European Diving Technology Committee

Guidance for Diving on Renewable Energy Projects

Members Issue

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Important Note

EDTC is NOT a Regulatory body

The information contained in this manual is documented for guidance purposes only and seeks to reflect current 'European Industry Good Practice'.

No legal liability shall attach to any opinion, comment and / or recommendation contained within this manual.

The content of this document should be considered in accordance with the requirements of any applicable National Regulation or Guidance.

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1 Introduction

1.1 Leading Text

1 The European Diving Technology Committee (EDTC) was set up in 1973 and has as a main objective of harmonisation so that common standards of diving safety may be achieved.

2 EDTC aims to make European professional diving safer.

The Committees motto is: **Securitas per uniatem.** (Strength and safety through unity)

The EDTC seeks to reach its aim by;

* Providing an independent European forum which may make recommendations relating to diving safety, technology and diving medicine;
* Providing a place for discussions on matter related to manned underwater operations and in particular types of diving, types of equipment and their use, together with medical aspects, examination and monitoring for fitness of divers;
* Where applicable, recommending harmonisation so that common standards may be achieved;
* Providing where appropriate, advice to governments, other organisations and individuals concerned with diving;

3 It is estimated that approximately 50% of European countries have regulations which set health and safety standards for commercial divers. However, the scope and detail of these regulations varies considerably.

4 The EDTC document "Goal-setting Principles for Harmonised Diving Standards in Europe" is a high level guidance document which aims to provide a common basis for the development of European standards for safe diving and to assist the development of national diving regulations within Europe and elsewhere.

5 EDTC is not a Regulator so it does not impose specific instructions or requirements on those who chose to follow the guidance issued through the committee.

6 All guidance issued by EDTC must be considered and implemented in accordance with the requirements of country specific Regulations and applicable Legislation.

7 EDTC accepts that across the member states of the EEC there may be great variance in quality of regulation or legislation that may be applicable to the activity of Commercial Diving. The guidance set out in this document seeks to promote a median that will help raise the standard of diving activity where none currently exists, whilst setting a base line from which other more developed countries will be able to further improve the standard to which they plan and carry out their works in the future

1.2 Scope of work covered by this Guidance Document

1 This guidance document is intended to cover all diving operations carried out in connection with renewable energy projects. This includes wind, wave and tidal energy production and distribution schemes.

2 This guidance is intended to apply to renewable energy diving projects within the territorial waters of a coastal state;

- Using surface supplied diving equipment.
- From a fixed platform or vessel which is not using dynamic positioned.
- Where no relevant local legislation or nationally recognised codes of practice apply.

3 A number of countries in Europe have national regulations and/or standards that apply to diving operations. Anyone deciding to use this guidance in such areas is reminded that, in cases where the national regulations and/or standards are more stringent than this guidance, they need to take precedence over this guidance and the contents of this guidance should only be used where they do not conflict with the relevant national regulations/standards.

4 Anyone deciding to use this guidance in such areas is reminded that, in case the national regulations and/or standards are more stringent than this guidance, they need to take precedence over this guidance and the contents of this guidance.

1.3 Key Elements of this Guidance Document.

1 **Planning and Task Risk Assessment:**

It is essential to plan each stage of the diving operation and consider the actions required for establishing;

* Normal diving procedures
* Emergency Diving Procedures
* Contingency arrangements for assistance from outside resources.

A risk assessment process should identify the hazards and allow procedures to be developed in order to mitigate the risks

2 **Vessel Types:**

Selection of most appropriate support vessel from which to carry out the diving work requires consideration of the conditions and duration of the project.

3 **Methods & Operational Procedures, Plant and Equipment**

The most appropriate method for carrying out the works should be selected and subjected to a task specific risk assessment.

Self contained underwater breathing apparatus (SCUBA) is not a suitable technique for diving under any of the works covered by the scope of this guidance.

Only surface supplied diving techniques should be used.

4 **Auditing:**

External monitoring of the standards and procedures used by formal auditing or inspection is to be encouraged by this guidance document.

The scope of the audit and standards against which performance is to be measured should be agreed in advance.

Refer to Section 6 for further information in regard to the approach to auditing.

1.4 Useful Definitions applicable to this Guidance Document.

Item	Definition
Inshore	Operations being carried out within a position not exceeding the limits of the applicable territorial waters or 50m maximum water depth.
Offshore	Operations being carried beyond the scope of 'inshore', to any practical working depth where direct access to land based support facilities would be limited and as a result more comprehensive self supporting arrangements would be required.
Bridging Document	A written document that defines how two or more safety management systems co-exist to allow cooperation and coordination on matters of health, safety and the environment between different parties.
Competence	Persons would be considered as being competent for a specific task when, as a result of a combination of training, experience, practice, familiarity and specific briefing is considered able to carry out the designated task to the required standard with minimum risk to themselves and others.
Client	Would be the owner or operator of the worksite on which the diving operation is to take place.
Clients Representative	Is a competent person, appointed by the client, to act as an intermediary between the designated diving contractor and client.
DDC	Deck Decompression Chamber. Generally a twin lock chamber
LARS	Launch and recovery system. Generally taken to be a mechanically operated system that would allow a diver or stand-by diver to be safely delivered to and recovered from the work location Multiple LARS units may be required to allow the safe use by both diver and stand-by at different times during a single activity..
Rescue Diver or Stand-By Diver	A diver who is at an immediate state of readiness to enter the water and assist the working diver in an emergency situation. (The terminology used does vary across the European Community)
Self Elevating Vessel	A generic term used to describe a variety of vessel types that are fitted with driven legs to enable them to elevate above water level, thus creating a more stable platform from which to work.
SMS	Safety Management System. A document that summarises the approach that the diving contractor would be expected to take to ensure the safety of the diving and support personnel whilst work is underway.

2 Planning and Task Risk Assessment

2.1 Organisation and Responsibilities

1 A clear understanding of how the organisation of the project is to be managed is required for reference by all those who may be involved.

2 The client has the responsibility to ensure that the diving contractor has access to the information necessary to plan and risk assess the work required.

3 This requirement should include provision of any information, hazards or dangerous substances that the diving contractor may or could expect to encounter whilst working on the structure or specified worksite.

4 Wherever possible it is recommended that the use of easy to view reference drawings, 2 or 3D images or other graphics are used to supplement any written information that is to be provided.

5 The Diving contractor should, ensure that the project is methodically planned, thoroughly risk assessed and safely managed by competent personnel, who are adequately briefed on the methods to be adopted, and fully aware of all emergency action plans that are in place.

The required planning and any control measures required to mitigate risks to the dive team should be fully documented and made known to all relevant parties.

6 Vessel owners and operators are also included in the requirement set out in item 2 above.

Particular attention needs to be paid to the isolations of operating machinery on board and establishment of a Permit to Dive System that seeks to ensure when diving commences that all relevant equipment has been shut down or controlled in such a way that the risk to the diver is reduced as far as is reasonable practical.

2.2 Risk Assessment

1 The planned diving operation should be methodically risk assessed. The diving contractor is responsible for ensuring that the risk assessment is carried out to identify site specific hazards, their risks and the control measures to mitigate those risks. The risk assessment should be documented, dated and stored in a suitable form. The person conducting the risk assessment should have good knowledge of risk assessment methods and the specific risks of the diving activity to be undertaken.

2 During development of the risk assessment, the following should receive particular attention:

- Composition of dive team: numbers, training, qualifications and experience,
- Allocation of tasks within the dive team and amongst others involved in the diving operation,
- Use of breathing gas and decompression tables,
- Used diving- and other work equipment and its compatibility.
- Breathing gas,
- Communication within the dive team,

- Launch time for rescue diver (stand-by diver),
- Access to worksite and dive operation area,
- Met ocean, weather and other conditions at the worksite,
- Coordination in-between the dive operation and other work tasks ongoing at the site,
- Planned actions when accident or emergency occurs,
- Availability of pressure chambers and time limit to reach these.

3 The diving contractor is responsible for the execution of the risk assessment. The task to carry out risk assessments can be delegated to someone with sufficient authority and resources and the necessary expertise. A natural choice for this delegation task may be the person designated as diving supervisor for the planned dive operation. However, it is appropriate that a group of people with different skills and capabilities are involved in the risk assessment process.

4 For multi-part or complex tasks, it will be necessary to reduce the diving activity into individual tasks and then to assess them separately. The following approach provides guidance and assistance to conduct a risk assessment in relation to the above listed examples, which only are the identification of a number of different elements of risk or areas of such.

5 Any assessment should consider defining the risk before a scale of 1 to 5 that sets out the actions associated with the expected scale of the risk;

	No risk	*Slight risk*	*Some risk*	*Certain risk*	*Very High risk*
Action	*1*	*2*	*3*	*4*	*5*

The recommended action could then be more simply defined as:

1 = no action,
2 = planned action
3 = specifically defined action,
4 = immediate action,
5 = may not be used or may not be carried out.

6 The risk assessment should be compiled for each project and not necessarily each individual dive within the operation. Although if there is need for it, individual dives should also be assessed.

2.3 Project Hazard Identification Study (HAZID)

1 A HAZID should be completed with the client and other contractors as soon after the full scope of work requirements and support vessel requirements have been identified.

This process is intended to complement rather than replace the normal process of risk assessment and should be completed in conjunction with this activity.

2 The primary objectives of the HAZID are to:

(A) Take a high level overview of the full work scope, its management, interfaces, procedures and equipment required to complete the task.

(B) Identify any specific areas of risk that may not form part of other aspects of the planning.

(C) Provide an open forum for voicing concerns that not normally be highlighted.

(D) Outline any specific requirements for personnel training, plant or equipment that are considered to be necessary.

2.4 Minimum Standards of Training and Equivalent Certification

1 All diving personnel should be appropriately qualified to a minimum standard **required by the legislating country** or its equivalent.

The EDTC Competences Standards published in 2003 should be referred to as a standard for assessment of appropriate qualifications.

2 Notwithstanding the above reference, it is important that the selected divers have the necessary level of competency to carry out the required work.

3 Where trainee personnel – *those who may be suitably qualified, but have yet to obtain the necessary level of competence* - are to make up part of the diving team, the ratio in connection to experienced personnel should not exceed 1:5.

4 Due to the remote nature of the worksites, it is recommended that all members of the diving team hold an appropriate valid, in date first aid certificate.

5 When considered appropriate dive teams should have access to a Diver Medic Technician as part of the overall manning.

2.5 Diving Medicals, Offshore Survival and other Training

1 All divers Need to hold a valid in-date diving medical certificate, a copy of which should be available for inspection on site with their log book. The validity of the medical certificate should not expire whilst work on site is being carried out.

2 All personnel working on near shore, sea or offshore sites are expected to have successfully completed an approved offshore sea survival or offshore survival training course prior to commencement of the works on site.

3 In addition to the above, dive team personnel who may be expected to carryout other tasks, including lifting operations, rope access or more specialist plant or equipment operation, will be expected to have completed the appropriate level of training to an accepted national or international standard.

2.6 Communications during the Project.

1 The names of key personnel, their position, level of responsibility and availability should be clearly set out and where appropriate the details displayed at or close to the worksite for reference.

2 Full details of the applicable contact information for relevant personnel by private radio, VHF or phone should be easily accessible to dive team for reference should an emergency event occur.

3 Clients should be expected to provide a list of names and contacts for their designated personnel, wherever possible specifying the level of authority that each person may have in respect to the approval and progress of diving operations.

2.7 Provision of Bridging Documents

1 Diving contractors should have their own in-house management systems, documenting all aspects of their work activity from safety systems through to operational work practices.

2 The object of bridging documents is to provide a 'link or bridge' between the management control processes of the client organization, site developer, vessel operator or main contractor and the diving contractors own safety management systems.

The bridging document needs to cover all aspects of the required works, with copies being issued to all key personnel who could expect to be involved.

4 As a guide, the content of the bridging document could include, make reference too, but may not be limited to inclusion of the following items:

1. An overview of the full scope of works.
2. A list of key dates and targets.
3. Summary of project works responsibilities.
4. Communication arrangements.
5. List of key reference documents and their relevance.
6. Details of any task specific work procedures.
7. Summarise contingency and Emergency procedures.
8. List of Permit controls that need to be activated.
9. External support available.
10. Circulation list and document revision status.

3 Vessel Types

3.1 Support Vessel Type Quick Reference Table

Important Note:

The following table is provided as a guide to selecting the most appropriate vessel type and dive team size. In referring to this table, the user needs to take into account the conditions that are likely to apply at the proposed work site, along with the nature and scope of work that is required for the project to properly establish the correct combination of vessel, equipment and manning to carry out the diving operation in the safest possible manner.

Ref	Vessel Type	Task	Max Range (Naut Miles)	Max Dive Depth	Min Size Dive Team	DDC Location	Notes
A	**Rigid Inflatable Boat**	***I, LS***	5 miles	25m	5	*Ashore*	*Any suitable small vessel operating from a port or harbour.*
	Fast Support Craft	***I, LS, LPR***	5 miles	25m	5	*Ashore*	
	Survey Vessel	***I, LS, LPR***	5 miles	25m	5	*Ashore*	
	Multi-Cat (1)	***I, LS, LPR***	5 Miles	25m	5	*Ashore*	
B	**Multi-Cat (2)**	***I, LS, LPR, LC***	8 Miles	35m	6	*On Board*	*Additional diving or support personnel as task requires.*
	Self Propelled Barge	***I, LS, LPR, LC***	8 Miles	35m	6	*On Board*	
	Towed Barge	***I, LS, LPR, LC***	8 Miles	35m	7	*On Board*	*Separate support vessel*
C	**RIB or Fast Survey Craft operating from a Mother Ship.**	***I, LS, LPR, LC***	12 Miles	35m	7	*On Mother Ship*	*Additional diving or support personnel as task requires.*
	Moored large barge	***I, LS, LPR LC, HC, JTC, CBP***	12 Miles	50m	7	*On Board*	
	Cable Lay barge	***I, LS, LPR LC, HC, JTC, CBP***	12 Miles	50m	7	*On Board*	
D	**Construction Barge**	***All***	12 Miles	50m	8	*On Board*	*Task may require two or more shifts of diving personnel.*
	Self Elevating Vessel	***All***	12 Miles	50m	8	*On Board*	
	Construction Jack Up	***All***	12 Miles	50m	8	*On Board*	
E	**DP Vessel**	Limited by Class Designation and Weather – Refer to Specific Guidance					

Key to Task References:

I	=	*Inspection tasks*
LS	=	*Light Survey*
LPR	=	*Light Parts Recovery*
LC	=	*Light construction work*

HC	=	*Heavy Construction work*
JTC	=	*J Tube Connections*
CBP	=	*Cable Burial / Protection*
CW	=	*Cutting and welding tasks*

SW	=	*Salvage Work*
All	=	*All work designations.*

3.2 Availability of Deck Decompression Chamber (DDC)

1 The most appropriate option is generally determined as part of the risk assessment process, but may also be specifically stated in legislation, or form part of the client requirements stated in the specification for the works.

2 Where diving operations are planned using surface decompression, then the diver should be able to reach recompression depth within 5 minutes from leaving the last stop in water.

3 The DDC should be:

- Of a multi-compartment format, fitted with a medical lock that directly accesses the main chamber compartment. The second smaller entry compartment would be used to enter and extract support personnel without comprising the treatment of the casualty
- The chamber should be of a suitable size to allow persons being treated to conduct any movement tests specified by the specialist Doctor supporting the treatment activity.
- The complete chamber should be properly certificated with full details of the certification and most recent inspection and maintenance regimes available for reference by the chamber operator should this be required.
- The DDC should be properly supported with adequate primary and emergency air supplies to allow a full treatment table to be completed with some spare capacity to allow for unforeseen events that may occur during treatment.
- An adequate supply of breathable medical Oxygen should be available to support the full scope of the longest treatment envisaged.
- First Aid and Medical Equipment considered appropriate by the specialist medical adviser, should be available on site.
- An adequate number of trained and experienced personnel should be available throughout any expected treatment to operate the DDC.
- A range of support equipment to allow the temperature to be controlled, the lighting in and outside the chamber, as well as providing welfare to all those involved, should be available throughout the period of the treatment.
- Consideration of actions to be taken in the event of an emergency should also be planned and documented.

3.3 Dynamically Positioned Vessels (DP2/3)

1 **Diving work carried out from DP vessels is not covered by this guidance and should be considered as an offshore diving operation requiring the development and us of specialist procedures, diving equipment and techniques.**

3.4 Mooring arrangements and Personnel Transfers

1 Extreme caution should be exercised where it is necessary for crew members to achieve the connection or attachment of mooring lines between a moving and static structure.

Wherever possible, hook lines or boat hooks should be used to remove the crew from the direct risk if crushing or entrapment as the initial connection is made.

2 Personnel and equipment transfers to static structures from support vessels can be challenging in anything other than ideal conditions.

3 Personnel transfer should only be commenced after the mooring operation has been completed and the vessel Master indicates that it is safe to proceed.

The use of safety harnesses, lifejackets and other PPE considered to be appropriate to the conditions in which the transfer is occurring should be adopted.

4 All personnel will need training, or at the very least, extensive briefing about the safety measures that will be required for transfer activities from moving vessels to static structures.

3.5 Diving Inside Monopiles or other enclosed environments

1 Most monopile structures are not fully sealed, and water exists within the monopole. As a result from time to time there may requirement to conduct diving operations inside the structure.

2 When diving is to be carried out inside a monopile, special attention will need to be given to the methodology adopted, the risk assessment compiled and the emergency procedure developed during the planning of the task.

3 Conducting diving from inside the monopile will necessitate personnel and equipment being moved onto the monopile and the diver entering the water via the internal platform.

4 The inside of the monopile should be considered as a confined space. As a result additional precautions and safety measures will be required to comply with confined space risk considerations prior to any diving being carried out.

4 Methods and Operational Procedures

4.1 Stand-By Diver

1 Irrespective of the method of surface diving adopted, a standby diver should be available at immediate readiness to provide any necessary assistance to the diver, whenever a diver is in the water, as instructed by the Supervisor.

2 The standby diver should be fully dressed to enter the water, but does not need to be wearing the mask or helmet, but this does need to be fully operational and be immediately to hand, i.e. connected to the bail out and harness, properly tested, and be held by the diver or supported at or close to chest height.

(Refer to section 5.3 for further clarity of this point)

3 Where there are two working divers in the water at any one time, there should be a stand-by diver available on the surface for each pair of divers, to render assistance as instructed by the Supervisor.

4 The use of an in water stand-by arrangement will not be acceptable.

4.2 Surface Supplied Air Diving

1 **Surface supplied diving** refers to divers using equipment supplied with breathing gas using a *diver's umbilical* from the surface, either from the shore or from a diving support vessel.

2 Diving operations are conducted from a static location, small or larger vessel, and a dive control station is set up. The intention of this method being able to carry out diving operations in depths up to a maximum of 50m.

3 The level of control provided using surface supply can result in an almost unlimited supply of air to support the diver. A properly established team size and range of support equipment will provide the diver with good support for carrying out diving operations in a safe way.

4.3 Nitrox Diving

1 Details of requirements for conducting safe Nitrox diving operations should be fully developed prior to the use of this diving method.

4.4 Shift Working.

1 Diving projects should be planned in accordance with the national regulations on rest periods. It is recommended that the complete diving team should work a shift not exceeding twelve hours in any twenty-four hour period and would strongly advise to equal shift pattern arrangements.

2 When diving in areas of strong tidal current, where diving is limited to those periods of

slack water which occur when the tide turns, the timing and duration of operations may be dictated by a mixture of astronomical and environmental conditions. If several periods of slack water are required to be worked in each day it may not be possible to follow the guidance above and an alternative shift procedure may be pursued, if accepted by the national authorities.

4.5 Emergency Event Response Procedures

1 Every diving contractor has a responsibility to develop, and exercise effective emergency arrangements for all reasonably foreseeable emergencies at each diving operation site, and in so doing communicate the details of the plans to all persons involved in the project.

2 The recovery of an unconscious diver is a foreseeable event that should be included in the Emergency Evacuation Plan (EEP).

3 All emergency arrangements should be of a site specific nature making clear references to any particular issues unique to that site that may compromise the ability of the support team and those assisting to gain the necessary access and deal with the nature of the incident.

4 Emergency plans should be achievable and should not be reliant on the intervention of the emergency services as the primary course of action. Whilst the use of the available emergency services may ultimately result credible plans that can be initiated by the support team but form the basis of the immediate action arrangement.

5 All diving contractors should have as part of their emergency arrangements, a list of applicable contact numbers, that permits contact with all necessary emergency services, hospitals or other parties at all times when work is underway, and should be clearly displayed on each dive site.

6 Emergency medical advice should be available during the period of a diving operation. Phone contact to a competent diving medical physician (or group of physicians) needs to be available and where appropriate exercised prior to the commencement of a project. The aim being to demonstrate that a link can be established quickly, should an emergency event occur.

7 Reference to all of the above should be including in a suitable Bridging Document

4.6 Communications (Between vessels and operational teams)

1 The standards of communication between various parties working in projects can vary and are often not uniform in style. As a result , some confusion can occur.

2 Users of communication equipment should have specific training in its use, particularly in the use of UHF and VHF radios. Ship's officers normally have that training but other members of project teams often do not.

These factors clearly have implications in relation to safety.

3 A communications matrix should be made. It will be a useful tool, especially in emergency situations. This will give an immediate understanding of the communications available and would be of valuable use as a handout at crew change, or when personnel unfamiliar with the vessel join for a project.

4 Company procedures should ensure that a high level of communications discipline is exercised at all times. Effective communications are vital to the safety and success of any operation and the term 'communication' covers all means of communication. Supervisors' encouragement toward clear comprehensive communication is extremely important at talks and debriefings.

5 All personnel directly involved in an operation should be fully aware of the work being undertaken and the status of any unusual situation that may arise during operations.

6 Radio communications are often heard by other personnel in the field, who are not necessarily involved, therefore a professional standard should be maintained at all times.

4.7 Weather conditions and Tidal currents

1 Currents are flowing masses of water within a body of water and can be divided into the following groups:

* major ocean / sea currents;
* tidal currents (which may augment or reduce existing currents);
* rip currents;
* river currents in the proximity of the estuary.

2 The direction and speed of a current varies with water depth, tide and bottom contour. Current readings near the surface may not reflect the actual speed and direction of a current in deeper water.

3 The effects of currents on divers varies with the individual, the work being done and the diving method used.

4 Currents produce forces which affect not only the diver's body but also his umbilical, together with the various lines and pieces of equipment he may have at the work depth.

5 A proportion of the diver's expended energy is therefore devoted to overcoming these forces until the point is reached when he will eventually become unproductive, and be focused solely on self preservation.

6 The greater the speed of the current, the shorter will be the period during which the diver will be effective before the onset of significant fatigue.

7 As a guide a diver operating from a surface controlled man basket or wet bell is better able to operate in currents than a surface orientated diver since his umbilical is shorter. He may be deployed in the horizontal plane and therefore is likely to attract much less resistance to water movement.

8 It should be appreciated, however, that it is impractical to be definitive in identifying the restrictions imposed by certain current conditions since these are affected by so many variable factors.

9 **Table 4.7:**

(This table is different to AODC 047 dated July 1987 and was updated by ADC following on site experience by Members and is included in the ADC Diving Supervisors Manual)

The values shown in this table could, therefore, be applied as guidance with a degree of flexibility to take account of the divers feedback and of course the operational requirements.

	Current (Knots)					
Dive Method	0-0.5	0.5-0.8	0.8-1.0	1.0-1.2	1.2-1.5	Over 1.5
Surface supply – Mid water	(1)	(2)	(3) + (4)	(4)		
Surface supply – Bottom	(1)	(1) + (2)	(2) + (3)	(3)	(4)	
Basket / Bell – Mid water	(1)		(1) + (2)	(3)	(4)	
Basket / Bell – Bottom	(1)		(1) + (2)	(3)	(4)	

Description: (1) Suitable for working with local factors taken into account.
(2) Some restrictions will apply, observation should be workable.
(3) Probably unsuitable, but local factors may permit.
(4) Unsuitable without cofferdam protection

4.8 Noise Exposure

1 Divers at work are routinely exposed to high levels of noise from a variety of sources both above and below water. The noise exposure of diving personnel along with all other persons at work should comply with the national regulation in noise exposure.

2 Since divers are routinely exposed to a range of noise sources of sufficiently high intensity to cause hearing damage and medical studies show that diver hearing can be impaired by exposure to factors directly associated with diving.

3 Human hearing underwater, in cases where the diver's ear is wet, is less sensitive than in air and as a result needs be assessed using an underwater weighting scale. Manufacturers of diving equipment, employers of divers and employees have a combined responsibility to ensure compliance with the exposure values in the Regulations.

4 Whilst it is recognised that noise is only one of the hazards to which a diver is exposed, there is a need to adopt a balanced risk assessment approach that needs to be applied to the whole diving operation, including any associated above water exposure and the background noise to which all persons are generally exposed.

5 Any diver noise reduction strategy that is evolved may need to be linked to a health surveillance programme, involving audiometric tests.

6 The guidance included here is not definitive but should be adequate to assist anyone to develop an adequate understanding of the noise exposure of divers to develop a strategy and achieve compliance with the national requirements.

4.9 Interface with Remotely Operated Vehicle Operations (ROV)

1 The term ROV covers a wide variety of equipment that range from the smallest flying camera inspection vehicles to the largest trenching excavators or cable burial systems.

2 For the purposes of this guidance, ROV's should be considered as unmanned vehicles operated from the surface under the control and direction of a specialist technician.

3 The offshore industry has subdivided the range of ROV's generally available into five classes:

Class 1 – Observation vehicles. Likely to be fitted with cameras, lights and sonar units only.

Class 2 - Slightly larger than Class 1 with the addition of a light payload capability.

Class 3 - Considered as work class vehicles generally fitted with an assortment of sensor or manipulators arms.

Class 4 - Towed bottom crawling vehicles for trenching or cable laying.

Class 5 - Usually reserved for vehicles that are prototypes being developed for any of the class of vehicles.

4 When used in advance of diving operations, ROV's have the potential to provide useful and highly relevant information that may not only improve the efforts to plan the diving operation, but may also help in more thoroughly briefing the divers involved.

For each separate planned use of an ROV, the contractor should be satisfied that the vehicles and equipment provided are fit for purpose, able to operate in the range of conditions that are to be expected and that the deployment along with divers can be done in a safe way.

4.10 Near Miss and Accident Reporting and Investigation.

1 Near miss reporting is strongly encouraged on all projects, for any unforeseen occurrence that develops in the workplace. National requirements on near miss reporting need to be fulfilled.

2 Only by adopting an open and honest approach to reporting near miss incidents, will the lessons be learnt that allow subsequent operations to progress without similar events.

3 Accident reporting is a mandatory requirement, and one that demands the persons involved and their supervisors record accurately the events that lead up to, and actions that were taken following the accident.

4 The principal reason for thorough investigation of any near miss incident or accident, is to identify how the events occurred and to develop appropriate preventative measures, and in many cases these will need careful considered before being published.

5 If a previously unknown risk is discovered in an investigation, care has to be taken in the way in which mitigation of it is factored into any operational process.

4.11 Machinery and Vessels

1 Diving operations conducted from, on, or in close proximity to an operational Merchant Vessel or energised machinery, have the potential to put diving personnel at additional risk, especially if there is inadequate planning and coordination between diving contractors, vessel operators, working crews or machinery operators.

2 Commercial divers regularly suffer severe or fatal injuries when they come into contact with live underwater fittings on merchant vessels (for example, sea chests, rotating shafts, propellers, impellers or other types of thrusters).

3 Effective measures should be taken to prevent access to dangerous parts of ships' machinery. If access to dangerous parts cannot be prevented, then effective measures should be taken to stop the movement of any dangerous parts of machinery before any person enters a danger zone. In addition the dangerous parts need to remain motionless until all persons are confirmed clear of the danger zone.

4 There may be situations where divers need to operate in or around danger zones associated with shipping;

(1) During maintenance or inspection operations or when using a vessel as a dive platform.

(2) During diving operations from, on, in, or close to live merchant vessels the operating controls for fittings located underwater, will normally be remote from the dangerous underwater parts, and thus more difficult to control.

5 The operators of such machinery may not be able to see divers in danger zones.

In order to prevent the risk of injury or death to divers working from, on or in close proximity to a Merchant Vessel two things are needed:

All involved personnel need to be properly briefed

Before diving commences proper, effective isolations need to be in place.

5 Diving Plant and Equipment

5.1 Choice of Diving Method

1 The choice of diving method and the type of equipment to be deployed will depend on a number of factors e.g. the type of vessel selected as the dive platform, the space available for installation of the dive system; the depth of water etc.

2 Prior to the commencement of any diving project a formal risk assessment should be undertaken to identify the most appropriate diving methods and equipment required to execute the diving project safely.

3 Most surface supplied diving is carried out using compressed air as the breathing gas. However, surface supplied diving is sometimes carried out using a breathing gas mix of nitrogen and oxygen with a higher percentage of oxygen in the mix than in natural compressed air. The common industry terminology for such a gas mix is nitrox.

For simplicity, in the remainder of Section 5 this guidance will always refer to "gas" rather than "air" or "nitrox" supplies.

5.2 Surface Supplied Diving Plant and Equipment

1 All surface supplied diving systems used in the renewable energy sector should be capable of offering the same level of safety redundancy for the divers as those found on purpose-built diving support vessels working in the offshore oil and gas industry.

In the renewable energy sector a variety of vessels are used as diving platforms.

2 Some of these vessels may be relatively small and have limited deck space available for the mobilisation of diving systems.

3 The main components of a fundamentally sound surface supplied diving system are described below. These are considered to be the minimum components that should be found on any surface supplied diving system.

* Deck decompression chamber (DDC)
* Control stations
* Primary and secondary air or gas supply.
* Handling equipmenty for launching and recovering the diver in/ out of the water.
* Divers umbilical, equipped with life support, communications and a strength member.
* Personnel diving equipment
* Emergency breathing capabilities.

4 The components making up the complete surface supplied diving spread will be more thoroughly detailed in national regulations or other specific guidance.

5.3 Provision of Safe Access and Egress and Emergency Recovery Arrangements for Divers

1 During surface supplied diving divers need to be able to enter and leave the water safely and in a controlled manner. In addition it should be possible to recover an injured or unconscious diver to the deck of the diving platform swiftly and in a manner which does no further harm.

2 When diving from an anchored vessel or a floating structure where there are no hull obstructions near the diving site and the freeboard is less than 2 metres, a suitably angled ladder may be appropriate.

3 Where diving is to take place with a freeboard in excess of 2m, the planning arrangements for the task will need to take into account the most appropriate method for safely launching and recovering both the diver and the stand-by at different times.

4 The equipment used, may need to include the use of a Launch and Recovery Systems (LARS).

The specification for the LARS should meet standard industry requirements for diving plant and equipment.

5.4 Maintenance of Diving Plant and Equipment

1 A Planned Maintenance System(PMS) reflecting manufacturer requirements should be established for all diving plant and equipment. The frequency and extent of examination and testing required for all items of diving plant and equipment should be in accordance with relevant legal provisions, and international, European or national standards.

2 It is strongly recommended that diving system assurance audits are carried out by competent persons prior to the commencement of diving projects.

5.5 Gas Purity

1 All breathing gas supplies (air or nitrox) should be adequately filtered, clean and free of contaminants. Positioning of compressor intake openings is important.

For example; Intakes may have to be moved if the wind direction changes to ensure that no engine exhaust gases or other contaminants enter working compressors.

2 Periodic (frequent) gas purity testing should be carried out on a regular basis to demonstrate the purity of breathing gases produced by diving plant meets the appropriate European Standards.

6 Auditing

6.1 Auditing Arrangements

1 All contractors have a moral, social and in most cases legal duty to prevent accidents by every practical means available to them.

2 Safety inspections and audits are a beneficial tool that assist management or others to judge how well safety is being managed and, when carried out effectively, helps to identify problems and possible causes of accidents before they happen.

3 Once problems or deficiencies are identified working practices, risk assessments or other control measures can be revised to reduce the possibility of a recurrence.

4 Since legislation requires the preparation of task specific risk assessments, and many clients require sight of safety policies, method statements or risk assessments prior to an award of contract, by providing evidence that an effective audit process exists, helps demonstrate that good safety performance is a key component within the organisation.

5 Internal audit results are critical inputs to aid in assessing the effectiveness of any SMS and are used to identifying opportunities for improvement. Their purpose is to determine whether the process has been effectively implemented and maintained and to identify opportunities for improvement.

6 Accordingly, the audit process – when used in a well planned mannere - is a key method for communicating with and involving all persons involved in a continual improvement process.

7 Internal audits should be conducted in accordance with a published schedule that identifies the audit scope and frequency. The schedule may be developed on the basis of status and importance of the activity to be audited and previous audit results.

8 External or third party audits should be carried out by competent persons, who have no direct connection with any other contractor, and most importantly an extensive knowledge of the activity being carried out, and the standards against which the audit should be conducted.

6.2 Client representatives

1 A client representative should be appointed by the client and provided with a clear briefing on the contractual requirements and standards to be adopted on the project.

2 The client representative should also be experienced in the type of operation being carried out and fully aware of the procedures and practices being used by the diving contractor.

3 The client representative should ensure that the standards to which the works are to be carried out are clearly set out and **ALL** parties understand and are familiar with their respective responsibilities.

4 Efforts to establish the above elements before the works on site are commenced should be made.

5 Changes to expectations or requirements that are imposed after contracts are awarded and works commence, can only result in unwarranted confusion and frustration that is of no benefit to any of the parties involved. A Management of Procedure (MoC) that documents and records changes that occur would normally be required.

6 Relations between the contractor and the client's representative should, whenever possible, be conducted in a professional and polite manner.

7 Better outcomes will result when all parties involved carry out their part of the works in a professional and courteous manner.

7 References:

7.1 Acronyms routinely used in the Commercial Diving Sector

ACoP	Approved Code of Practice. Commercial Diving Projects Inland / Inshore (ACoP L104)
ADC	Association of Diving Contractors is the inland / inshore diving industry trade association body for UK and Ireland
AODC	Association of Offshore Diving Contractors. (Superseded 01-April-1995 by the formation of ADC and IMCA)
CCTV	Closed Circuit Television
Certification	A document that confirms that a particular test or examination has been carried out or witnessed at an identified time on a specific piece of equipment or system by a competent person
Classification	A diving system built in accordance with a classification society's own rules, can, at the owner's request, be assigned a class
Competence	Having sufficient training or experience (or a combination of both) to be capable of carrying out a task safely and efficiently
DCI	Decompression Incident
DDC	Deck Decompression Chamber. (Used for recompression following diving operations) See also SDC and alternate acronym for a decompression chamber.
DMAC	Diving Medical Advisory Committee.
DOR	Diving Operation Record
Diving System	All diving plant and equipment used during a diving project including responding to all reasonably foreseeable emergencies on site and off site e.g. remote decompression chambers etc
DPV	Dynamically Positioned Vessel (DP)
DPP	Dive Project Plan
EAP	Emergency Action Procedures
FMEA	Failure Modes and Effect Analysis. This is a methodology used to identify potential failure modes, determine their effects and identify actions to mitigate the failures
FMECA	Failure Mode Effect Criticality Analysis is an extension of FMEA.
FSSS	Full surface supplied spread
HAZARD	A hazard is something with the potential to cause harm, e.g. water, environmental factors, working at height, plant, lifting operations, diving methods (SCUBA)
HAZID	Hazard Identification Study
HAZOP	Hazard and Operability Study
HP	High Pressure (Generally as a reference to air supply)
IAW	In accordance with
IMCA	International Marine Contractors Association is the international trade association representing offshore, marine and underwater engineering companies
ISM	International Safety Management
ISS	International Ship Security
JUV	Jack Up Vessel (See also SEV)
LARS	Launch and Recovery System (Generally an air or hydraulic winch or crane arrangement)
LMSSS	Lightweight Mobile Surface Supplied System.
LOLER	Lifting Operations and Lifting Equipment Register
LP	Low Pressure or Lift Plan (Depending on context)
MoC	Management of Change. *(A formal process undertaken by competent personnel, incorporating risk assessment, should take place to change an existing approved design / fabrication or work / installation procedure.)*
MS	Method Statement
MSMS	Model Safety Management System
NCR	Non Conformance Report
NITROX	Any mixture of nitrogen and oxygen where the two gasses represent the major constituents of the gas mix.
PMS	Planned Maintenance System (For Diving plant and equipment)
PPE	Personnel Protective Equipment

PTD	Permit to Dive
PTW	Permit to Work
PUWER	Provision and Use of Work Equipment Regulations 1998
RIB	Rigid Inflatable Boat
RIDDOR	Reporting of Injuries, Diseases and Dangerous Occurrences Regulations
RISK ASSESSMENT	The process by which every perceived risk is evaluated and assessed. As part of the process control measures to be established to prevent harm before an operation commences should be identified. The findings and actions will be documented. A risk assessment is part of the risk management process
ROV	Remotely Operated Vehicle
SCUBA	Self Container Underwater Breathing Apparatus
SDC	Surface Decompression Chamber (Alternative to DDC)
SEP / SEV	Self Elevating Platform / Vessel
SMS	Safety Management System
SSDE	Surface Supplied Diving Equipment
SSOW	Safe System of Work
SWP	Standard Work Procedure
TBT	Tool Box Talk
TD	Tidal Volume (The volume of gas that moves in or out of the lungs with each breath)
TOFS	Time Out for Safety
TRA	Task Risk Assessment

7.2 Useful list of Third Party Reference Sources:

1	ADC	*The **Association of Diving Contractors** represents diving contractors who are involved with inland or inshore diving operations in the UK and Ireland.* *ADC circulate to Members information and reference documents relevant to the Inland / Inshore diving activity. W: www.adc-uk.info*
2	IDSA	***International Diving Schools Association** was formed in 1982 with the primary purpose of developing common international diving standards. W: www.idsaworldwide.org*
3	IMCA	***International Marine Contractors Association** is the international trade association representing offshore, marine and underwater engineering companies and offers good practice guidance to industry on technical and commercial topics by way of documents, seminars and dialogue. W: www.imca-int.com*
4	MSF	*The **Martine Safety Forum** actively promotes good practices and initiatives to promote safety within the marine sector of the Northern European oil and gas industry. W: www.marinesafetyforum.org*
5	NORSOK	*The **NORSOK** standards are developed by the Norwegian petroleum industry to ensure adequate safety, value adding and cost effectiveness for petroleum industry developments and operations. Furthermore, NORSOK standards are as far as possible intended to replace oil company specifications and serve as references in the authorities regulations.*
6	NADO	***The Netherlands Association of Diving Contractors** The Netherlands Diving Centre aims to serve the Netherlands diving community. The NDC is a not for profit foundation. Its Board consists of representatives of the government, the unions, the industry en sports diving.*
7	National Legislation	*Will vary from country to country but should be an excellent source of information or informed contacts.*
8	EN Standards	*A standard is a document that sets out requirements for a specific item, material, component, system or service, or describes in detail a particular method or procedure. Standards facilitate international trade by ensuring compatibility and interoperability of components, products and services. They bring benefits to businesses and consumers in terms of reducing costs, enhancing performance and improving safety.* *Standards are developed and defined through a process of sharing knowledge and building consensus among technical experts nominated by interested parties and other stakeholders - including businesses, consumers and environmental groups, among others.* *The formal definition of a standard is a "document, established by consensus and approved by a recognised body, that provides, for common and repeated use, rules, guidelines or characteristics for activities or their results, aimed at the achievement of the optimum degree of order in a given context".*