Boats should have a first-aid kit, an emergency oxygen unit, and other required life support equipment, as appropriate given the distance to the level of care that may be required. Medical equipment should be unexpired, serviced regularly and logged monthly.
13	Hydration of passengers and crew	All vessels should have adequate drinking water on board. Dive professionals and crew should be trained in the recognition and prevention of dehydration and ensure frequent hydration by all onboard.
14	Depth-sounding device	Boats should have either an electronic or a weighted-line depth-sounding device to avoid damage to the boat or to reefs.
15	Anchor	Boats should have an anchor appropriate for the setting.
16	Capsize rope and watertight container	This is applicable to smaller vessels, in case they become inverted in the water. The watertight container should include essential items (e.g., flares, survival gear, emergency equipment, etc.).
17	Grab lines	Grab lines are appropriate for smaller vessels not fitted with ladders. Tag lines are useful tools for almost any sized vessel. These should be visible and equipped with a buoy to keep them afloat. Attachment points should be adjustable to position these safely.
18	Boat hook	Boats should have a boat hook of a length suitable for securing divers or others in the water.
19	Tool kit	Boats should have a tool kit appropriate to the vessel (e.g., including a bellows on vessels that have any inflatable parts).
20	Spares kit	Boats should have a spares kit that includes all parts required to permit a return to shore.
21	Boat license and registration	Boats should have all appropriate licenses, registrations, permissions, park or reserve permits, and any other documents that may be required. Waterproofing or dry-storing these documents is recommended.

Notes:

[1] These recommendations are offered for the typical small vessel (boat) used for dive operations; they are not exhaustive and are intended only as a guide.

Requirements (as distinct from recommendations) may be disseminated in a broad range of documents, including national maritime and coast guard regulations, regional or local by-laws, and national park or reserve rules.

Mandatory regulations, by-laws, rules, and other such requirements take precedence over recommendations.

All items of equipment should be approved in accordance with national or local maritime regulations; the term “approved” is therefore assumed and is not used within this table.

[2] The equipment listed here is intended to encompass portable items that need to be checked prior to launching or sailing, and not items that should be permanently installed on an appropriately approved and licensed vessel.

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Appendix E - Oxygen Kit Inspection and Maintenance

Inspection and maintenance of emergency life support equipment is essential to ensure availability and effective use in the event of an emergency.

The following guidelines should be considered and preferably be enclosed in the emergency oxygen kit and filed in the operational safety manual.

Oxygen Kit Inspection and Maintenance Recommendations
Before each outing, inspect this oxygen unit to ensure the following:
• All contents are present, clean and ready for assembly.
• The cylinder contains sufficient oxygen for its intended use.
After each use:
• Wipe down regulators and all other components with warm, soapy water.
• Replace disposable components and disinfect any reusable components that came in contact with a person.
• Refill the cylinder, and function test the unit before stowing it for future use.
Regular inspection and function testing:
• Regularly inspect the multifunction regulator and demand valve regulator for corrosion, damage and deterioration of components.
• Function test the unit at least every two months. Depending on use and working environment, more frequent monitoring and testing may be required.
Visual inspection, servicing and hydrostatic testing:
• Oxygen cylinders must be visually inspected annually and hydrostatically tested every five years by an authorized inspector. Hydrostatic testing is also required when structural damage is evident. (Testing frequency for small, portable oxygen cylinders for medical use varies by country.)
• Cylinder valves should be inspected and serviced at the time of cylinder inspection and testing.
• Service first- and second-stage regulators according to the manufacturer’s recommendations. These may vary depending on use.
• All high-pressure parts (cylinder, cylinder valve and first stage regulator) must be oxygen-cleaned by trained personnel before being put back into service.

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Appendix F - Safety Considerations for Compressed Gas Filling Stations

National or jurisdictional requirements always take precedence.[1]

No.	Areas of Operation	Recommended Actions
1	Customer interface	Establish a policy that customer cylinders must be checked prior to being filled, for condition and inspection status (including visual and hydrostatic inspections for valve and cylinder condition).
		Establish a policy regarding partially filled cylinders that may contain any gas mixture.
		Establish a policy regarding acceptance for filling or handling of cylinders containing oxygen or oxygen-enriched gas.
		Inspections prior to filling should include: • checking the date of the last hydrotest; • checking the date of the last visual inspection; • inspecting for any visible damage; • hammer-testing steel cylinders (they should have a bell-like tone); • verifying the cylinder code of construction, ensuring it is legal to fill it; • verifying the rated fill pressure; and • checking that the cylinder contains positive pressure prior to filling it.
		Perform a gas-content analysis for any mixed gases.
		Maintain a log of customer complaints (e.g., reports of odors, taste, over-filling, and any other concerns).
2	Air/gas quality	Establish a schedule for frequency of air/gas-quality testing.
		Retain the testing certificates.
		Display the current air/gas-quality testing certificate.
		Retain the gas-analysis certificates for vendor-supplied cylinders (e.g., oxygen, helium, nitrogen).
		Establish a policy for replacing filters and lubricants (including whether generic consumables and parts may be used instead of original equipment manufacturer [OEM] products).
		Establish a policy to change filters per manufacturers' specifications; a color-change indicator; a filter pressure-drop indicator; or air-quality testing.
3	Cylinder handling	Establish instructions for cylinder handling, filling, and safe storage.
		Secure cylinders upright, in vertical cylinder banks.
		Log all cylinder fills, including the customer name, date, gas-content testing, etc., as applicable.

No.	Areas of Operation	Recommended Actions
4	Compressor, booster, and filling areas	Establish daily start-up and shut-down checklists, including daily visual inspection of filling connections; whips; compressing equipment; and fuel, lubricant, and coolant levels.
		Schedule regular inspections that include checking performance, leak-checking piping, and function-testing control and safety components.
		Perform regular maintenance and servicing according to manufacturers' recommendations, based on running hours or time periods.
		Schedule visual and hydrostatic inspection of all storage cylinders.
		Establish a policy for service by a manufacturer-approved or other external service center and/or by in-house personnel.
		Log all service and repairs performed on compressors, boosters, and pressurized gas equipment.
		Retain all maintenance, service, and repair records.
		Clean external surfaces on compressors, boosters, and motors.
		Maintain oxygen cleanliness for oxygen or oxygen-enriched air compressors, booster pumps, piping, and all controls.
		Maintain oxygen cleaning records.
		Ensure that compressor belt guards remain in place.
		Regularly assess the compressor intake location for contaminant risks (e.g., CO, CO_2, odors, fumes, chemical vapors, smoke, car exhaust, cooking extraction exhaust, etc.).
		Regularly check that the gas-management area is well ventilated to prevent a buildup of heat.
		Regularly check that the gas-management area is clean and uncluttered (especially that there are no restrictions on ingress and egress).
		Regularly assess the compressing and filling areas for other risks (e.g., noise, unauthorized access, space, lighting, fire, etc.).
		Regularly inspect and test fire detectors, fire alarms, and fire extinguishing equipment and ensure that appropriate signs are in place.
		Ensure that signs about hazardous equipment, the operation of dangerous equipment, and restrictions on access are posted and easily visible.
		Establish a policy regarding appropriate, environmentally responsible disposal of compressor, gas-engine, and filter-system waste.

No.	Areas of Operation	Recommended Actions
5	Personnel safety	Establish a policy regarding unattended filling stations (e.g., require operators to remain at filling stations throughout the filling process).
		Establish clear training and competency requirements for all compressor and filling operations. Keep all training certificates on file.
		Comply with OSHA (or comparable) requirements for pressurized equipment.
		Ensure that compressor and filling station operators are covered by workers compensation.
		Screen operators' hearing status upon hiring and at periodic intervals, to detect any subsequent hearing loss.
		Check/screen operators for fitness to work (including daily checks if there is any evidence of substance abuse, etc.).
		Provide operators with PPE (ear-protectors, safety glasses, and hard-toed shoes), together with training in its use.
		Post appropriate signage regarding the use of PPE.
		Monitor operators' compliance with PPE requirements.

Notes:

1 The applicability of this safety checklist may vary, depending on the equipment and filling gases a dive operation uses and the services it offers, including whether cylinder-filling is offered to outside customers or only in-house.

National and local requirements for health and safety may require additional considerations.

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Appendix G - Relevant Air-Quality Standards

High-Pressure Breathing Air: Common Allowable Limits												
Element	**CGA**		**SANS**		**EN**		**AS/NZS**		**OCA[1]**		**Best practice[2]**	
	Grade E		**10019**		**12021**		**2299.1**		**Various**			
CO	10	ppm_v	5	ppm_v	5	ppm_v	10	ppm_v	2	ppm_v	5	ppm_v
CO_2	1000	ppm_v	500	ppm_v	500	ppm_v	480	ppm_v	1000	ppm_v	500	ppm_v
H_2O vapor[3]	50	mg/m^3	50	mg/m^3	50	mg/m^3	50	mg/m^3	50	mg/m^3	50	mg/m^3
Oil vapor[4]	5	mg/m^3	0.5	mg/m^3	0.5	mg/m^3	0.5	mg/m^3	0.1	mg/m^3	0.5	mg/m^3
Odor	None		None		NS		None		None		None	

Notes:

1 These standards apply to Oxygen Compatible Air (OCA).

2 Source: See Appendix I, References used, #16 (Part II).

3 Some standards specify a limit of 50 mg/m^3 for air under 2,900 psi (200 bar), 35 mg/m^3 for air over 2,900 psi (200 bar), and 25 mg/m^3 for air at the compressor outlet.

Some cylinders are filled to 3,365 psi (232 bar), yet standards require adherence to the 50 mg/m^3 limit.

Some standards specify no limits, and limits shown above have been extrapolated from the notes in the stated standards.

Some standards list moisture in ppm_V or dew-point temperature (DPT). In such cases, the following factors were considered:

- The limits were converted to mg/m^3 and rounded up or down as applicable.
- The main criteria are to avoid regulators freezing up and to avoid excessive water collection in HP cylinders.

4 Some standards use this as the limit for oil and particles or for oil and hydrocarbons.

See the Abbreviations section for the relevant words or terms used in this table.

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Appendix H - Tropical Diseases Relevant to Dive Travelers

Endemic diseases	Carriers	Typical areas	Prevention/treatment
Chagas disease	“Kissing bug” (triatomine)	Americas	Early medication
Chikungunya	Mosquito	Tropics	Supportive treatment
Cholera	Water and/or food	Tropics	Vaccination
Dengue fever	Mosquito	Tropics	Supportive treatment
Malaria	Mosquito	Tropics	Prophylaxis
Sleeping sickness	Tsetse fly	Sub-Saharan Africa	Medication
Yellow fever	Mosquito	Tropics, Latin America, Sub-Saharan Africa	Vaccination
Zika virus	Mosquito	Latin America	Supportive treatment

Notes:

This list is supplied to give dive operators an indication of diseases potentially relevant to their clientele. The CDC, a travel clinic, or a travel medicine specialist should be consulted regarding any specific diseases or illnesses.

This list excludes diseases and conditions that are usually included in childhood and/or adult vaccination regimens, including but not limited to diphtheria, hepatitis A and B, seasonal Influenza, measles/mumps/rubella, meningococcal diseases, rabies, rotavirus, polio, tetanus, typhoid, varicella (chicken pox), etc.

This list excludes sexually transmitted and drug-related diseases, as well as diseases atypical in dive travelers, such as HIV/AIDS, tuberculosis, hemorrhagic fever, and tick-borne diseases.

This list excludes common food-borne diseases, such as ciguatera, salmonella, and traveler’s diarrhea. Some diseases have multiple carriers; only the most common carrier(s) are listed here.

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Appendix I - References and Additional Resources

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19. "Offshore Standard for Diving Systems," DNV, Offshore Standard DNV-OS-E402, Hovik, Norway, 20102
20. United States Centers for Disease Control and Prevention (CDC); see www.cdc.gov/ for links to relevant organizations and information about most countries around the world.
21. United States Department of Labor, Occupational Safety & Health Administration; see https://www.osha.gov/SLTC/heatstress/ for information on occupational heat exposure.
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Additional resources

1. Architecture guidelines, multiple sources.
2. Articles published in Alert Diver magazine by Divers Alert Network Southern Africa (DAN SA), including the following:
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   (b) "Scuba Air Quality," F. Burman, Part I in Autumn 2013 (Vol. 5, No. 1) and Part II in Spring 2013 (Vol. 5, No. 2).
   (c) "Diving Safety Officer," F. Burman, Spring 2016 (Vol. 8, No. 1).
   (d) "Emergency Planning," F. Burman, Spring 2017 (Vol. 9, No. 2).
   (e) "Hazard Identification and Risk Assessment Program," F. Burman, Part I in Autumn 2015 (Vol. 7, No. 1), Part II in Spring 2015 (Vol. 7, No. 2), Part III in Spring 2015 (Vol. 7 No. 2), Part IV in Autumn 2016 (Vol. 8, No. 1).
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   (l) "Carbon Monoxide Safety: What is a safe CO level in our breathing air?", F. Burman, Winter 2020 (Vol. 36, No. 1)
   (m) "Reduce your liability risk", F. Burman, Winter 2020 (Vol. 36, No. 1)
   (n) "Carbon Dioxide Safety: What is a safe CO_2 level in our breathing air?", F. Burman, Spring 2020 (Vol. 36, No. 2)
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   (p) "Hose Failures", F. Burman, Spring 2020 (Vol. 36, No. 2)
   (q) "Oil and Particulates: What are safe levels in our breathing air at depth?, F Burman, Summer 2020 (Vol. 36, No. 3)
12. "Safety Report: Safety improvement: Planning to do better," F. Burman, Pressure, Undersea & Hyperbaric Medical Society (UHMS) Membership Newsletter, North Palm Beach, Florida, USA, First Quarter 2018.

Notes

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Divers Alert Network
6 West Colony Place
Durham, NC 27705
DAN.org