



# Guidelines for Health and Safety in the Marine Energy Industry



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## Preface

The BWEA is proud to endorse these guidelines for health and safety for marine energy converters. The BWEA produced its health and safety guidelines for the wind industry in 1994 and has been maintaining these with the latest understanding of best practice ever since. Since 1994 it has become clear that many of our members were also becoming involved in wave and tidal stream generation and so in 2004 we took marine energy to be part of our remit as well. Though there are similarities between the wind and marine energy industries, there are also great differences, significantly in the stage of development of the respective technologies and the very exposed and high energy marine locations in which wave and tidal arrays will be located. This document will be taken forward with consultation and further consideration to make full use of the knowledge contained within the industry and draw on experience from the offshore wind industry and other sectors.

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## 1 Introduction

The potential of wave and tidal energy around the UK shores is significant. To harness this potential will require great efforts of engineering. Wave energy converters will be located in exposed marine conditions with sometimes severe wave climates, whilst tidal energy converters will be located in areas of very high current. These 'high energy' locations present new and complex challenges to offshore construction and it is vital that developers ensure that they place adequate emphasis on understanding and mitigating the health and safety risks associated with these novel developments.

Developers are expected to adhere to the highest standards and ensure that contracts for design, procurement and operation are written so as to promote safe practices and avoid clauses that may compromise health and safety. This is fundamental to the development and maintenance of a strong safety first culture within the industry.

Owners, designers, manufacturers and installers of the plant and equipment will have significant impact on health and safety throughout the life of the project. As such they have a major influence in promoting improvements in health and safety within the industry.

The emerging nature of the marine renewable energy industry means there is a great variety in the devices under development and their installation and maintenance requirements. Health and safety guidance will need to be specific enough to give an adequate level of protection and also flexible enough to allow innovative ideas to be developed.

Future revisions of these guidelines are expected as the marine renewable industry expands and new devices are developed. At this stage it is by no means certain which technologies will become the most extensively used in future. Experience will develop as projects are installed, technologies mature and the industry moves, in some cases, from single device installations to device arrays. The knowledge gained from this will need to be incorporated in future editions of this document. New legislation and regulations being developed may require a change to health and safety practices. These guidelines intend to be at the forefront of these changes, shaping them to assist in delivering the highest standards for the industry.

## 2 The Nature of the Guidelines

- 2.1** This guidance is intended to be relevant to all organisations contributing to the life cycle of marine device arrays (from initial feasibility studies through to de-commissioning) but is particularly relevant to senior management within organisations developing, constructing or operating marine devices, or considering becoming involved in the sector.
- 2.2** It is not intended to provide in-depth advice and guidance on all aspects of health and safety in relation to the design, construction, commissioning, operation, maintenance and removal of devices. However, it does provide senior management with sufficient information to ask the necessary questions in relation to these aspects, in order to satisfy themselves that their organisation is promoting the highest standards of health and safety.
- 2.3** Both wave and tidal stream devices are covered by this guidance, however, there are aspects of health and safety where these devices differ. It is made clear in the text whether the advice is appropriate for both types of technologies or if only one is covered.

### 3 Status of the Guidance

- 3.1** Organisations involved with the marine renewable energy industry are reminded that they do have statutory duties under UK health and safety legislation. The purpose of this document is to offer some advice on health and safety issues that are specific to the marine energy industry. Satisfying the requirements of this guidance should not be viewed as an indication of total compliance with the law. There is no substitute for knowledge of individual duties and legal requirements.



## 4 Further Information

- 4.1** Appendix 1 highlights navigational and maritime issues for marine device health and safety.
- 4.2** Appendix 2 contains a brief explanation of the main areas of legislation applicable to the marine renewable energy industry. A list of some useful health and safety publications can be found in Appendix 3.
- 4.3** Further advice is available directly from the Health and Safety Executive (HSE) and some contact points are provided in Appendix 4.
- 4.4** For small organisations that do not have the necessary knowledge, skills or resources available to them, specialist advice can be sought from an independent Health and Safety Consultant. The Institution of Occupational Safety and Health (IOSH) maintains a Register of Health and Safety Consultants. Further information is available on the Internet at [www.iosh.co.uk/index.cfm?go=consultancy.main](http://www.iosh.co.uk/index.cfm?go=consultancy.main).

## 5 Principles of Successful Health and Safety Management

### 5.1 Introduction

Successful Health and Safety Management is achieved by creating and maintaining a strong health and safety culture at the projects conception. A Health and Safety Management System should be put in place from the start and responsibility for its development and implementation should be allocated.

### 5.2 Legislative Requirements

The following health and safety legislation sets out requirements for all employers to establish a health and safety policy and supporting arrangements for the effective implementation of the policy.

#### **The Health and Safety at Work etc Act 1974**

**Section 2 (3)** – *It shall be the duty of every employer to prepare and as often as may be appropriate revise a written statement of his general policy with respect to the health & safety at work of his employees and the organisation and arrangements for the time being in force for carrying out that policy, and to bring the statement and any revision of it to the notice of all his employees.*

#### **Management of Health & Safety at Work Regulations 1999**

##### **Regulation 5 - Health and safety arrangements**

**Reg 5 (1)** *Every employer shall make and give effect to such arrangements as are appropriate, having regard to the nature of his activities and the size of his undertaking, for the effective planning, organisation, control, monitoring and review of the preventive and protective measures.*

The HSE's Guidance document "Successful Health and Safety Management" - HSG 65 - ISBN 0 7176 1276 7, has been designed to provide employers with appropriate guidance to enable them to understand how they may implement and fulfil, in practice, the requirements of this legislation.

The key elements described within this guidance document are:

- policy;
- organising;
- planning and implementation;
- measuring performance;
- auditing and review.

Properly linked, these elements combine to form a coherent and effective health and safety management system. It is important to remember, as with all management systems, they should be tailored to the needs of the organisation and be continuously reviewed and where necessary improved, to ensure their effectiveness.

### 5.3 Policy

*Setting the overall aims and confirming management commitment.*

The ultimate aim of a health and safety policy is to apply the logic and rigour of business planning to the identification and control of risks. All areas of business are influenced by health and safety policy. The policy provides amongst other things, the commitment of senior management to the health and safety objectives of the organisation.

### 5.4 Organising

*Identifying who will do what.*

To secure the implementation and continued development of a health and safety policy, it is essential to have a clearly-defined structure to manage the implementation of policy and resulting procedures. Although health and safety is the responsibility of everyone, specific responsibilities of individuals involved in health and safety at all levels of the organisation should be established, as should the relationships between those individuals. The aims of the organisation should be to:

- establish and maintain management control within the organisation;
- promote a strong safety culture;
- promote co-operation between individuals, safety representatives and groups so that health and safety becomes a collaborative effort;
- ensure that responsibilities are clearly set down and understood;
- ensure communication of relevant information throughout the organisation;
- secure the competence of employees.

### 5.5 Planning and implementation

*Putting policy into practice*

To be successful in health and safety management, it is necessary to draw up plans and set performance standards, with the overall aim of controlling or eliminating risks. The plans define the standards of health and safety the organisation is aiming to achieve, how they will be accomplished, and the timescale for achievement. The planning and implementation process, which should include staff consultation and training, will result in operating and maintaining systems which:

- identify objectives and targets for their achievement within a specified period
- set performance standards for management actions;
- set performance standards for the control of risks to employees and others affected by work activities (for example, customers and visitors);
- establish priorities for provision and maintenance of control measures;
- ensure adequate supporting documents for all performance standards;
- provide adequate resources including time

In devising control measures, it is necessary to analyse work practices, systematically identify risks and carry out risk assessments (see Section 5.8). When identifying and formulating appropriate control measures employers are required to follow the hierarchy of control in accordance with Regulation 4 – “Principles of prevention to be applied” and Schedule 1 of the Management of Health & Safety at Work Regulations 1999 (detailed below):

- a. avoiding risks
- b. evaluating the risks which cannot be avoided
- c. combating the risks at source
- d. adapting the work to the individual, especially as regards the design of workplaces, the choice of work equipment and the choice of working and production methods, with a view, in particular, to alleviating monotonous work and work at a predetermined work-rate and to reducing their effect on health.
- e. adapting to technical progress
- f. replacing the dangerous by the non dangerous or the less dangerous
- g. developing a coherent overall prevention policy which covers technology, organisation of work, working conditions, social relationships and the influence of factors relating to the working environment
- h. giving collective protective measures priority over individual protective measures
- i. giving appropriate instructions to employees

## 5.6 Measuring and reviewing performance

*Checking standards are really being achieved, praise achievement and ensure faults / opportunities for improvement are acted on*

In order to check that the health and safety standards are actually being achieved in practice, it is necessary to measure performance against the pre-determined plans, standards and procedures. Any areas where the planned standards are not being met should be identified for remedial action. The types of systems that can be used to monitor health and safety performance can be categorised into active and reactive systems.

### *Active monitoring systems*

Also known as Pro-active monitoring, include:

- monitoring of specific objectives and reporting results quarterly or monthly.
- periodic examination of documents to review performance assessment, recording of training needs and delivery of suitable training.
- the systematic inspection of premises, plant and equipment by supervisors, maintenance staff, management and safety representatives or other employees to ensure the continued effective operation of workplace precautions.
- environmental monitoring and health surveillance to check on the effectiveness of health control measures and to detect early signs of harm to health.
- direct observation of work and behaviour by first line supervisors to assess compliance to procedures, rules and risks control.
- the operation of audit systems
- regular review of health and safety performance reports by the Board of Directors

#### *Reactive monitoring systems*

Identify where health and safety standards are not being met and report and analyse failures – for example, accidents, cases of ill health or damage to property.

When reporting and response systems are put in place it is important to ensure that monitoring information is evaluated by people competent to recognise situations where there is an immediate risk to health or safety, as well as longer term trends. They should have sufficient authority to ensure that appropriate remedial action is taken. Effective investigation and analysis requires that:

- priority is given to incidents which indicate the greatest risk;
- identification of both the immediate and the underlying causes of events;
- information reaches management with sufficient authority to initiate remedial action, including organisational and policy changes;
- adequate analysis is made of all collected data to identify common features or trends and initiate improvements at an organisational level.

The response to auditing is the final step in the health and safety management cycle. Together, performance auditing and review constitute the 'feedback loop' needed to enable the organisation to maintain and develop its ability to manage risks to the fullest possible extent. Auditing and review ensure that any inadequate performance is identified and appropriate remedial action is put into effect. Regular auditing of health and safety systems can identify whether they have deteriorated or are becoming obsolete. Auditing needs to be comprehensive and to examine, over time, all the components of the health and safety management systems in an organisation.

### **5.7 Relevance of Occupational Health & Safety Auditable Standard (OHSAS) 18001: 2007**

HSG 65 contains guidance on compliance with the requirements of the Management of Health & Safety at Work Regulations 1999 (MHSAW) Regulation 5 – Health & Safety Arrangements; and the basis of a Health & Safety Management System (HSMS) model.

OHSAS 18001 is increasingly the preferred Health & Safety Management System model. If correctly used in conjunction with the guidance detailed within HSG 65, compliance to the requirements of Regulation 5 (of MHSAW) is achieved.

- the structure of OHSAS 18001 standard enables other more commonly used standards such as BS EN ISO 9001 (Quality Management) & BS EN ISO 14001 (Environmental Management) to be easily transposed into a singular Integrated Management System (IMS) covering all three internal company disciplines.
- the UK Accreditation Society currently list only 3 bodies capable of certifying to OHSAS 18001. Other bodies may offer auditing to the standard but cannot offer certification.

## **5.8 Risk Assessment**

Risk assessment is a key activity in the management of health and safety. The main health and safety legislative requirement for risk assessment is detailed under the Management of Health & Safety at Work Regulations 1999:

It should be noted that other legislation, such as Confined Spaces Regulations 1997, Control of Substances Hazardous to Health Regulations 2002 as amended 2005, Manual Handling Regulations 1992 as amended, etc, all require an assessment of risk to be undertaken.

Various techniques are available and some are more suited than others to different phases of the design, manufacture, construction, commissioning, operation, maintenance and decommissioning activities.

An organisation's health and safety management system should define the risk assessment techniques to be used at each of the project disciplines to be undertaken. This should also include the level of competence required from those carrying out the risk assessments.

Risk assessments should address all health, safety and environmental risks, during all phases of the life cycle of a project, including those to members of the public as well as all personnel working on site.

The findings of a risk assessment should be in the form of controls to be applied to the work place to reduce exposure to the identified risks. Both the identified risks, and the control measures selected to prevent the realisation of those risks, should be communicated to those carrying out the work, prior to work commencing. Records of all information, instruction and training are required to be retained as evidence they were provided.

Initial guidance on risk assessment can be found in the HSE's publication INDG163, '5 Steps to Risk Assessment'.

## 5.9 Management of Change

All temporary and permanent changes to organisation, personnel, systems, procedures, equipment, products, materials or substances should be evaluated and managed to ensure that health, safety and environmental risks arising from these changes remain at an acceptable level.

The Management of Change process should consider;

- risk assessment
- the revision of existing documentation or the issuing of a method statement or work instruction.
- the introduction of a realistic timescale to implement control measures and any change.
- the identification of the control measures, which are to be implemented.

Any revisions to existing documentation or the issuing of new documentation must be authorised by the responsible person(s). Personnel assigned to the task or procedure shall be involved in this process, so they have a full understanding of any proposed changes.

Where major changes are planned, it is important that their potential impact on the health and safety of the project is properly assessed so that hazards or risks associated with the change are identified and managed. The CDM regulations require all parties to co-operate and co-ordinate their activities and this requires clear channels of communication to be set up and maintained. A management of change procedure should be established at the start of a project to ensure changes are managed and implemented effectively.

## 6 Legislation and Standards

### 6.1 Relevant Health and Safety Legislation

The legislation which is likely to be most relevant to different phases of a Marine Renewables Project is listed in the table below. The Construction (Design & Management) Regulations 2007 (CDM Regulations) supported by the Health & Safety at Work Act 1974 and Management of Health & Safety at Work Regulations 1999, is the main piece of health and safety management legislation which is required to be used when preparing for and carrying out construction activities, including the planning, design, installation, commissioning, maintenance and decommissioning of a Marine Renewables Project.

The table is intended to provide a guide to each of the project phases of a Marine Renewables Project lifecycle, described in Sections 7 to 10, into which each act or regulation may apply. It is not exhaustive and the indication of applicability should not be taken as a legal interpretation.

It is recognised that the unique nature of each type of marine energy device may raise questions of applicability of the identified legislation. In the interests of personal safety and in the absence of specific direction, it is recommended that this legislation be adopted and applied wherever practicable.

It is also recognised that some aspects of Marine Operations may fall under the Merchant Shipping Regulations and jurisdiction of the Maritime and Coastguard Agency (MCA). Additional guidance has been provided within the Marine Legislation section below.

Under normal conditions the Master of the vessel would be responsible for implementing the requirements of the UK Marine legislation and reporting to the MCA and the Principle Contractor will implement UK Health and Safety Legislation for the construction activities, reporting to the HSE.

The MCA will be the lead authority for inspection of, and MAIB for the investigation of accidents to or on, any vessel which is used in navigation. MCA's interest is in the seaworthiness of the vessel and the safety and competence of the crew. The HSE will be the lead authority for enforcement and investigation of occupational accidents (including accidents to workers on the vessel) resulting from land based works or undertakings, including e.g. dock work, drilling into the seabed and related activities.

Where immediate action is required, HSE or MCA surveyors will be expected to take it and notify each other's organisations accordingly.

The legislation is set out more fully in Appendix 2, which includes a synopsis of each item. More recent UK health and safety legislation has been drafted to enact European Directives and thus the general provisions should prove familiar to suitably competent persons from other EU countries.



Name of Legislation	Section			
	7	8	9	10
Health & Safety at Work etc Act 1974	√	√	√	√
Management of Health & Safety at Work Regs 1999	√	√	√	√
The Construction (Design & Management) Regs 2007	√	√	√	√
Merchant Shipping and Fishing Vessels (Health & Safety at Work) Regs 1997			√	√
Merchant Shipping (Code of Safe Working Practices for Merchant Seamen) Regulations 1998	√	√	√	
The Workplace (Health, Safety & Welfare) Regs 1992	√	√	√	√
The Docks Regulations 1988			√	√
The Regulatory Reform (Fire Safety) Order 2005	√	√	√	√
Fire (Scotland) Act 2005	√	√	√	√
Fire Safety (Scotland) Regulations 2006	√	√	√	√
The Health & Safety (Consultation with Employees) Regulations 1996	√	√	√	√
The Safety Representatives and Safety Committee Regulations 1977	√	√	√	√
The Diving Regulations 1997			√	√
Provision and Use of Work Equipment Regulations 1998	√	√	√	√
The Supply of Machinery (Safety) Regulations 1992 as amd. 1994	√	√	√	√
Lifting Operations and Lifting Equipment Regulations 1998	√	√	√	√
Pressure Equipment Regulations 1999 (Pressure Equipment Directive)	√	√	√	√
Pressure System Safety Regulations 2000	√	√	√	√
Electricity at Work Regulations 1989	√	√	√	√
The Electricity (Safety, Quality and Continuity) Regulations 2002	√	√	√	√
The Electromagnetic Compatibility Regulations 1992	√	√	√	√
Working at Height Regs 2005		√	√	√
Confined Spaces Regulations 1997		√	√	√
The Control of Vibration at Work Regulations 2005	√	√	√	√
Noise at Work Regulations 2005	√	√	√	√
Control of Substances Hazardous to Health 2002 as amd 2005	√	√	√	√
Dangerous Substances and Explosive Atmospheres Regulations 2002	√	√	√	√
The Carriage of Dangerous Substances & Use of Transportable Pressure		√	√	√
Health & Safety (Display Screen Equipment) Regulations 1992 as amd 2002	√	√	√	√
Manual Handling Regulations 1992 as amd 2004	√	√	√	√
Personnel Protective Equipment Regulations 1992 as amd 2005	√	√	√	√
The Construction (Head Protection) Regulations 1989	√	√	√	√
The Health & Safety (Safety Signs and Signals) Regulations 1996	√	√	√	√
The Health & Safety (First Aid) Regulations 1981	√	√	√	√
The Reporting of Injuries Diseases and Dangerous Occurrences Regulations 1995	√	√	√	√
Health & Safety Miscellaneous Amendments Regulations 2002	√	√	√	√
The Coast Protection Act 1949, as amended by the Merchant Shipping Act 1988	√	√	√	√
The Factories Act 1961	√	√	√	√
Offices, Shops and Railway Premises Act 1963	√	√	√	√

### Marine Legislation

Over the years various international conventions have been ratified to cover health and safety of merchant shipping and the use and operation of vessels. Under the Merchant Shipping Act, the UK Government has adopted the international convention orders and implemented its requirements into UK Law, usually under "Merchant Shipping Regulations". The MCA are responsible for monitoring the implementation of UK Marine legislation.

The specialist type, nature and availability of appropriate construction vessels, many of which are contracted from non-UK countries, make it difficult to ensure vessel compliance with UK Marine legislation. These non-UK vessels shall however, comply with their own country's interpretation of the international conventions for shipping.

Under the Construction (Design & Management) Regulations 2007, clients and principal contractors have specific responsibility for ensuring the **competence of contractors** who they may engage to carry out work on their site.

Therefore all organisations constructing Marine Renewables Projects within the jurisdiction of the UK should ensure all vessels contracted comply with (as a minimum) the international conventions detailed below as appropriate to the specific vessels and their intended tasks:

**SOLAS** – Safety of Life at Sea

International Convention for the Safety of Life at Sea (SOLAS), 1974

**STCW** - International Convention on Standards of Training, Certification and Watchkeeping for Seafarers, 1995

**COLREG** - Convention on the International Regulations for Preventing Collisions at Sea, 1972

**MARPOL** - The current Convention is a combination of 1973 Convention the 1978 Protocol, and the various annexes enacted to date. It entered into force on 2 October 1983. As at 31 December 2005, 136 countries, representing 98% of the world's shipping tonnage, are parties to the Convention.

**Marine Guidance Note 371** - Offshore Renewable Energy Installations (OREIs) - Guidance on UK Navigational Practice, Safety and Emergency Response Issues

## 6.2 Relevant Standards and Guidelines

With the marine renewables industry still at an early stage of development, relevant standards are currently being adopted from other technologies. There are a number of Industry specific standards and guidelines currently being drafted which will be published during 2008. These are:

- tank testing of Wave Energy Conversion Systems
- tank testing of Tidal Energy Conversion Systems
- guidelines for Marine Energy Certification Schemes
- assessment of Performance of Tidal Energy Conversion Systems
- assessment of Performance of Wave Energy Conversion Systems
- assessment of Tidal Energy Resource
- assessment of Wave Energy resource
- guidelines for Manufacturing, Assembly and Testing of Marine Energy Conversion Systems
- guidelines for Project Development in the Marine Energy Industry
- guidelines for Grid Connection of Marine Energy Conversion Systems
- guidelines for Environmental Appraisal in the Marine Energy Industry\*\*
- guidelines for Design Basis of Marine Energy Conversion Systems

The above guidelines are being produced by the European Marine Energy Centre funded by the Scottish and the UK Governments.

Other useful references include:

#### **Managements System Models**

- BS EN ISO 9001 2000 - Quality Management Systems;
- BS EN ISO 14001 2004 - Environmental Management Systems;
- BS EN ISO 18001 2007 - Health & Safety Management Systems;
- ISO 9001 and TickIT accreditation (ISO 9001 for software lifecycle)

#### **Marine Energy Converter - Specific**

- guidelines for the use of metocean data through the lifecycle of a marine renewable development', CIRIA 2008
- EMEC Draft Standard "Performance Assessment for Wave Energy Conversion Systems in Open Sea Test Facilities"
- DNV (2005) Guidelines on design and operation of wave energy converters. A guide to assessment and application of engineering standards and recommended practices for wave conversion devices
- DNV-OSS-312 (2007): Certification of tidal and wave energy converters (in preparation)

#### **Design**

- DNV-RP-C202: Shell Buckling
- DNV-RP-C203: Fatigue Design of Offshore Steel Structures
- DNV Rules for Planning and Execution of Marine Operations
- DNV-OS-A101: Safety Principles and Arrangement
- DNV-OS-C101: Design of Offshore Steel Structures, General (LRFD method)
- DNV-OS-C301: Stability and Watertight Integrity
- DNV-OS-E301: Position Mooring
- DNV-OS-D101: Marine and Machinery Systems and Equipment
- PED - Pressure Equipment Directive 97/23/EC
- IEE (1992): Recommendations for the Electrical and Electronic Equipment of Mobile and Fixed offshore installation
- IEC 60204-1: Safety of machinery –Electrical equipment of machines – Part 1: General requirements
- BS 7671: IEE Wiring Regulations 17th Edition
- BS 6739 process control, installation and practice
- BS 61508 programmable electronic systems in safety related functions
- IEC 61131 PLC programming standard
- DNV-OS-D202: Instrumentation and Telecommunication Systems

#### **Deployment**

- DNV-RP-H101: Risk management in marine and subsea operations
- DNV-OS-J003: (1996-2002) Rules for planning and execution of marine operations
- HSE-OTR-2001 / 063 Marine risk assessment

This is not intended to be an exhaustive list and the developer will need to research the guidelines and standards most appropriate to their technology.

## **6.3 The Construction (Design and Management) Regulations 2007 (CDM regulations)**

### **6.3.1 Introduction to CDM**

The Construction (Design and Management) Regulations 2007 place duties on the client, designer and/or others in relation to construction projects in the UK, its territorial waters and or extensions outside of the UK (as defined within the Application Outside of Great Britain Order 2001) and includes construction within a Marine environment.

The CDM regulations are set out in the following 5 parts.

Part 1 – Introduction

Describes interpretation and application of the regulations

Part 2 – General management duties applying to construction projects

Details all duties to be applied to all construction projects (including non-notifiable)

Part 3 – Additional duties where projects is notifiable

Details specific duties to be applied to projects which are notifiable

Part 4 – Duties relating to health & safety on construction sites

Provides detail of specific precautions to be adopted and used on all construction sites.

Part 5 – General – Describes civil liability, enforcement, transition, revocations and amendments.

All regulations, duty holder responsibilities, duties and codes of practice are fully explained within the Approved Code of Practice (ACOP) - HSC Document: Managing health and safety in construction - L144 - ISBN 978-0-7176-6223-4.

### **6.3.2 Notifiable Projects**

Notifiable Projects are those which require to be notified to the HSE. The CDM regulations require the CDM Co-ordinator to ensure notification is provided to the HSE through the HSE Form F10 (rev) or if in Northern Ireland NI10.

A project shall require to be notified to the HSE when;

- the work is defined as construction work within the meaning described in Part 1 – Regulation 2 (1) Interpretation;
- the construction work shall take longer than 30 days to complete, or;
- the construction work shall take longer than 500 person hours to complete.

In most cases the construction of a Marine Renewables Project will be notifiable. It should be noted that some maintenance works may also become notifiable and it is important that those planning significant maintenance or upgrades are aware of their responsibilities with respect to this legislation.

### 6.3.3 Duty Holders under CDM regulations

The Main duty holders under the CDM regulations are:

- Client
- CDM Co-ordinator (Notifiable Project only)
- Designer
- Principal Contractors
- Contractors

In summary, and purely for guidance, the responsibilities imposed by the regulations on the Duty Holders are listed below. It is the responsibility of those involved with projects to ensure that they understand fully the detailed responsibilities and requirements within the CDM regulations and act accordingly.

#### **Client** – Organisation funding a project

- appoint a competent and adequately resourced CDM Co-ordinator at an early stage in project development;
- ensure the competence and adequate resources of any designer or contractor whom the client may arrange to prepare a design or carry out or manage construction work;
- appoint a designer and principal contractors at an early enough stage for them to plan and complete their work;
- provide all relevant pre-construction information that is likely to be required by other parties involved in the project;
- ensure the co-operation and co-ordination of all parties throughout the project;
- ensure there are reasonable management arrangements for health and safety in place for the duration of the project;
- receive and retain the Health and Safety File from the CDM Co-ordinator at the end of the project and keep available for future use, such as, maintenance, cleaning, modifications to or demolition.
- where a design is prepared or modified outside Great Britain for use in construction work to which the CDM regulations apply:-
  - If the person commissioning the design is established within Great Britain they shall ensure all the duties of the Designer have been complied with.
  - If the person commissioning the design is not established in Great Britain, any client for the project shall ensure all the duties of the Designer have been complied with.

**Designers** – Person/s or organisation/s making decisions on the form, nature, scope and timing of any structure (including plant and equipment)

- ensure they are competent and adequately resourced to enable them to complete their work
- ensure clients are aware of their duties
- ensure their designs avoid foreseeable health and safety risks (wherever possible eliminate hazards and reduce risks) to those involved in the construction and future use of the structure;
- ensure adequate information about any significant risks associated with the design is passed on to those who shall carry out the construction;
- co-operate and co-ordinate with all other parties involved within the project
- provide the CDM Co-ordinator all relevant information required for the Health & Safety File

**CDM Co-ordinator** – Person / Organisation appointed to support and advise client in order for them to comply with their duties

- provide advice and assistance on the competence of those others to be appointed within the project (designers and contractors);
- provide advice and assistance on adequate arrangements are in place for managing the project;
- notify the HSE of the project through form F10;
- ensure the co-operation and co-ordination of all parties through the design planning and other preparation work;
- identify and collect the pre-construction information required;
- provide all parties with all appropriate pre-construction information they may require;
- advise the client on the suitability and adequacy of the Construction Phase Plan;
- create and update a Health & Safety File suitable for future use at the end of the construction phase.

**Principal Contractor** – Competent construction contractor appointed by the Client.

- ensure client is aware of their duties;
- ensure a co-ordinator has been appointed;
- ensure HSE notified before they start work;
- ensure they are competent to address the health and safety issues likely to be involved in the management of the construction phase
- ensure construction work is planned, managed and monitored effectively;
- ensure appropriate resources and competent persons are available throughout the project;
- ensure all contractors are notified of the minimum amount of time required to enable them to effectively plan and complete their work;
- ensure all contractors are provided with all relevant information required to complete their work safely;
- ensure co-operation and co-ordination with all parties involved within the project;

- ensure a Construction Phase Plan is prepared and implemented prior to construction starting
- ensure all welfare facilities are in place from the start of the construction phase
- prevent unauthorised access to site
- provide the CDM co-ordinator all information relevant to the Health and Safety File;
- ensure that all the site personnel involved in the construction work workers are provided with and appropriate health and safety induction, information and training;
- ensure the workforce is consulted on all health and safety matters;
- display the project notification.

**Contractors** – any organisation carrying out construction work on site.

- ensure clients are aware of their duties;
- ensure they are and anyone they employ or engage are competent and adequately resourced;
- plan, manage and monitor their own work
- provide workers under their control with appropriate information, instruction and training required to perform their work safely
- ensure they co-operate and co-ordinate with all parties involved with the project;
- ensure their workers are consulted on all health and safety matters; and

#### **6.3.4 Documentary Process**

The main documentation requirements under the CDM regulations are:

##### **Pre-Construction Information**

Appendix 2 of the ACOP – L144 detail specific requirements for the provision of pre-construction information to be provided. The Pre-Construction Information is provided by the Client to designers and contractors detailing project specific health and safety information needed to identify hazards and risk involved with the project. This information is usually prepared and issued within a Pre-Construction Phase Plan (PCPP), which is used as an effective way of issuing and controlling this information and is widely used throughout the construction industry.

##### **Construction Phase Plan**

Appendix 3 of the ACOP – L144 details specific issues to be considered when formulating a Construction Phase Plan. The document is designed to set out a description of the work to be undertaken, the management arrangements for the project and the arrangements for controlling significant risks. The contents may vary depending upon the extent, the technical complexity of the project and level of involvement from other parties.

**The Health & Safety File**

Page 62 of the ACOP – L144 details the contents of the Health and Safety File. The file is required to be created during the construction phase by the CDM Co-ordinator. Once the construction phase is complete the file should be handed over to the Client. The file itself should remain with the owner of the structure until it is either decommissioned or the owner sells the structure to another, where the file would be passed on. The contents of the file should only include information relating to the structure, its operation, maintenance and decommissioning, the purpose being to provide the owner and others who may be required to work on the structure, with all appropriate information regarding residual risks, hazardous materials etc, its safe operation, etc, to enable them to identify and implement appropriate safety precautions prior to working on it.



## Sections 7-10

Sections 7-10 describe the current best practise for Health and Safety throughout the project lifecycle, from Site Selection through to decommissioning. Whilst advising the reader of their obligations under the applicable legislation, the document will go further in offering a detailed analysis of health and safety considerations and practical steps that should be taken to mitigate risks at different stages in the project.

## 7 Site selection, initial site investigation & planning considerations

### 7.1 Introduction

This section will cover site selection and initial site investigations from two aspects; the safety factors and relevant impact categories that should be considered when identifying possible sites, and those that should be taken into account when planning and executing investigation works. Where applicable, existing industry regulations and guidelines will be identified and drawn upon to provide the developer with an appropriate and relevant approach to Health and Safety in their site development program.

There are two key areas of consideration with respect to initial selection of potential safe sites for marine renewables installations:

- The selection of a marine renewable site that constitutes a 'safe' location with regards to its position within its surrounds;
- The safety considerations required when undertaking site investigations to obtain data in assistance of site selection.

The reader's attention is drawn to HSE research report 286 – 'Risk implications in site characterisation and analysis for offshore engineering and design'. This report considers site characterisation issues, geotechnical analysis and design and risk management.

## 7.2 Site Selection

The identification of suitable sites for marine renewable generation installation will be dependant upon a number of impact categories and their inter-relation within the proposed project. These categories include the following:

- wave / tidal resource;
- wind conditions;
- water depth;
- distance from shore;
- visual impact;
- local port facilities;
- the safe navigation of other marine users;
- fishing and fisheries;
- military exercise areas;
- other sea users:
  - marine archaeology;
  - sub-sea cables and pipelines;
  - marine aggregate extraction;
  - marine waste disposal;
  - offshore oil and gas;
  - marine recreation
- radar and communication interference
- sea bed bathymetry / soil materials;
- sedimentation/silting;
- marine growth;
- obstacles on the sea bed;
- nature conservation areas;
- grid connection;
- local MRCC / coastguard;

Each of these factors could influence the ability to safely construct, operate and maintain the site and should therefore be considered at this early stage.

### 7.2.1 Metocean factors

The most accurate design parameters for metocean data are derived from long data sets gathered at the intended location of an installation, i.e. site-specific data. However, data sets of sufficient length, accuracy and completeness are rarely available at this stage in a project, and preliminary design should then be based on more general, or indicative, values.

Site selection should take into account the ability of the design to safely withstand the full range of conditions that might be anticipated during the project lifetime. It is vital that attention is also paid to the conditions likely to be encountered during construction, operations and maintenance of the installation.

Metocean factors that are recommended for consideration with respect to the safe development of the site, including

- 100, 10 and 1-year return period values for wind-speed and significant wave height;
- wave height, current and tides;
- directional data for extreme values of wind, waves and current;
- wave height/period joint frequency distribution (wave scatter diagram);
- wave spectral parameters;
- wind/wave/current angular separation data;
- current speed and/or directional variation over the water depth;
- long term wave statistics by direction;
- frequency of weather events such as fog, ice and electrical activity.

### **7.2.2 Port facilities**

Port facilities and associated infrastructure can be a key motivation in locating a marine renewable project. Efficient construction works and ease of operations and maintenance may be heavily dependant upon nearby port facilities available to the project owner/operator. The suitability of the port facilities should be considered with regards to factors such as:

- appropriate and safe land access;
- water depth across the port and quays;
- tidal range;
- draught of approach channel and any other navigational constraints;
- quay space;
- lifting and transportation;
- under cover work areas.

However, with port operations comes a greater level of marine traffic. Careful consideration should be given to the benefits and risks associated with increased congestion of navigation routes.

### **7.2.3 Accessibility and access routes**

The selection of positioning of marine renewable devices as a single or multi unit array should consider the operations to be undertaken in the life of the device / array. A field layout diagram should be produced that indicated for information purposes:

- water depths
- the location of sub-sea equipment
  - Moorings
  - Anchors
  - Power cable
- sea bed features of interest

Details should also be provided detailing permitted and prohibited underwater activities / equipment, where a risk to the device and/or operating personnel exists.

Consideration should be given to the use of external markings to inform personnel as to the locations of safe access routes and hazardous regions, for example, sub-obstructions.

#### **7.2.4 Navigational risks**

Marine projects should be located in areas that do not endanger existing marine users. The extent of existing use should be identified through a traffic survey, conducted in support of consent for the device or array location. The navigational risks associated with existing traffic can then be assessed and the device or array located to minimise these.

Consent conditions for offshore wave and tidal devices, as stipulated by the Crown Estate, included the requirement for a navigational risk assessment within the Developer's Environmental statement. It is likely that similar requirements will be made of wave and tidal development proposals and consideration should therefore be given to Marine Guidance Note 275, issued by the Maritime Coastguard Agency, with regards to traffic surveys and the extent to which navigation would be feasible in close proximity to or within the array. Review and application of BERRs 'Methodology for Assessing the Marine Navigational Safety Risks of Offshore Wave and tidal devices' (URN 05/1948) may also be useful to the developer in assessing the site suitability with respect to navigational safety.

#### **7.2.5 Cable Routes**

Awareness of existing marine cables is an important consideration when undertaking site selection of marine structures and suitable routes for cable laying to shore. Submarine cables are supplied by high voltage of up to several thousand volts: on average, this might be 3-4000 V for a trans-Atlantic cable, and less than 1000 V for a UK-France cable. Severing a live cable may result in injury or death.

Cable awareness charts are available in electronic and paper copies from, for example, 'Kingfisher Information Service - Cable Awareness', <http://www.kisca.org.uk>. Emergency procedures and contact details are also available.

### **7.3 Site investigation**

Site investigation data, often supported by laboratory testing, is required to identify:

- resource potential and metocean conditions
- sea bed topography;
- nature and stability of the sea bed surface;
- existence of metallic objects and structures;
- geomorphology and engineering properties of the strata underlying the sea bed.

The extent of investigations should be sufficient in area, depth and detail to adequately cover the device or array location and potentially the cable routes. The size and complexity of the proposed anchor point arrangements, piling or foundation positions and the anticipated sea bed soil conditions to be encountered at these locations should also be considered in determining their extent.

Site investigation may include combinations of the following methods:

- detailed bathymetric and side-scan sonar surveys.
- shallow seismic reflection surveys.
- shallow sea bed sampling.
- shallow and deep in situ cone penetrometer / vibrocore
- current, tidal flows and wind speed recording

These offshore surveys may take the form of short campaigns, for example, seismic surveys, or may require the installation, monitoring and maintenance of measuring devices as in the case of metocean data. Each will in themselves pose health and safety risks that require the same methods of identification, assessment and mitigation as those offshore activities in later phases of the project. This section will discuss mitigation measures that can be used to reduce these risks.

Consideration should be given to the presence of munitions in the area, locations of official dump sites for both chemical and conventional weapons can be obtained using the information supplied by the OSPAR Commission and the Imperial College. A combination of surveying equipment such as side-scan sonars, magnetometers, underwater television and pulse induction gear can be used to establish the extent and density of munitions contamination in the area.

### **7.3.1 Hazard Identification and Risk Assessment**

Hazard Identification and Risk Assessments should be completed prior to commencement of site investigation works, to ensure that all risks associated with carrying out the works have been properly addressed and reduced to 'as low as reasonably possible' (ALARP). HIRA processes are discussed in more detail in section 5.

### **7.3.2 Contractor Selection for site investigation works**

Under CDM regulations, the Client should ensure that contractors selected to carry out site investigation works are competent to do so. Contractors should operate a fully documented Health and Safety management system which should address all of the issues inherent to marine survey operations. A job specific risk assessment and construction phase plan should be provided to the client prior to mobilisation. The client should ensure that the contractor is made aware of health and safety risks associated with working at the location.

Vessels engaged shall as a minimum meet the requirements of the Maritime Coastguard Agency vessel code for the operations to be undertaken.

### 7.3.3 Passage planning

Navigational passage planning should provide a means to safely complete a berth to berth marine passage in accordance with of SOLAS Chapter V Annex 24 'Voyage Planning' and under the guidance of the ICS Bridge Procedures Guide.

Information relevant to the safe navigation of the vessel would include, but not be limited to:

- tidal data
- under-keel allowances
- information from pilot books/sailing directions
- chart dangers (rocks, shallow water oil-rigs, etc)
- traffic schemes
- weather information (shipping forecasts)
- possible areas of restricted visibility
- any areas, which would involve an area of high traffic density

The planning stage uses this information to formulate a plan for the intended voyage.

The execution of the passage plan involves transferral of the formulated plan onto the charts, checking estimated times of arrival (ETA's) at key points along the route.

Once the passage actually commences, the executed plan is monitored.

### 7.3.4 Safe working conditions

The requirement for safe working conditions is legislated with the Health and Safety at Work etc Act 1974 with reference made to the Maritime Coastguard Agency Code of Safe Working Practices for Merchant Seamen.

All employers have a general duty under the Health and Safety at Work etc. Act 1974 (HSW Act) to ensure, so far as is reasonably practicable, that the health, safety and welfare at work of their employees is protected. This duty includes:

- providing and maintaining machinery, equipment, appliances and systems of work that are safe and without risks to health;
- ensuring that articles and substances are used, handled, stored and transported safely and without risks to health;
- providing the necessary information, instruction, training and supervision to ensure the health and safety at work of all employees;
- maintaining a workplace that is safe and without risks to health;
- providing and maintaining a working environment which is safe, without risks to health, and which has adequate facilities and arrangements for employees' welfare at work.

This section will highlight some of the specific responsibilities of the employer and give guidance on best practise for safe working environments offshore.

## 8 Design, Specification, Manufacture and Testing

### 8.1 Introduction

This section will cover safety aspects of the design, specification, manufacture and testing of marine renewable devices from two aspects:

- consideration of existing marine related classification rules and regulations (Lloyds / DNV / API) to highlight relevant design basis requirements for marine structures and
- design considerations for marine structures with regards to operations that may be conducted. Appropriate legislation (UK / IMO) shall be identified and referenced to aid the reader.

Designers have a duty under the CDM Regulations 2007 and the Management of Health and Safety at Work Regulations 1999, to identify and eliminate hazards at every stage of the design process, and to provide information with the design as to the nature of any significant risks remaining.

Where a design is prepared or modified outside Great Britain for use in construction work to which the CDM regulations apply:-

- if the person commissioning the design is established within Great Britain they shall ensure all the duties of the Designer have been complied with.
- if the person commissioning the design is not established in Great Britain, any client for the project shall ensure all the duties of the Designer have been complied with.

### 8.2 Site Specific Data Requirements for Safe Designs

While there are no standards that specifically cover the design and construction of wave and tidal devices, design engineers may utilise a great number of relevant codes and standards to assist in the creation of a safe design. Examples include publications by

- Lloyds Register
- Det Norske Veritas
- Health & Safety Executive
- Germanischer Lloyd
- American Petroleum Institute
- American Bureau of Shipping
- Institute of Electrical Engineers

An accurate assessment of the operating environment for a marine structure is fundamental to the correct application of any of the design standards. This will provide information necessary to calculate the structural loads that the installation should be able to safely bear.

A comprehensive set of operating and extreme environmental limiting conditions should be recognised and critical cases identified. The following cases are provided to guide the reader, but should be defined for each device as applicable:

- Intact case:
  - This case assumes the mooring system / structure is intact;
- Damaged case:
  - This case involves the failure of a single component, i.e. failure of a mooring line or anchor point;
- Design environmental conditions:
  - 100 year wave + 100 year wind + 10 year current;
  - 100 year wave + 10 year wind + 100 year current;
- Directional combinations:
  - For spread-mooring units, wind, wave and current can be applied in-line;
  - For weather vaning units, sufficient combinations of directions of wind, and current relative to wave direction should be investigated.
  - Piled or gravity based units should similarly be considered, using the 'worst case' combination effects

Designers should consider whether independent review of new designs, using a third party organisation, is appropriate, to i) provide greater assurance of overall integrity and ii) to assist in obtaining insurance as well as increasing the confidence of prospective purchasers.

### **8.3 Device Design Considerations**

#### **8.3.1 Structure and moorings**

Exact design requirements will be dependant upon each device, however structural factors of safety do exist for other offshore structures and moorings and these should be considered in the design. Indeed, existing design rules and regulations may be adopted by a device designer in a manner that enables design validation against existing marine structures.

These existing regulations may be obtained from a number of globally recognised sources including:

- Lloyds Register
- Det Norske Veritas
- Health & Safety Executive
- Germanischer Lloyd
- American Petroleum Institute
- American Bureau of Shipping

When designing structures and moorings, consideration should be given to their safe and practical installation and access for maintenance. Structures and moorings should also be designed such that their construction, assembly and testing can take place onshore as far as is possible.



### 8.3.2 Design Risk Analysis

In order to comply with the CDM regulations and Health and Safety at Work etc Act, device designers should identify hazards and risks associated with their designs for all stages of development from assembly, construction, installation, operation and maintenance to decommissioning.

The design risk analysis should consider the use of the following risk assessment tools to facilitate the identification of hazards and risks within the design and to stimulate design safety and reliability improvements into the design.

**Failure Mode Effect Analysis (FMEA)** and Failure Mode Effect and Criticality Analysis (FMECA) – are both formal, structured processes that are intended to look at, in detail, the many different ways in which a component and or system may fail and how frequently these failures may occur. Designers can use these tools to identify and understand weaknesses within their design, so appropriate modifications may be made. In addition, the device reliability data generated by analysis may also be used in the development of a planned preventive maintenance scheme for use in the Operations and Maintenance phase of a project.

**Hazards In Design (HAZID)** – is a formal, structured process which that is intended to look (at various stages within the design creation process) at the failure of components and systems and their consequential effect to personal safety, device integrity and overall project impact. To enable this process to be effective, the involvement of a number of key individuals from various disciplines, (for example; those from manufacturing, installation, commissioning) will provide the designer with specialist knowledge to help them understand and identify problems with the design and appropriate modifications to be made.

**Hazard Operability Study (HAZOP)** – is a detailed look at the hazards involved with the operability of the device, again this process should include specialist knowledge of from the various disciplines already mentioned within the HAZID. This tool shall identify specific issues and or problems relating to its operation and use, and when components need to be removed or replaced, enabling designers to make appropriate modifications and improvements to their design.

These assessments should be reviewed at each key design stage to identify, eliminate or reduce health and safety risks.

Particular attention should be paid to design choices affecting safety in the following areas:

- method of transport to site
- safe Installation and commissioning
- earthing and protection;
- insulation of electrical equipment and cables;
- safe isolation of mechanical and electrical equipment for maintenance;
- safe remote control and operation, including emergency shut down / isolation;
- manufacturers certifications and warrants;
- safe working access;
- safe working areas;
- safe means of escape;
- consequential failure of components
- guarding of machinery;
- fire prevention / detection / protection / suppression;
- prevention of unauthorised access and appropriate warning signs;
- operational controls;
- warning signs and markings;
- vessel Collision;
- wear and Corrosion;
- navigational aids and their access for maintenance.
- containment of hazardous or polluting substances

#### **8.4 Design for Marine Hazards**

Marine hazards are diverse in nature, being defined as '*any potential accident on a marine installation connected with its interface with the marine environment*'. HSE publication 2001/063 - Marine Risk assessment addresses marine hazards on a marine installation including:

- loss of position keeping (e.g. mooring failure)
- loss of structural integrity (e.g. hull, ballast tank, support structure failure)
- loss of stability (e.g. ballast system failure, shift of internal items)
- loss of marine / utility systems (e.g. hydraulics, power)
- collision (e.g. support vessels, passing vessels)

In addition to the aforementioned publications, the readers attention is also drawn to the Code of Safe Working Practices for Merchant Seamen, which covers this and a wide range of other safety issues.

Within the design, development, installation and operation of a marine renewable array, additional consideration should be given to tow-out operations. These operations would be subject to special deliberation as they may transit areas not normally considered in the site investigation. Further discussion of this topic is included in Appendix A.

## 8.5 Specifications

Those creating the physical design of a marine device should ensure throughout the design phase they set out clear specifications of the design. Specifications should be able to provide sufficient information to enable others to understand how the device is to be manufactured (including factory acceptance testing), constructed, installed, commissioned, operated, maintained and decommissioned.

Specifications should typically include (but not limited to) the following:

- Drawings for individual components and general assembly arrangements which include dimensions and tolerances;
- Material specifications, including references to appropriate standards;
- Reference to other standards for welding, pressure systems, electrical assembly, etc;
- Assembly instructions, which include the identification of safety critical or device integrity critical components and / or assemblies;
- Details of appropriate workmanship standards to be achieved and appropriate inspection, measuring and testing activities and techniques to be adopted to ensure design specification requirements have been achieved.

## 8.6 Manufacture

To enable marine devices to be manufactured correctly (and repetitively) the design should be provided with clear specifications. Those involved with the manufacture of the device/s shall understand the requirements more easily and shall be able to reproduce components, assemblies and devices to the required standards, with minimal misunderstanding, ultimately reducing errors and costly failure.

The design and specifications should be broken down into a logical manufacturing stage process, designed to ensure the safest and most practicable order of assembly. Clear assembly instructions should be created for each stage, clearly specifying order / methods of work, tools to be used, workmanship standards and acceptance criteria to be achieved. These instructions should be reviewed and approved by the designers to ensure no errors have occurred within the transfer of information, the correct assembly methods have been identified and all of the design criteria are correct.

The assembly instructions should be appropriately risk assessed to ensure due consideration of the specific hazards related to the actual work activity, tools and equipment used and the uniqueness of the work environment the activity is being undertaken within. All employees involved with the assembly activities relating to the device should be provided with appropriate information, instruction, training and supervision to ensure their health, safety and welfare and ensure correct assembly of the device.

## **8.7 Testing**

The importance of quality control at each stage of the manufacturing process cannot be underestimated. Quality control activities are designed to ensure that components, assemblies and devices are inspected, measured and tested to ensure their compliance to the design and specifications. Without these activities in place prior to device deployment, poorly assembled devices may go undetected and may result in premature device failure. The significance of any failure whilst the device is deployed can only be speculated, but may result in anything from a catastrophic device failure and risk to other mariners within the area or loss of production, both of which would require costly response to rectify.

A Quality Plan should be created detailing all the stages of the manufacture process, all inspections, measurements and testing to be performed, acceptance standards to be achieved and persons responsible for the quality control activity. Manufacturers and designers should agree on the critical areas of assembly and should ensure a Hold Point within the process is established to ensure the assembly is prevented from proceeding until a thorough inspection has taken place and confirmation of the required workmanship standards has been achieved.

Manufacturers of devices should establish a factory acceptance test criteria, to enable all appropriate pre-installation testing to be carried out, prior to deployment and installation. During the manufacture and testing of the initial device the manufacturer should ensure all non-conformities, negative test results and assembly improvements are fed back to the designer so they may review the data and perform the first stage of the design validation process - proof of assembly.

## 9 Installation, Commissioning and Decommissioning

### 9.1 Introduction

The installation and commissioning phases of the project will represent one of the highest risk phases with respect to Health and Safety considerations. As discussed in Section 8, much can and should be done in the design phase to improve constructability and remove or reduce construction phase risks, and section 9 now addresses key steps to further mitigate risks during this phase of the project.

Decommissioning activities will involve the same inherent hazards and risks, and so decommissioning is also addressed in this section.

### 9.2 Planning, Communication, Co-ordination

Excellent planning, communication and co-ordination of project health and safety goals, rules and requirements during construction, commissioning and decommissioning, can go a long way in preventing accidents. Areas for particular focus include:

- project organisational structure and identification of H&S roles and responsibilities
- communication – Client responsibilities, communication within the project, communication with third parties and other site users, communication with the public.
- communication Links- onshore, offshore and ship to shore
- management of Health and Safety issues throughout the project

### 9.3 Notification

The developer will be required to ensure that proper notification is given to the relevant authorities and other third parties in advance of construction works and for certain types of construction works to be carried out. Under the Construction (Design and Management) Regulations 2007, the HSE must be notified of any project that will last more than 30 days (of construction) or involve more than 500 man days. The F10 form supplied to the HSE must also be displayed on site. Notices to Mariners and regular navigational warnings will need to be given prior to and during offshore construction activities, and other third parties may need to be informed of certain activities, such as fishermen, or, where tall structures or cranes are to be erected, aviation users.

#### **9.4 Documentary control and Record keeping**

It is recommended from the outset that the project establish a document control and record keeping procedure for all documentation. Throughout the project various types of documentation shall be raised detailing specific information about the construction of the project. It is important to ensure all technical and safety related information contained within the documentation is controlled, so changes may be identified and effectively controlled. Examples of typical project documentation which will require to be controlled include:

- Project Health & Safety Management System procedures and documentation
- Pre-construction Information
- Construction Phase Plans
- Drawings
- Design Documents
- Specifications
- Minutes of Project Meetings
- Project Reports
- Method Statements
- Risk Assessments
- Test & Commissioning Reports
- Training Records and Certification
- Equipment Certification
- Construction Daily Reports

In addition the CDM regulations require a Health & Safety File to be created and maintained for the life time of the structure. This file is required to contain all relevant information relating to the structure (further detail is contained within the ACOP - L144).

#### **9.5 Hazard Identification and Risk Assessments (HIRA)**

The HIRA process (in line with Section 5.7 Risk Assessment) should be used to identify and mitigate or control hazards and risks at every step of the installation and commissioning phase. Outcomes of the HIRA process should feed into method statements and tool box talks to ensure that all those engaged in carrying out the works are aware of the residual hazards and risks and any steps that they should be taking to mitigate them. Where changes are being considered all potential hazards are to be identified and risks evaluated, Section 5.8 expands on this subject 'Management of Change'

#### **9.6 Safe System of work**

Written 'Safe System of Work' or 'Method Statements' are used to describe in detail the individual tasks to be carried out for each phase of the construction and commissioning and to list the risk mitigation measures to be taken. Any residual risks that should be properly controlled during the works are also highlighted.

These procedures should be prepared by the Principal Contractor or, if prepared by a subcontractor for specific areas of work, should be approved by the Principal Contractor.

### **9.8 Information, Consultation, Training and Supervision**

General duties of the employer, under the Health and Safety at Work, etc Act 1974, include the provision of information, training and supervision necessary to ensure employees, contractors or visitors' health and safety in the work place.

All personnel should be given a site safety induction before being authorised to entering any of the project sites. The contents of the induction will vary according to the nature of the site and whether it is on or offshore. Training requirements for specific locations or tasks should also be identified appropriate training provided, including

- minimum requirements for general safety inductions
- minimum appropriate safety inductions and training for personnel working offshore
- assessment of skills requirements for specific jobs
- training Matrices
- tool Box talks

The requirements of the management of Health and Safety at Work Regulations 1999 must of course be met.

### **9.9 Competency and Fitness**

In accordance with CDM Regulations 2007, all parties engaged in construction activity for the project have a responsibility to ensure that personnel under their control are competent to carry out their assigned duties. A Competency assessment and Training Policy shall be developed, to include

- Control and Assessment of Appointed Sub Contractors
- Drugs and alcohol Policy
- Health and Fitness
- Medical certification for Offshore personnel

### **9.10 Met Ocean Considerations**

Weather working limits may be a complex combination of wind, wave and tidal velocities. It is likely that different working limits will be set for different project activities for example crane operations, towing or diving operations- and also for different vessels. Good, site specific forecasts are important in assisting the scheduling of weather dependant operations safely and efficiently. Contingency planning in the event of deteriorating conditions requiring the suspension of operations should be considered as part of a risk assessment prior to commencement of works.

## **9.11 Safe Working Practices**

### **9.11.1 Site Access and Road Safety (Onshore)**

Site access onshore, should be managed to ensure the safety of project personnel and the public alike. Temporary access routes and hard standings may need to be established and should be appropriately specified and marked. Similarly HIRA findings may recommend the temporary closure of public highways and erection of fences or barriers during the project mobilisation or demobilisation.

An onshore transport management plan is recommended for all vehicle operations

### **9.11.2 Site Access and Navigational Safety (Offshore)**

All vessel movements under the control of the Principal Contractor will require the submission of passage plans in accordance with MCA guidelines to include;

- notification of relevant authorities
- notices to Mariners
- assessment of third party activity
- proper Navigation signals
- temporary Safety Zones
- marking of equipment left on site
- marine Co-ordination on site

Reference should also be made to site security which is discussed in section 9.15 and to weather working limits, discussed in section 9.10.

Developers will also need to take note of the Docks Regulations SI 1988 no. 1655 and subsequent amendments for health and safety requirements with respect to all dock operations, particularly where the device is intended to be accessed by means of a confined space entry whilst in port, the requirements of the Confined Spaces Regulations 1997 will be applied. They will also need to ensure that all vessels engaged on the project comply with the requirements of the International Ship and Port Security Code (ISPS).



### **9.11.3 Device Access and Egress**

Access to most marine energy converters out at sea is a high risk activity and should not be attempted if other means of completing the work are possible.

When establishing procedures for safe personnel access and egress, it is recommended that consideration is given to

- Metocean limits for safe access, including access during the hours of darkness or in poor visibility
- PPE required during access
- maximum loads for personnel accessing device
- personnel training
- contingency arrangements for emergency egress or extraction of a casualty, including a rehearsed emergency response plan.

Personnel transfers offshore should always be limited to those deemed absolutely necessary. It is imperative that safe systems of work or method statements for access and egress are fully developed and subject to rigorous risk assessment prior to implementation.

### **9.11.4 Towing**

Some marine renewable devices will be towed to and from the site for installation and for subsequent maintenance works. In addition towing operations may be required during installation for jack up and other barges bringing parts and equipment to the construction site.

Health and safety considerations for safe towing operations include

- appropriate vessel selection
- selection of tow equipment
- weather limits and forecasting
- safe practices for line handling

Further reference should be made to the Merchant Shipping (Code of Safe Working Practices for Merchant Seamen) Regulations 1998, Chapter 33.

### **9.11.5 Diving**

Diving operations represent a high risk to the safety of any project and particularly those that are by definition carried out in high energy locations for wave and tidal activity. Every effort should be made to 'design out' diving operations from the project, and where possible, ROV equipment should be used in preference to divers. However, there are some works where diving operations are likely to be necessary.

Diving operations shall, as a minimum standard, be carried out in accordance with the requirements of the Diving at Work Regulations 1997 and the appropriate ACOP (ISBN 0-7176-1495-6).

Important practical steps that can be taken to manage the risks associated with diving operations include

- selection of suitable vessel
- safe method for access & egress from vessel
- diver Competency
- management of diving operations
  - recompression
  - emergency Response Planning

#### **9.11.6 Working at height**

All work at height where there is a risk of a fall liable to cause personal injury shall be carried out in accordance with The Work at Height Regulations 2005. The regulations set out a simple hierarchy for managing work at height, duty holders should first:

- avoid work at height where they can;
- use work equipment or other measures to prevent falls where they cannot avoid working at height;
- where they cannot eliminate the risk of a fall, use work equipment or other measures to minimise the distance and consequences of a fall should one occur.

If work at height is to be carried out the following requirements shall be met:

- all work at height is properly planned and organised;
- those involved in work at height are competent;
- the risks from work at height are assessed and appropriate work equipment is selected and used;
- the risks from fragile surfaces are properly controlled;
- equipment for work at height is properly inspected and maintained

#### **9.11.7 Enclosed Spaces**

All work conducted in Confined Spaces shall be carried out in accordance with the Confined Spaces Regulations SI 1997 No. 1713, with further guidance given in *Safe Work in Confined Spaces* ACOP. It should be noted that these regulations are written with onshore access in mind. Risk assessments should therefore highlight the increased risks offshore, including access and egress from the confined space, and the effect of any motion.

If work is to be carried out in a confined space, or if there is a risk that, in the event of an accident, emergency access to a confined space may be required, then it is recommended that procedures are established prior to the commencement of works, to include

- personnel training;
- rescue personnel training;
- rescue Equipment.
- use of low voltage electrical equipment, residual current devices, and cable protection to be used.

### **9.11.8 Lifting**

All lifting equipment must be certified, maintained and operated in accordance with the requirements of the LOLER and PUWER regulations. It is recommended that a lifting plan is developed before each lift or set of lifts. Key precautions that should be highlighted within the lifting plan, include:

- assessment of competency and fitness of personnel carrying out lifts;
- assessment of equipment suitability and certification;
- method statements and risk assessments;
- assessment of environmental factors including condition of terrain weather;
- contingency planning;
- emergency planning.

### **9.11.9 Electrical Safety**

It is vital that very clear procedures are drawn up with respect to the handling and isolation of electrical equipment during installation and particularly during commissioning.

Any electrical installation must be made by an authorised electrician and any electrical equipment installed must comply with and be maintained to the standard of the Institute of Electrical Engineers (IEE) requirements for electrical installations.

Practical measures that should be considered to improve electrical safety on the site, include:

- electrical safety training;
- authorised persons;
- isolation;
- signage and restricted areas;
- first aid training;
- use of hand tools;
- fire and explosion risks.

And also refer to the Electricity at Work Regulations, SI1989 No. 635.

### **9.11.10 Personnel Tracking**

Personnel tracking systems should be implemented for onshore and offshore construction sites and records kept in a manner which assists immediate access to the data, in the event of an emergency requiring rapid accounting of personnel. Consideration should be given to personnel tracking devices for all personnel working over water to aid location in the event of an MOB.

### **9.11.11 Manual Handling**

All Manual Handling operations (with the exception of those of the master of crew of a ship in respect of their normal ship-board activities) must comply with the Manual Handling Operations Regulations 1992. These regulations place a duty on the employer to avoid, wherever possible, the requirement for hazardous manual handling operations and where manual handling is required, to assess the operation, take steps to reduce risk of injury and to supply the employee with appropriate information about the operation, including;

- current guidance on manual handling operations in the construction industry;
- manual handling assessment techniques;
- prevention and management of MSDs (musculo-skeletal disorders);
- manual Handling Training Courses.

### **9.11.12 Personal Protective Equipment (PPE)**

Selection of the appropriate PPE should be determined by risk assessment for each activity. Requirements and standards for PPE for onshore and offshore activities, include the use and maintenance of offshore safety equipment such as lifejackets, harnesses, immersion suits, PLBs, and fall arrest systems. It is imperative that personnel have appropriate training in the use of the equipment provided and reference shall be made to the Personal Protective Equipment at Work (PPE) Regulations SI 1992 No. 2966.

### **9.11.13 Slips trips and falls**

According to HSE figures, over one third of the major injuries to employees reported in 2005/2006 were due to slips or trips.

'Slips, trips and falls' accidents can often be prevented with simple measures including;

- management of the overall order and cleanliness of the site
- use of appropriate non slip materials, footwear and handrails
- working areas clear of obstacles and waste.

### 9.12 Onshore Works

Onshore works that may be required for installation of marine generators include

- establishment of quayside base for parts and equipment load out;
- cable shore landings and burial;
- installation of substation and Grid Connection works.

Safe planning of these activities will include

- assessment of load limits of the quay;
- assessment of quay space required for safe handling of parts and equipment;
- establishment of safe temporary facilities;
- assessment of ground conditions and any previous land use that could affect cables; and substation installation;
- electrical safety rules and regulations.

### 9.13 Safety Signs

Signage should meet the minimum requirements of the Health and Safety (Safety Signs and Signals) Regulations, 1996.

These regulations require the employer to provide specific safety signs whenever there is a risk that has not been avoided or controlled by other means.

### 9.14 Chemicals and Substances

COSHH assessments are a requirement of the Control of Substances Hazardous to Health Regulations 2002, for all substances and materials used during installation and commissioning which may present health and safety hazards. Further, it is recommended that

- a register of all hazardous substances brought onto site is maintained, accompanied by the MSDS and COSHH risk assessment.
- specification of first aid facilities should taken into account the nature of any substances used

There are both legislative requirements and good industry practice for the storage of hazardous substances. Consideration should be given to prevention of / emergency procedure for spillages of chemicals and substances into the water which could have harmful effects on the environment or lead to a marine pollution incident. Emergency procedures should address spillage, and any other emergency presented from such storage.

Finally, the developer will need to consider the storage, handling and use of any explosive, oxidising or flammable substances in conformance with the Dangerous Substances and Explosive Atmospheres Regulations, 2002

### 9.15 Security

Site security arrangements, both onshore and offshore, play an important role in preventing access by unauthorised persons, who could cause harm to themselves or to project personnel or equipment.

### 9.16 Occupational Health

Occupational health risks and requirements shall depend on the work undertaken. Both shall be defined during risk assessment, specific to the operation involved. Organisations should ensure they have appropriate procedures established that define:

- any requirements for a pre-employment medical;
- any legal requirements for health surveillance;
- any local minimum standards, *for example. fitness, eyesight, hearing, colour blindness*
- proper arrangements for health records, *for example confidentiality*;
- appropriate medicals for personnel working offshore.

### 9.17 Medical Facilities and First aid

A risk assessment will determine the appropriate level of medical treatment facilities for each construction site, defined as

- medical treatment room or space,
- medicines and treatment consumables,
- medical treatment equipment,
- persons with medical training.

The requirements of the Health and Safety (First Aid) Regulations 1981 will assist in defining the appropriate arrangements for the site.

### 9.18 Emergency Response Planning

A site Emergency Response Plan (Project ERP) should be in place during the Construction phase, with appropriate additions or adjustments for specific or 'one off' operations. Where subcontractors are involved, the plan should detail 'bridging' arrangements between the Emergency Response Plans of individual contractors and particularly individual vessels engaged. Operators and developers are required to use the MCA's '*Emergency Response Cooperation Plan (ERCop)*' in formulating their emergency response plans and site Safety Management Systems.

When developing the ERP, consideration of the remoteness of the site location and the extreme local conditions (dictated by the nature of the device wave or tidal energy) and the response times of emergency services should be made and appropriate arrangements ie, equipment and trained personnel provided to ensure self sufficiency and preservation of life until emergency services are in attendance.

These plans should be discussed with the MCA and the relevant MRCC.

Emergency Response Plans should include

- emergency contact details for all internal and external parties involved in the works
- vessel contact details
- third party emergency service contact details
- emergency Communications procedures
- emergency response initial actions flowchart, for emergencies that could be anticipated including
  - man overboard
  - enclosed Space emergencies and evacuation procedures
  - emergency shutdown of energised equipment
  - failed lifting operations
  - fire
  - sickness
  - injury
  - vessel collision / grounding/punch through
  - vessels not under command
  - pollution
  - security
  - extreme weather
  - diving emergencies (if applicable).
- statutory reporting requirements
- training and drills requirements

It is recommended that exercises are regularly undertaken to validate the ERP and to ensure that operations staff are familiar with it. It is particularly important to engage local emergency services, including medical facilities in understanding the potential needs of the project and the environmental conditions under which they may be asked to assist.

### **9.19 Reporting and Investigation of Accidents and Incidents**

Statutory requirements for the reporting of major accidents, dangerous occurrences and diseases are specified under schedules 1, 2 and 3 of RIDDOR. NOTE: Part 5 of schedule 2 identifies specific offshore dangerous occurrences which are to be reported.

It is recommended that a procedure is established for the reporting of any incidents, accidents and near misses for the project and that all contractors are required to participate in the reporting. Proper investigation of individual events has been proven to deliver safety improvements, whilst trend analysis can lead to the identification of root causes which can again deliver significant improvements in project safety.

All accidents, incidents and near misses must be investigated.

In general, those which have a high actual or potential severity should have a greater in-depth investigation than those which did not. The potential that an accident or incident had to harm or damage, is the factor to be used to determine a suitable level of investigation and use of resources.

### **9.20 As built data and the Health and Safety File**

CDM regulations require the publication of a Health and Safety File for the installation on completion of the works. This is a very important document for the on going operation and maintenance of the site, since it includes specific information about the key hazards and risks associated with the installation, that should be taken to account in any future works being planned. The Health and Safety File should be updated to reflect any changes to the installation during the project lifetime.

It should include

- as built drawings of all installed equipment
- key safety hazards affecting future works
- other information relevant to the safety of future works

The file will form part of the key information required by future Clients, Designers, CDM Co-ordinators and Principal Contractors to carry out future maintenance or construction work on the installation.



## 10 Operation and Maintenance

### 10.1 Introduction

The Operations and Maintenance phase of the projects lifecycle will be its longest. It is likely to involve similar activities to those addressed in section 9 and also, therefore represents a high risk phase for the project. The operations and maintenance of the installation, whether individual device, or array, should be considered in detail at the design stage, so that unsafe practices are not 'designed in'. During the Operations and Maintenance phase smaller crews and vessels will be utilised and special consideration is required, ensuring suitable contingencies are implemented for all operations to be carried out safely.

Proactive management in maintaining a strong health and safety culture from the start is a key factor in getting all personnel to accept ownership of Health and Safety performance. A full site Safety Management System, such as that discussed in Section 5, should be in place for the lifetime of the installation and should be updated and amended as appropriate. Regular reporting of accidents, incidents and near misses should be encouraged and corrective actions identified. Further, it is recommended the 'Safe Systems of Work' are developed within the Safety Management System for all regular Operations and Maintenance activities, particularly those involving high voltage electrical equipment, with Permit to Work schemes where appropriate.

A Safety Officer, responsible for maintaining safety standards, documentation, reporting and improvements, should be appointed.

Many of the safety considerations and risk mitigation measures discussed in section 9 are also applicable to the Operations and Maintenance phase, and are listed again for convenience, with further discussion of particular interest to this section, where relevant.

All major maintenance activities shall fall under the Construction (Design and Management) Regulations 2007, however, the extent of compliance to these regulations shall depend upon amount of time required to complete the work. For example, if the work will take longer than 30 days or 500 person days to complete, the work is notifiable and the whole of the regulations (parts 1, 2, 3, 4 & 5) shall be required to be complied with; if however the work is not expected to take or exceed the timescales for notification only parts 1, 2, 4 and 5 of the regulations should be complied with.

When defining the maintenance activities to be undertaken, consideration should be given to the design risk analysis, in particular the Failure Mode Effect Analysis. This process shall have defined the failure modes and frequencies of components and system failure which may occur during the lifecycle of the device. From this a clear understanding of failure sensitive components may be identified, criticality of the failure of specific components and known frequencies of failure shall help to identify the frequency of maintenance intervention, thus forming the basis of a programme of planned preventive maintenance, inspection and testing.

Developers should also consider unplanned intervention after extreme events, such as extreme wave conditions, tidal surges and or exceptionally

high winds, etc, to ensure the integrity of the device has not been compromised.

Performance information collected during the installation, commissioning, operation and maintenance stages should be feedback to the designer so they may review the data and perform their (in service) design validation, to confirm their designs "work in practice". This data will typically include:

- operational performance data
- maintenance inspection reports
- service reports
- non-conformities
- improvements suggestions

### **10.2 Planning, Communication, Co-ordination**

Effective planning, communication and co-ordination of project health and safety goals, rules and requirements throughout the working lifetime of the installation, can go a long way in preventing accidents. This section will highlight

- project organisational structure and identification of H&S roles and responsibilities
- communication –communication with third parties and other site users, communication with the public.
- communication Links- onshore, offshore and ship to shore.
- management of Health and Safety issues throughout the working life time of the installation

### **10.3 Documentary Control and Record Keeping (O&M)**

In addition to the requirements detailed under section 9.4, additional documentation shall be required and records made to collect data on the operational performance of the device/s. Maintenance records shall be required to be maintained for each device, usually in the form of a maintenance record log, detailing all checks made and maintenance performed on the device throughout its lifecycle. The Health & Safety File shall require to be updated with specific information relating to the structure, should, during the maintenance phases there are significant changes to the structure and or device (again further details are contained within the ACOP - L144).

Typical project documentation which will require to be controlled during the Operations and Maintenance phase shall include:

- Project Health & Safety Management System procedures and documentation
- Construction Phase Plans / Maintenance Phase Plans
- Drawings
- Specifications
- Method Statements
- Risk Assessments
- Test & Commissioning Reports
- Training Records and Certification
- Equipment Certification
- Maintenance Record Logs

#### **10.4 Safe Systems of Work**

The Safety Management System for the project will be significantly developed by this stage, but it is important to ensure that there are safe systems of work, in place, including Permit to Work systems where appropriate, for the regular maintenance activities and for third parties or the general public.

Written 'Safe Systems of Work' or 'Method Statements' are used to describe in detail the individual tasks to be carried out during Operation and Maintenance activities and to list the risk mitigation measures to be taken. Any residual risks that should be properly controlled during the works are also highlighted.

Safe Systems of Work should be prepared by the site owner or operator or, if prepared by a subcontractor for specific areas of work, should be approved by the operator.

#### **10.5 Information, Consultation, Training and Supervision**

General duties of the employer, under the Health and Safety at Work, etc Act 1974, include the provision of information, training and supervision necessary to ensure employees, contractors or visitors' health and safety in the work place.

All personnel should be given a site safety induction before being authorised to entering any of the project sites. The contents of the induction will vary according to the nature of the site and whether it is on or offshore. Training requirements for specific locations or tasks should also be identified, to include.

- minimum requirements for general safety inductions
- minimum appropriate safety inductions and training for personnel working offshore
- assessment of skills requirements for specific jobs
- training Matrices
- tool Box talks

Appropriate provision should be made for the requirements of the management of Health and Safety at Work Regulations 1999.

## **10.6 Maintenance Planning**

Planned preventive maintenance should, wherever possible, take place during the summer months when both safety and schedule risks are as low as possible. Further, consideration should be given to specific preventative maintenance of equipment during the summer months that could minimise the requirement for unplanned maintenance during the winter months.

The reduction in sea temperatures during the winter months significantly reduce the survival times in man over board situations and consideration should be given to this when planning winter maintenance activities, particularly with respect to

- weather working limits
- night working
- PPE
- emergency procedures

## **10.7 Safe Working Practices**

### **10.7.1 Site Access and Road Safety (Onshore)**

Access to onshore facilities, should be managed to ensure the safety of project personnel and the public alike. This will be particularly important for any shore based substations and Grid connection facilities.

An onshore Transport Policy is recommended for all vehicle operations.

### **10.7.2 Site Access and Navigational Safety (Offshore)**

All movements under the control of the Site Operator shall be the subject of passage plans in accordance with MCA guidelines.

- notification of relevant authorities
- notices to Mariners
- assessment of third party activity
- proper Navigation signals
- temporary Safety Zones
- marking of equipment left on site
- marine Co-ordination on site

Reference should also be made to site security which is discussed in section 9.15 and to weather working limits, discussed in section 9.10

Developers will also need to take note of the Docks Regulations SI 1988 no. 1655 and subsequent amendments for health and safety requirements with respect to all dock operations, particularly where the device is intended to be accessed by means of a confined space entry whilst in port. They will also need to ensure that all vessels engaged on the project comply with the requirements of the International Ship and Port Security Code (ISPS Code).

### **10.7.3 Device Access & Egress**

Access to most marine energy converters out at sea is a high risk activity and should not be attempted if other means of completing the work are possible.

When establishing procedures for safe personnel access and egress, it is recommended that consideration is given to

- metocean limits for safe access, including access during the hours of darkness or in poor visibility
- PPE required during access
- maximum loads for personnel accessing device
- personnel training
- contingency arrangements for emergency egress or extraction of a casualty including a rehearsed emergency response plan.

Personnel transfers offshore should always be limited to those deemed absolutely necessary. It is imperative that safe systems of work or method statements for access and egress are fully developed and subject to rigorous risk assessment prior to implementation.

### **10.7.4 Working at height**

All work at height where there is a risk of a fall liable to cause personal injury shall be carried out in accordance with The Work at Height Regulations 2005. The regulations set out a simple hierarchy for managing work at height, duty holders should first:

- avoid work at height where they can;
- use work equipment or other measures to prevent falls where they cannot avoid working at height;
- where they cannot eliminate the risk of a fall, use work equipment or other measures to minimise the distance and consequences of a fall should one occur.

If work at height is to be carried out the following shall be requirements should be met:

- all work at height is properly planned and organised;
- those involved in work at height are competent;
- the risks from work at height are assessed and appropriate work equipment is selected and used;
- the risks from fragile surfaces are properly controlled;
- equipment for work at height is properly inspected and maintained

### **10.7.5 Enclosed Spaces**

All work conducted in confined spaces shall be carried out in accordance with the Confined Spaces Regulations SI 1997 No. 1713, with further guidance given in *Safe Work in Confined Spaces* ACOP. It should be noted that these regulations are written with onshore access in mind. Risk assessments should therefore highlight the increased risks offshore, including access and egress from the confined space, and the effect of the motion.

If work is to be carried out in a confined space, or if there is a risk that, in the event of an accident, emergency access to a confined space may be required, then it is recommended that procedures are established prior to the commencement of works, to include

- personnel training;
- rescue personnel training;
- equipment.

### **10.7.6 Lifting**

All lifting equipment should be certified, maintained and operated in accordance with the requirements of the LOLER and PUWER regulations. It is recommended that a lifting plan is developed before each lift or set of lifts. Key precautions that should be highlighted within the lifting plan, include:

- assessment of competency and fitness of personnel carrying out lifts;
- assessment of equipment suitability and certification;
- method statements and risk assessments;
- assessment of environmental factors including condition of terrain weather;
- contingency planning;
- emergency Planning.

### **10.7.7 Electrical Safety**

It is vital that very clear procedures are drawn up with respect to the handling and isolation of electrical equipment.

Any electrical installation must be made by an authorised electrician and all installed electrical equipment must comply with and be maintained to the standard of the Institute of Electrical Engineers (IEE) requirements for electrical installations.

Practical measures that should be considered to improve electrical safety on the site, include:

- electrical safety training
- authorised persons
- isolation
- signage and restricted areas
- first aid training
- use of hand tools
- fire and explosion risks

And also refer to the Electricity at Work Regulations, SI1989 No. 635

#### **10.7.8 Manual Handling**

All manual handling operations (with the exception of those of the master of crew of a ship in respect of their normal ship-board activities) must comply with the Manual Handling Operations Regulations 1992. These regulations place a duty on the employer to avoid, wherever possible, the requirement for hazardous manual handling operations and where manual handling is required, to assess the operation, take steps to reduce risk of injury and to supply the employee with appropriate information about the operation, including

- current guidance on manual handling operations in the construction industry
- manual handling assessment techniques
- prevention and management of MSDs
- manual Handling Training Courses

#### **10.7.9 Personal Protective Equipment (PPE)**

Selection of the appropriate PPE should be determined by risk assessment for each activity. Requirements and standards for PPE for onshore and offshore activities, include the use and maintenance of offshore safety equipment such as lifejackets, harnesses, immersion suits, PLBs, and fall arrest systems. It is imperative that personnel have appropriate training in the use of the equipment provided and reference shall be made to the Personal Protective Equipment at Work (PPE) Regulations SI 1992 No. 2966.

#### **10.7.10 Personnel Tracking**

Personnel tracking systems should be implemented for onshore and offshore sites and records kept in a manner which assists immediate access the data, in the event of an emergency requiring rapid accounting of personnel. Consideration should be given to personnel tracking devices for all personnel working over water to aid location in the event of an MOB.

#### **10.7.11 Slips trips and falls**

- management of the overall order and cleanliness of the site
- use of appropriate non slip materials, footwear and handrails

- working areas clear of obstacles and waste.

### **10.8 Safety Signs**

Signage should meet the minimum requirements of the Health and Safety (Safety Signs and Signals) Regulations 1996.

These regulations require the employer to provide specific safety signs whenever there is a risk that has not been avoided or controlled by other means.

### **10.9 Chemicals and Substances**

COSHH assessments are a requirement of the Control of Substances Hazardous to Health Regulations 2002, and required for all substances and materials used during installation and commissioning which may present health and safety hazards. Further, it is recommended that

- a register of all hazardous substances brought onto site is maintained, accompanied by the MSDS and COSHH risk assessment.
- Specification of first aid facilities should taken into account the nature of any substances used

There are both legislative requirements and good industry practice for the storage of hazardous substances. Emergency procedures should address spillage, and any other emergency presented from such storage.

Finally, the operator will need to consider the storage, handling and use of any explosive, oxidising or flammable substances in conformance with the Dangerous Substances and Explosive Atmospheres Regulations 2002

### **10.10 Security**

Site security arrangements, both onshore and offshore, play an important role in preventing access by unauthorised persons, who could cause harm to themselves or to project personnel or equipment.

### **10.11 Occupational Health**

Occupational health risks and requirements shall depend on the work undertaken, both shall be defined during risk assessment, specific to the operation involved. Organisations should ensure they have appropriate procedures established that define:

- any requirements for a pre-employment medical;
- any legal requirements for health surveillance;
- any local minimum standards, *e.g. fitness, eyesight, hearing colour blindness;*
- proper arrangements for health records, *e.g. confidentiality;*
- appropriate medicals for personnel working offshore.



### 10.12 Medical Facilities and First aid

A risk assessment will determine the appropriate level of medical treatment facilities for each site, defined as

- medical treatment room or space,
- medicines and treatment consumables,
- medical treatment equipment,
- persons with medical training.

The requirements of the Health and Safety (First Aid) Regulations 1981 will assist in defining the appropriate arrangements for the site.

### 10.13 Emergency Response Planning

The site operator should consider emergency response planning at an early stage, . Due to the nature of the sea conditions sought for power generation, the location of the device arrays may well be sited in remote locations, with little 'back up' cover available from emergency services.

A site Emergency Response Plan (Project ERP) should be in place during the Operations and Maintenance phase, with appropriate additions or adjustments for specific or 'one off' maintenance operations. Where subcontractors are involved in maintenance operations, the plan should detail 'bridging' arrangements between the Emergency Response Plans of individual contractors and particularly individual vessels engaged. As stated in Section 9. 18, operators and developers are required to use the MCA's '*Emergency Response Cooperation Plan (ERCoP)*' in formulating their emergency response plans and site Safety Management Systems. These plans will need to be discussed with the MCA and the relevant MRCC.

When developing the ERP, consideration of the remoteness of the site location and the extreme local conditions (dictated by the nature of the device wave or tidal energy) and the response times of emergency services will indicate a need for self sufficiency, particularly in the early stages of any emergency.

Emergency response Plans should include

- emergency contact details for all internal and external parties involved in the works
- vessel contact details
- third party emergency service contact details
- emergency Communications procedures
- emergency response initial actions flowchart, for emergencies that could be anticipated including
  - man overboard
  - enclosed Space emergencies and evacuation procedures
  - emergency shutdown of energised equipment
  - failed lifting operations
  - fire
  - sickness
  - injury
  - vessel collision / grounding/punch through
  - vessels not under command
  - pollution
  - security
  - extreme weather
  - diving emergencies (if applicable).
- statutory reporting requirements
- training and drills requirements

It is recommended that exercises are regularly undertaken to validate the ERP and to ensure that operations staff are familiar with it. It is particularly important to engage local emergency services, including medical facilities in understanding the potential needs of the project and the environmental conditions under which they may be asked to assist.

#### **10.14 Reporting and Investigation of Accidents and Incidents**

Statutory requirements for the reporting of accidents and dangerous occurrences under RIDDOR are laid down in schedules contained within the regulations and document: "Guide to the Reporting of Injuries, Diseases and Dangerous Occurrences Regulations 1995" - L73 - ISBN 0 7176 2431 5.

It is recommended that a procedure is established for the reporting of any incidents, accidents and near misses for the project and that all operations staff and contractors are required to participate in the reporting. Proper investigation of individual events has been proven to deliver safety improvements, whilst trend analysis can lead to the identification of root causes which can again deliver significant improvements in project safety.

All accidents, incidents and near misses must be investigated. In general, those which have a high actual or potential severity should have a greater in-depth investigation than those which did not. The potential that an accident or incident had to harm or damage, is the factor to be used to determine a suitable level of investigation and use of resources.

### **10.15 Safety Equipment**

The appropriate level of safety equipment required will be determined by risk assessment of the operating characteristics of each device using legislation and European and UK standards for equipment specifications, such as SOLAS. Safety equipment that should be considered includes

- fire fighting equipment
  - fire detection
  - fire suppression
- life saving appliances
  - personal survival aids
  - installation survival aids
  - emergency Locating equipment
- medical treatment equipment
  - medical facilities
  - medical equipment
  - medicines
- work site safety equipment
  - fall arrest equipment
  - standard PPE
  - special task PPE
- emergency communications

## APPENDIX 1: Marine and Navigational Planning

### A. General

The following section applies to the way in which a passage is initially planned, formulated and then undertaken.

When considering a passage (or tow) all the relevant information should be channelled into a concise plan which can be promulgated and agreed by all parties.

Whilst undertaking the passage the plan shall be followed and monitored; should a deviation of plan be required a full assessment shall be undertaken and in any case any action shall have due regard to good seamanship and the prevailing circumstances and conditions.

This plan should include weather limits that shall not be exceeded during the passage, with these limits being used to influence health and safety decisions.

Appropriate local notice to mariners should be issued when appropriate, with the notification of local harbours and other marine users.

This plan shall include environmental limits that shall not be exceeded during the passage.

The execution stage of the plan takes into account the conditions expected during the transit and pre-departure weather forecasts should give an exact weather window and transit time available.

To ensure a due regard to the health and safety of the vessel and her crew it is imperative that contingencies are built into the plan. These shall take into account all possible 'worst case scenarios' and highlight ports of refuge and all possible areas of shelter.

During the passage the safe navigation of the vessel is the responsibility of the Master and his/her crew. Navigational guidance is given in the following MCA M-Notices and Regulations.

- MGN 315 (M): Keeping a safe navigational watch on merchant vessels.
- MGN 137 (M+F): Look-out during periods of darkness and restricted visibility.
- MGN 202 (M+F): Navigation in Fog.
- MGN XXX (M+F): Guidance to mariners operating in the vicinity of offshore renewable energy installations
- MGN 371 (M+F): Offshore Renewable Energy Installations (OREIs) - Guidance on UK Navigational Practice, Safety and Emergency Response Issues.
- MSN 1767(M): Hours of Work, Safe Manning and Watch keeping Revised Provisions from 7 September 2002
- Convention on the International Regulations for Preventing Collisions at sea, 1972, Consolidated Edition 2002

### B. Passage Planning

Planning of the passage shall be carried out in accordance with the requirements of SOLAS Chapter V Annex 24 'Voyage Planning' and shall be verified by the Vessel's Master prior to issue.

The finalised plan shall take into account factors such as

- the vessel's capability
- any limitations on the tow or towing equipment
- the detailed route from berth to berth (or site)
- weather forecasts
- fuel/water consumption and reserves
- ports of refuge
- departure and arrival port details including communication and pilotage facilities
- areas of traffic density and abnormal currents/depths.

### **C. Weather routing and forecasting**

When appropriate a weather forecasting service may be employed to assist in the planning and execution of the voyage or tow. In any event, every effort should be made by the master to obtain regular and suitable weather forecasts from a reputable source during the voyage.

Weather forecasts for the passage should commence well in advance of the anticipated departure time and should continue throughout the duration of the voyage.

Whenever possible more than one forecast should be obtained from a reputable source.

For all passages, the weather conditions for the departure from the sail away port or any intermediate port (or shelter) shall take into account:

- capabilities of the vessel and/or tow
- forecast wind speed and direction
- significant and maximum wave height
- swell direction and height
- visibility

### **D. Departure**

Prior to departure a departure condition report for the tow should be provided by the developer / owner for the vessel master and a marine warranty surveyor may be invited to make an assessment.

The departure condition report should contain as a minimum:

- a general arrangement of the structure showing:
  - Towage points;
  - Strong points;
  - Weak point;
- copies of relevant construction certificates;
- tabulation and distribution of ballast;
- stability booklet / information;
- drag calculations;
- calculated displacement and draught;
- actual displacement and draught;
- a statement that longitudinal bending and shear force are within acceptable limits;
- towage manual for the intended operation;
- installation manual if applicable;
- site manual detailing the array location and environmental details.

**E. Ports of Shelter, shelter areas, holding areas**

With due regard to the health and safety of the Vessel's Master and crew the passage Plan will identify ports of shelter and refuge at various stages of the passage. The basis for these ports will be the prevailing winds in those areas and the forecasts received pre-departure.

**F. Pilotage**

Harbour Pilots have a local knowledge of regulations, weather and tidal conditions and a good ship handling ability.

Unless the Vessel's master has proved his familiarity to the Harbour Master and is in possession of an Exemption Certificate he will require a Pilot when within any Port limits; another important part of the Passage Plan is to have documented the Pilotage areas and contact details, many Ports require over 24 hours notice for a Pilot.

**G. Log**

A Bridge Deck Logbook should be kept by the Deck Officers to record the events / weather / consumptions / distances of the full 24 hour period – this should be signed off by the Master at the end of every day.

Additionally to this a Bridge Movement book should be kept to record all entries when arriving/departing port and/or site.

**H. Towage**

A comprehensive 'Towage manual' should be written to identify all aspects of the tow in detail, covering all likely contingencies and specify exactly how the tow will be conducted. The towing of unusual or prototype floating devices may present particular hazards and the towing and response characteristics should be fully assessed.

**I. Tug selection**

The tug selected should comply with the minimum bollard pull requirements of the tow. Bollard pull requirements should be calculated using appropriate methods such as that detailed by Noble Denton in report No.0030/NDI General Guidelines for Marine Transportations. Tug selection should also include consideration of the manoeuvring and handling characteristics of the vessel or vessels. If more than one tug is to be used, for example for positioning or mooring, the establishment of a clear command structure will be required.

## APPENDIX 2 – KNOW THE LAW

### Introduction

The following information is a summary of UK health and safety legislation that is relevant to marine renewables developments. It is not a legal interpretation and does not cover every detail. It is incumbent on all persons with legal responsibilities to ensure that they are aware and fully understand all current legal requirements.

### THE HEALTH AND SAFETY AT WORK, ETC. ACT 1974

All employers have a general duty under the Health and Safety at Work etc. Act 1974 (HASAW Act) to ensure, so far as is reasonably practicable, that the health, safety and welfare at work of their employees is protected. This duty includes:

- providing and maintaining machinery, equipment, appliances and systems of work that are safe and without risks to health;
- ensuring that articles and substances are used, handled, stored and transported safely and without risks to health;
- providing the necessary information, instruction, training and supervision to ensure the health and safety at work of all employees;
- maintaining a workplace that is safe and without risks to health;
- providing and maintaining a working environment which is safe, without risks to health, and which has adequate facilities and arrangements for employees' welfare at work.

Under the HASAW Act, employees also have a legal duty to take reasonable care of themselves and others and to co-operate with their employers regarding their legal obligations. They are also required to ensure that their activities are not a danger to themselves or others.

Employers will also have a responsibility for the health and safety of visitors (whether authorised or not), e.g. members of the public, self-employed people or contractor's employees working with them, who may be affected by work activities under the contractor's control. This may entail co-operating and exchanging information with all those employers working on the wave and tidal devices about each others' undertakings.

Employers with five or more employees are required to prepare a written statement of their general policy, organisation and arrangements for the health and safety at work of their employees. The statement and any revision of it should be brought to the attention of all the employees.

One of the most important parts of the act is Section 6 – "Design of Articles and Substances", this section requires persons design, manufacture, import or supply articles or substances for use at work to:

- ensure that they are safe and without risk to health when properly used;
- carry out such tests or examinations as may be necessary to ensure that they are safe and without risks to health when properly used;
- provide any information necessary to ensure that they are safe and without risk to health when properly used; and
- any person who erects or installs any article for use at work should ensure that, so far as is reasonably practicable, nothing about the way in which the article is erected or installed makes it unsafe or a risk to health when properly used.

**MANAGEMENT OF HEALTH AND SAFETY AT WORK REGULATIONS SI 1999 No.3242**

The Management of Health and Safety at Work Regulations 1999 are aimed mainly at improving health and safety management. Their main provisions are designed to encourage a more systematic approach to dealing with health and safety. The regulations require employers amongst other duties, to:

- assess the risks to the health and safety of their employees and others who may be affected by their work activity;
- make arrangements for putting into practice the health and safety measures that the risk assessment shows to be necessary. These arrangements should cover planning, organisation, control, monitoring and review;
- ensure co-operation on health and safety measures between contractors and subcontractors.

Specific risk assessments already carried out under other health and safety legislation, e.g. COSHH and the Manual Handling Operations Regulations, do not need to be repeated or supplemented: they will form part of the overall risk assessment.

The regulations further expand the general duties under the HSW Act by requiring employers to take into account their employees' capabilities, as regards health and safety, when giving them tasks to do, e.g. previous training, knowledge and experience.

Further information is given in the Approved Code of Practice Management of Health and Safety at Work - L21 - ISBN 0 7176 2488 9

**CONSTRUCTION (DESIGN AND MANAGEMENT) REGULATIONS SI 2007 No.320**

These regulations apply to construction projects and everyone associated with them: clients, designers, professionals, contractors and site workers. The regulations are about the management of health and safety on construction projects. The regulations do apply to all projects however the extent of applicability and compliance shall be determined by whether or not the project is a notifiable project.

The regulations place duties on clients, CDM Co-ordinators, designers and contractors to plan, co-ordinate and manage health and safety throughout all stages of a construction project.

Anyone who appoints a designer or contractor has to ensure that they are competent for the work and will allocate adequate resources for health and safety.

The CDM regulations also include specific construction requirements with respect to the health, safety and welfare of persons carrying out 'construction work' and others who might be affected by such work.

**THE WORKPLACE (HEALTH, SAFETY AND WELFARE) REGULATIONS SI 1992 No.3004**

The Workplace (Health, Safety and Welfare) Regulations 1992 aim to ensure that workplaces meet the health, safety and welfare needs of each member of the workforce. These regulations give more detail to the general duties of employers under the Health and Safety at Work etc. Act 1974. One relevant area is access/egress (including prevention of falls) and risks associated with transport.



**MERCHANT SHIPPING AND FISHING VESSELS (HEALTH AND SAFETY AT WORK) REGULATIONS SI 1997 No.2962**

These regulations apply to all activities of workers on United Kingdom ships. Some of the regulations also apply to ships other than United Kingdom ships which are operating in United Kingdom waters. They give effect to a number of EC directives relating to health and safety. They place a general duty upon the employer to ensure the health and safety of the workers.

**THE DOCKS REGULATIONS SI 1988 No.1655**

These regulations were formed under the Factories Act 1961. They have been amended by subsequent regulations and EC Directives, however the majority of the regulations remain in their original form. They impose health, safety and welfare requirements with respect to all dock operations in Great Britain and within territorial waters. They also cover loading, unloading, refuelling or provisioning of a vessel anywhere within the United Kingdom Continental Shelf Area (UKCS).

The main health, safety and welfare provisions of the regulations are:

- the safe planning and execution of the work;
- the provision of adequate lighting;
- safe access and egress;
- transport by water;
- rescue facilities, life-saving equipment, fire-fighting equipment and the provision of means of escape;
- the condition and use of hatches, ramps and car decks;
- the operation, use and marking of lifting equipment. The original part of the regulations relating to the examination, testing and certification of lifting equipment now comes under LOLER (Lifting Operations and Lifting Equipment Regulations SI 1998 No.2307);
- confined space entry.

**DIVING AT WORK REGULATIONS SI 1997 No.2776**

The Diving at Work Regulations 1997 require every person, who to any extent, is responsible for, has control over or is engaged in a diving project or whose acts or omissions could adversely affect the health and safety of persons engaged in such a project, to take such measures as it is reasonable for a person in his position to take to ensure that these regulations are complied with.

Such people include:

- the client who placed a contract with a diving contractor to deliver a diving project;
- the principal contractor carrying out work for the client and overseeing the work of the diving contractor;
- a consultant acting for the client, owner, contractor or agent;
- a master of a vessel or floating structure from which diving is to take place who controls the vessel or floating structure and all personnel on it;
- any other person whose actions or activities may affect the safety of the diving project.

These people need to carefully consider the actions required of them to comply with these regulations. They should, where appropriate:

- take reasonable steps to ensure that any diving contractor selected is capable of complying with the regulations;
- make available to the diving contractor the results of any risk assessments undertaken by other persons under other statutory legislation that could affect the health and safety of the dive team;
- agree to provide facilities and extend all reasonable support to the supervisor or diving contractor in the event of an emergency. The diving project plan should reflect this;
- consider whether any known underwater or above-water items of plant under their control may cause a hazard to the dive team;
- consider whether other activities in the vicinity may affect the safety of the diving project;
- ensure they have a formal control system in place to cover diving activities;
- provide the diving contractor with details of any possible substance likely to be encountered by the dive team that would be a hazard to their health;
- keep the supervisor informed of any changes that may affect the supervisor's diving operation in so far as they have control or knowledge of such changes.

The regulations also address the responsibilities of diving contractors, supervisors and divers themselves.

Further information is available in the Diving at Work Regulations 1997 Commercial Diving Projects Offshore Approved Code of Practice and the Diving at Work Regulations 1997 Commercial Diving Projects Inland/Inshore Approved Code of Practice.

**THE REGULATORY REFORM (FIRE SAFETY) ORDER 2005, THE FIRE (SCOTLAND) ACT 2005 AND THE FIRE SAFETY (SCOTLAND) REGULATIONS 2006**

This order, act and regulations are the supporting sets of legislation which cover all aspects of work premises with regard to fire. The topics include fire risk assessments, fire precautions, provision and training.

**THE SAFETY REPRESENTATIVES AND SAFETY COMMITTEE'S REGULATIONS SI 1977 No.500  
and  
THE HEALTH AND SAFETY (CONSULTATION WITH EMPLOYEES) REGULATIONS SI 1996 No.1513**

Employers have a duty to consult their employees in good time on matters relating to their health and safety at work. This applies irrespective of whether the employees are represented by Safety Representatives or not.

SI 1977 No.500 has been amended many times, the latest being in 1999. These regulations cover work places where there is representation of the workforce by safety representatives. Safety Representatives are usually selected by the union.

SI 1996 No.1513 covers work places where there are no safety representatives. This may be because the workplace is non-unionised.

**THE PROVISION AND USE OF WORK EQUIPMENT REGULATIONS SI 1998 No.2306**

The Provision and Use of Work Equipment Regulations 1998 apply to all equipment (including lifting equipment) at work. These regulations place general duties on employers and list minimum requirements for work equipment to deal with selective hazards, whatever the industry. Important new additions were introduced in 1998 including a requirement to inspect work equipment where significant risk could result from incorrect installation or relocation; deterioration; or as a result of exceptional circumstances; and to record the results of inspections. There are also requirements to deal with risks from mobile work equipment.

**THE SUPPLY OF MACHINERY (SAFETY) REGULATIONS SI 1992 No. 3073**

These regulations require that suppliers and manufacturers of machinery ensure that the machinery complies with defined requirements, is marked (EC Mark) and is certified by an approved body.

**LIFTING OPERATIONS & LIFTING EQUIPMENT REGULATIONS SI 1998 No.2307**

The Lifting Operations and Lifting Equipment Regulations 1998 (LOLER) aim to reduce risks to people's health and safety from lifting equipment provided for use at work. These regulations set out specific requirements for controlling lifting operations and ensuring both lifting equipment and accessories are regularly tested and thoroughly examined prior to use.

NOTE: lifting equipment is also subject to the requirements of the Provision & Use of Work Equipment Regulations 1998.

**PRESSURE EQUIPMENT REGULATIONS SI 1999 No.2001**

These regulations are the UK interpretation of the EU Pressure Equipment Directive, they set out specific design criteria for pressure systems and equipment to ensure they have been constructed correctly, are appropriately tested and were relevant CE marked prior to supply. All pressure equipment used within the UK shall be required to comply with these regulations.

**THE PRESURE SYSTEMS SAFETY REGULATIONS SI 2000 No. 128**

These regulations apply to all installed pressure systems. Where a system exceeds 250 bar litres (product of pressure and volume), a written scheme of periodic examination by an independent competent person is required.

**ELECTRICITY AT WORK REGULATIONS SI 1989 No.635**

These regulations lay down principles of safety that apply to the generation, provision, transmission, transformation, rectification, conversion, conduction, distribution, control, storage, measurement and use of electrical energy.

The purpose of the regulations is to ensure appropriate safety precautions are taken to prevent the risk of death or personal injury from electricity. As such these regulations impose requirements for de-energising systems prior to starting work.

The regulations impose duties on persons (referred to as 'duty holders') in respect of systems, electrical equipment and conductors and in respect of work activities on or near electrical equipment.

**THE ELECTRICITY SAFETY, QUALITY AND CONTINUITY REGULATIONS SI 2002 No.2665**

These regulations apply to electricity suppliers and distributors regarding aspects of supply and distribution, including such topics as protection and earthing, substations, underground cables and equipment, overhead lines, generation and supplies to installations and to other networks.

**THE ELECTROMAGNETIC COMPATIBILITY REGULATIONS SI1992 No.2372**

The regulations are the UK interpretation of the EU Electromagnetic compatibility Directive. The regulations provide information to designers to allow them to consider the effects on their electrical equipment from electromagnetic forces generated from other electrical equipment.

**THE WORK AT HEIGHT REGULATIONS 2005**

The Work at Height Regulations 2005 apply to all work at height, where there is a risk of a fall liable to cause personal injury. They place duties on employers, the self-employed, and any person that controls the work of others to the extent of their control (for example wave and tidal devices owners who may contract others to work at height).

The regulations include schedules giving requirements for existing places of work and means of access for work at height, collective fall prevention (e.g. guardrails and working platforms), collective fall arrest (e.g. nets, airbags etc), personal fall protection (e.g. work restraints, fall arrest and rope access) and ladders.

**CONFINED SPACES REGULATIONS SI 1997 No.1713**

These regulations apply to all work situations in Great Britain except for diving operations and mining.

The key duties are:

- avoid entry to confined spaces, *e.g. by doing the work from outside;*
- if entry to a confined spaces is unavoidable, assess the risks and follow a safe system of work;
- put in place adequate emergency arrangements before the work starts.

**THE CONTROL OF VIBRATION AT WORK REGULATIONS SI2005 No. 1093**

These regulations require employers to protect their employees from exposure to vibration injury. Two different types of vibration injury are described within these regulations:

Whole Body – from vibrating plant, vehicles, platforms, etc  
Hand Arm – from electrical, pneumatic, hydraulic power tools

The regulations require an assessment of risk to be undertaken, control of work activity to ensure no-one is exposed to vibrations frequencies above specified action levels.

**THE NOISE AT WORK REGULATIONS SI 2005 No. 1643**

These regulations are intended to reduce hearing damage caused by loud noise. They require employers to take action when noise exposure reaches an 80dB(A) 'First Action Level' and further action if it reaches 85 dB(A) At the First Action Level, employers have to provide ear protectors to any employees who want them. Control of levels above 85 dB(A) has to be by means other than ear protectors where reasonably practicable.

**CONTROL OF SUBSTANCES HAZARDOUS TO HEALTH REGULATIONS 2002 as amended 2005 – SI2005 No.2677 + SI2004 No. 3386**

The Control of Substances Hazardous to Health Regulations 2002 as amended 2005 (COSHH) require employers to ensure that exposure of their employees to hazardous substances is either prevented, or if this is not reasonably practicable, adequately controlled. Under these regulations some of the employer's responsibilities extend to people, other than employees, who may be affected by the work activity.

The employer is required to carry out an assessment of the health risks which might arise from the various work activities, and state the action they intend to take to prevent or control the exposure of their workforce to hazardous substances, and to comply with other requirements of the regulations.

The regulations require all employers to:

- assess the risk to their employees and others from exposure to hazardous substances at work and so establish whether precautions are needed; This will include determining what substances are present and in what form; how are they handled; what harmful effects are possible; who is likely to be affected;
- introduce appropriate measures to prevent or control the exposure to those substances where a risk has been identified which needs to be controlled, such as substitution by a safer product;
- ensure that control measures are used and that equipment is properly maintained and procedures observed;
- where necessary, monitor the exposure of the workers and carry out an appropriate form of surveillance of their health;
- inform, instruct and train employees about the risks and the precautions to be taken.

Practical guidance on COSHH is given in HSE publications COSHH – The Control of Substances Hazardous to Health Regulations 2002 as amended 2005: Approved Code of Practice and Guidance. L5.

#### **THE DANGEROUS SUBSTANCES AND EXPLOSIVES ATMOSPHERES REGULATIONS SI 2002 No. 2776**

These regulations concern the use of any substance or preparation in the workplace which is explosive, oxidising, extremely flammable, highly flammable or flammable. Risk assessments are required which focus upon the elimination or reduction of risks from the dangerous substances.

#### **THE CARRIAGE OF DANGEROUS SUBSTANCES & USE OF TRANSPORTABLE PRESSURE EQUIPMENT REGULATIONS SI 2007 1573**

These regulations cover the carriage (transportation) by road, rail, air and sea of substances hazardous to health. They require a Dangerous Goods Safety Advisor to prepare appropriate documentation to ensure safe transportation (and required notification of specific substances) the hazardous substance.

#### **HEALTH AND SAFETY (DISPLAY SCREEN EQUIPMENT) REGULATIONS SI 1992 No.2792**

The regulations impose minimum health and safety requirements for work with display screen equipment where there is a 'user', that is, an employee who habitually uses display screen equipment as a significant part of normal work.

#### **THE MANUAL HANDLING OPERATIONS REGULATIONS SI 1992 No.2793**

The Manual Handling Operations Regulations 1992 require employers to take reasonably practicable steps to avoid manual handling activities where there is a risk of injury. Where such manual handling cannot be avoided, the employer should make an assessment and take appropriate measures to reduce the risk of injury to the lowest level reasonably practicable. The assessment will form part of the overall risk assessment required by the Management of Health and Safety at Work Regulations 1992.

**PERSONAL PROTECTIVE EQUIPMENT AT WORK (PPE) REGULATIONS SI 1992 No.2966**

The Personal Protective Equipment at Work Regulations 1992 require employers to make sure that suitable personal protective equipment is provided and used by employees wherever there is a risk to health and safety that cannot be adequately controlled by other means. This includes, for example, the provision of safety footwear where there is a risk of foot injuries; headgear where there is a risk of head injuries or suitable outdoor clothing if the job involves working outside in adverse weather conditions that could prejudice the health and safety of the employees.

**THE CONSTRUCTION (HEAD PROTECTION) REGULATIONS SI 1989 No.2209**

Every duty holder in charge of a site has a duty to ensure that all persons who are at work on operations or works on that site are wearing suitable head protection.

**THE HEALTH AND SAFETY (SAFETY SIGNS AND SIGNALS) REGULATIONS SI 1996 No. 341**

Safety signs should be provided where the risk assessment indicates that risks cannot be avoided or adequately controlled in other ways.

**HEALTH AND SAFETY (FIRST AID) REGULATIONS SI 1981 No.917**

Under the Health and Safety (First Aid) Regulations 1981 a risk assessment of first aid needs is required to be completed. In addition, all workplaces should have first-aid material in a clearly identified box and an appointed person(s) to ensure the proper management of injuries or illnesses at work. The first-aid provision will depend on a variety of factors including: the nature and degree of the hazards at work; whether there is shift work; what medical services are available; and the number of employees. The HSE booklet First Aid at Work explains the requirements and provides guidance to help employers meet their obligations.

**THE REPORTING OF INJURIES, DISEASES AND DANGEROUS OCCURRENCES REGULATIONS SI 1995 No.3163**

The Reporting of Injuries, Diseases and Dangerous Occurrences Regulations 1995 (RIDDOR) require employers, people in control of premises and in some cases the self-employed to report certain types of injury, occupational ill health and dangerous occurrences to the enforcing authority.

There are several cases in which injuries and incidents have to be reported to an enforcing authority and these depend on the severity and the potential for harm:

- (a)
- i. an employee or a visitor dies or suffers a major injury in an accident arising from or in connection with work; or
  - ii. someone who is not at work, e.g. member of the public, suffers an injury as a result of an accident and is taken to hospital for treatment; or
  - iii. there is a dangerous occurrence. Then the employer should notify the enforcing authority forthwith by the quickest practicable means, normally by telephone, and within seven days send a written report using Form 2508 (available from HSE Books). Reports are required whether or not the person concerned is an employee.
- (b) where anyone at work is off work or cannot carry out their normal duties for more than three consecutive days as a result of an accident at work, this is also reportable and the employer has seven days in which to send a report to the enforcing authority.

**THE HEALTH & SAFETY (Miscellaneous Amendments) REGULATIONS SI2002 No. 2174**

These regulations include various amendments to current UK legislation, this includes:

- The Health & Safety (First Aid) Regulations 1981
- The Manual Handling Regulations 1992
- The PPE Regulations 1992
- The Health & Safety (Display Screen Equipment) Regulations 1992
- The Provision and Use of Work Equipment Regulations 1998

**THE COAST PROTECTION ACT 1949, AS AMENDED BY THE MERCHANT SHIPPING ACT 1988**

Section 34 – Restriction of Works Detrimental to Navigation

No person shall without the consent of the Secretary of State for Transport, Local Government and the Regions:

- (a) Construct, alter or improve any works on, under or over any part of the seashore lying below the level of mean high water springs;
- (b) Deposit any object or any materials on any such part of the seashore, or
- (c) Remove any object or any materials from any part of the seashore lying below the level of mean high water springs, if the operation causes or is likely to result in obstruction or danger to navigation.

The Secretary of State may, as a condition of considering an application for consent under this section, require to be furnished with such plans and particulars of the proposed operation, as he may consider necessary.

If the Secretary of State is of the opinion that any operation will cause or is likely to result in obstruction or danger to navigation, he may refuse consent or give his consent, subject to conditions, having regard to the nature and extent of the obstruction or danger.

**THE FACTORY ACT 1961**

The majority of this Act has now been repealed by the Health and Safety at Work etc Act 1974 and subsequent EC Directives. Section 123 of the Act regarding Electrical Stations still applies. Also a number of sets of regulations were made under this Act which are still needed to cover particular industries and workplaces which have specific hazards and associated risks that need to be regulated and controlled. These regulations include the Docks Regulations SI 1988 No.1655 (see above) and the Breathing Apparatus, etc (Report on Examination) Order SI 1961 No.1345.

**OFFICES, SHOPS AND RAILWAY PREMISES ACT 1963**

This Act followed the general pattern of the Factories Act 1961 and like that Act, much of it was repealed by the Health and Safety at Work etc Act 1974 and subsequent EC Directives. It does still cover premises that are either in single or multiple ownership.

## APPENDIX 3 - REFERENCES

The following publication references have been provided to allow readers who wish to understand more about the application and interpretation of specific areas of UK health & safety legislation, approved codes of practice and guidance.

NOTE: All publications are available from HSE Books, The Stationary Office (TSO) or from most large book stores.

HSE Books catalogue. Free from HSE Books

Successful Health and Safety Management - HSG 65 - ISBN 0 7176 1276 7

Management of Health and Safety at Work - Management of Health and Safety at Work Regulations 1999 Approved Code of Practice & Guidance - L21 - ISBN 0 7176 2488 9

Managing Health and Safety - Five Steps to Success - HSE free leaflet - INDG275

Managing Health & Safety in Construction - Construction (Design and Management) Regulations 2007 Approved code of Practice and Guidance - L144 - ISBN 0 7176 6223 4

Managing Contractors - A guide for employers - HSG159 - ISBN 0 7176 1196 6

Health and Safety Regulation - A short Guide - HSE free leaflet - HSC 13 (Rev 1)

Directors' responsibilities for health & safety - HSE free leaflet - INDG343

Need help on health & safety? Guidance for employers on when and how to get advice on health & safety - HSE free leaflet - INDG 322.

5 Steps to Risk Assessment - HSE free leaflet - INDG 163

A Guide to the Health & Safety (Consultation with Employees) Regulations 1996 - L95 - ISBN 0 7176 1120 1

Essentials of Health and Safety at Work - ISBN 0 7176 0716 X

Workplace (Health, Safety and Welfare) Regulations 1992. Approved Code of Practice and Guidance - L24 - ISBN 0 7176 0413 6

HSG177- Managing Health & Safety in Dock Work - 978-0-7176-2020-3

Dangerous Substances and Explosive Atmospheres - Dangerous Substances and Explosives Atmospheres Regulations Approved Code of Practice - L138 - ISBN 0 7176 2203 0

Safety in Docks (Docks Regulations) 1988 - Approved Code of Practice with Regulations and Guidance -- COP25 - ISBN 0 7176 1408 0

Safety Signs and Signals - The Health and Safety (Safety signs and Signals) Regulations 1996 Guidance on Regulations - L64 - ISBN 0 7176 0870 6



Memorandum of Guidance on the Electricity at Work Regulations 1989 - HSR 25 - ISBN 07176 16029

Electricity at Work - Safe Working Practices - HSG 85 - ISBN 07176 21642  
BS 7671:2001 Requirements for Electrical Installations. IEE Wiring Regulations. Institution of Electrical Engineers 17<sup>th</sup> Edition 2001 - ISBN 0852969880

Avoidance of Danger from Overhead Electrical Power Lines - GS 6 2002 - ISBN 0 7176 13488

Safe Use of Work Equipment - Provision and Use of Work Equipment Regulations 1998 - Approved Code of Practice & Guidance on the Regulations - L22 - ISBN 0 7176 1626 6

Simple Guide to the Provision and Use of Work Equipment Regulations 1998 - HSE free leaflet - INDG291

Safe Use of Lifting Equipment - Lifting Operations and Lifting Equipment Regulations 1998 - Approved Code of Practice and Guidance - L113 - ISBN 0 7176 1628 2

Technical guidance on the safe use of lifting equipment offshore (Second Edition) - HSG221 - ISBN 0 7176 6229 6

Simple Guide to the Lifting Operations and Lifting Equipment Regulations 1998 - HSE free leaflet - INDG290

Safety of Pressure System - Pressure systems Safety Regulations 2000 - Approved Code of Practice - L122 - ISBN 0 7176 1767 8

Work with display screen equipment. Health and Safety (Display Screen Equipment) Regulations 1992 As amended - Guidance on the Regulations - L26 - ISBN 0 7176 2582 6

Effective Collision Risk Management for Offshore Installations. Offshore Technology Report - OTO 1999 052. [www.hse.gov.uk/research](http://www.hse.gov.uk/research)

Health & Safety in Construction - HSG150 - ISBN 0 7176 6182 4

Commercial Diving Projects Offshore - Diving at Work Regulations 1997- Approved Code of Practice - L103 - ISBN 0 7176 1494 8

Commercial Diving Projects Inland/Inshore - Diving at Work Regulations 1997 - Approved Code of Practice - L104 - ISBN 0 7176 1495 6

Safe Work in Confined Spaces - Approved Code of Practice and Guidance on the Confined Spaces Regulations 1997 - L101 - ISBN 0 7176 1405 0

Safe Work in Confined Spaces - HSE free leaflet - INDG258

Control of Substances Hazardous to Health (Fifth Edition) - The Control of Substances Hazardous to Health Regulations 2002 as amended 2005 - Approved Code of Practice and Guidance - L5 - ISBN 0 7176 2534 6

Controlling Noise at Work – The Control of Noise at Work Regulations 2005 – Guidance on Regulations – L108 – ISBN 0 7176 6164 0

Hand-Arm Vibration – The Control of Vibration at Work Regulations 2005 – Guidance on Regulations – L140 – ISBN 0 7176 6125 1

Whole Body Vibration – The Control of Vibration at Work Regulations 2005 – Guidance on Regulations – L141 – ISBN 0 7176 6126 8

Manual Handling - Manual Handling Operations Regulations 1992 Guidance on the Regulations - L23 - ISBN 0 7176 2415 3

Personal Protective Equipment at Work (Second Edition) - Guidance on Personal Protective Equipment at Work Regulations 1992 as amended - L25 - ISBN 0 7176 0415 2

The Construction (Head Protection) Regulations 1989 – Guidance on Regulations – L102 - ISBN 0 7176 1478 3

The Costs of Accidents at Work - HSG 96 - ISBN 0 7176 1343 7

First Aid at Work: Health and Safety (First Aid) Regulations 1981. Approved Code of Practice and Guidance - L74 - ISBN 0 7176 1050 0

Dealing with Offshore Emergencies – HSG142

Guide to the Reporting of Injuries, Diseases and Dangerous Occurrences Regulations 1995. L73 - ISBN 0 7176 24315

RIDDOR Offshore - HSE free leaflet - HSE 33 (Rev 1).

Code of Safe Working Practices for Merchant Seamen' - <http://www.mcga.gov.uk/c4mca/mcga-shs-coswp2007.pdf>

Marine Guidance Notice 275 (M) – Proposed UK Offshore Renewable Energy Installations (OREI) Guidance on Navigational Safety Issues

The Merchant Shipping (Small Commercial Vessels and Pilot Boats) Regulations

The Small Commercial Vessel and Pilot Boat Code of Practise (SCV Code)

## APPENDIX 4 - USEFUL CONTACTS

### Health & Safety Executive (HSE)

Online: [www.hse.gov.uk](http://www.hse.gov.uk)

Your local HSE Inspector's address and telephone number can be found in the local area telephone directory listed under Health & Safety Executive.

### HSE - Offshore Division

online: [www.hse.gov.uk/offshore](http://www.hse.gov.uk/offshore)

Health and Safety Executive  
Hazardous Installations Directorate  
Offshore Division  
Lord Cullen House  
Fraser Place  
Aberdeen  
AB25 3UB  
Tel: 01224 252500

Health and Safety Executive  
Hazardous Installations Directorate  
Offshore Division  
Redgrave Court  
Merton Road  
Bootle  
Merseyside  
L20 7HS  
Tel: 0151 951 4000

Health and Safety Executive  
Hazardous Installations Directorate  
Offshore Division  
GSW Rose Court  
2 Southwark Bridge  
London  
SE1 9HS  
Tel: 0207 717 6000

Health and Safety Executive  
Hazardous Installations Directorate  
Offshore Division  
1st Floor, Lakeside 500  
Old Chapel Way  
Broadland Business Park  
Norwich  
Tel: 01603 828000

Enquiries relating to diving operations should be directed to the appropriate Diving Inspection Teams:

- London (020 7717 6000) for London, Southern England and Wales;
- Norwich (01603 828000) for Central and Northern England; and
- Aberdeen (01224 252500) for Scotland.

### HSE Infoline

General Health and Safety advice is available from the HSE by contacting:

Tel: 08701 545500  
Fax: 02920 859260  
e-mail: [hseinformationservices@natbrit.com](mailto:hseinformationservices@natbrit.com)

Or write to:

HSE Information services  
Caerphilly Business Park  
Caerphilly CF83 3GG

**Employee Medical Advisory Service (EMAS)**

EMAS are an integral part of the HSE, they are staffed by specialist occupational health professional (doctors and nurses) who provide expert advice on medical matters relating to work. A directory of regional EMAS offices may be found at the following online link: [www.hse.gov.uk/forms/health/emasoffices.htm](http://www.hse.gov.uk/forms/health/emasoffices.htm)

**HSE Books**

PO Box 1999  
Sudbury  
Suffolk  
CO10 2WA  
Tel. 01787 881165  
Fax. 01787 313995  
e-mail: [hsebooks@prolog.uk.com](mailto:hsebooks@prolog.uk.com)  
online: [www.hsebooks.co.uk](http://www.hsebooks.co.uk)  
HSE priced publications are also available from good booksellers

**Maritime and Coastguard Agency (MCA)**

Spring Place,  
105 Commercial Road,  
Southampton,  
Hampshire,  
UK.  
SO15 1EG  
Offshore renewable energy contact number - 02380 329316  
e-mail: [infoline@mcga.gov.uk](mailto:infoline@mcga.gov.uk)  
online: [www.mcga.gov.uk](http://www.mcga.gov.uk)

**MCA - Wales and West of England Regional Office**

Tutt Head  
Mumbles  
Swansea  
County of Swansea  
SA3 4HW  
Tel: (01792) 368 472  
Fax: (01792) 363 125

**MCA - East of England Regional Office**

Humber MRSC  
Limekiln Lane  
Bridlington  
YO15 2LX  
Tel: (01262) 607 355  
Fax: (01262) 670 613

**MCA - Scotland and Northern Ireland Regional Office**

Marine House  
Blaikies Quay  
Aberdeen  
AB11 5EZ  
Tel: (01224) 597 900  
Fax: (01224) 571 920

**International Maritime Organization (IMO)**

Official Headquarters address:  
4 Albert Embankment  
London  
SE1 7SR  
United Kingdom  
Tel +44 (0)20 7735 7611  
Fax +44 (0)20 7587 3210  
online: [www.imo.org](http://www.imo.org)

**Environment Agency (EA)**

National Customer Contact Centre  
PO Box 544  
Rotherham  
S60 1BY  
General Enquiries: 08708 506 506 (Mon-Fri 8-6)  
Incident hotline: 0800 807060 (Freephone\* 24 Hour)  
e-mail: [enquiries@environment-agency.gov.uk](mailto:enquiries@environment-agency.gov.uk)  
Online: [www.environment-agency.gov.uk](http://www.environment-agency.gov.uk)

**Scottish Environmental Protection Agency (SEPA)**

SEPA Corporate Office  
Erskine Court  
Castle Business Park  
STIRLING  
FK9 4TR  
Tel: 01786 457700  
Fax: 01786 446885  
online: [www.sepa.org.uk](http://www.sepa.org.uk)

**Office of Public Sector Information**

Provides records of all Legislation (Acts, Statutory Instruments, etc) back to 1987.  
[www.opsi.gov.uk](http://www.opsi.gov.uk)

**Institute of Occupational Safety & Health (IOSH)**

The Grange, Highfield Drive, Wigston, Leicestershire, LE18 1NN, UK  
Tel: 0116 257 3100  
Fax: 0116 257 3101  
online: [www.iosh.co.uk](http://www.iosh.co.uk)

IOSH practitioners can be contacted via the IOSH Register of Consultancy Services.

**British Standards Institute (BSI)**

389 Chiswick High Road  
London  
W4 4AL  
Telephone: +44 (0)20 8996 9001  
Fax: +44 (0)20 8996 7001  
online: [www.bsi-global.com](http://www.bsi-global.com)

**Institute of Marine Engineering, Science and Technology,**

80 Coleman Street,  
London,  
EC2R 5BJ  
Tel: 020 7382 2600  
Fax 020 7382 2670  
online: [www.imarest.org](http://www.imarest.org)

**European Marine Energy Centre (EMEC)**

Old Academy,  
Back Road,  
Stromness,  
Orkney, KW16 3AW  
Tel: 01856 852060  
e-mail: [info@emec.org.uk](mailto:info@emec.org.uk)  
online: [www.emec.org.uk](http://www.emec.org.uk)

**British Wind Energy Association (BWEA)**

Renewable Energy House  
1 Aztec Row  
Berners Road  
London  
N1 0PW  
Tel: 020 7689 1960  
Fax: 020 7689 1969  
e-mail: [info@bwea.com](mailto:info@bwea.com)  
online: [www.bwea.com](http://www.bwea.com)

## APPENDIX 5 – Other related BWEA initiatives

### 1) Training

In most respects this document provides guidance on health and safety. However, in respect of training for personnel working offshore, BWEA has introduced a safety accreditation scheme whereby industry personnel undergoing training to the minimum training standards recommended by the Association are accredited accordingly by BWEA. The scheme was formally launched in 2007 and uses external training providers and is administered by OPITO on behalf of BWEA. The training modules currently available that are relevant to the wave and tidal energy sector are:

- General Safety passport;
- Marine survival;
- Crane awareness;

There is also a module entitled “Work at height / escape from turbine” which may be relevant to some wave and tidal devices. Further modules may be developed as the need arises.

BWEA members are advised to use only those organisations whose personnel have undergone training relevant to their roles, either from BWEA accredited UK service providers or from recognised equivalent overseas providers. For up to date information on BWEA training standards please visit [www.bwea.com/safety/training.html](http://www.bwea.com/safety/training.html).

### 2) Incident Reporting

BWEA recognises the value in being able to learn from experience in order to better manage the health and safety risks associated with all wind and marine renewable energy activity. To this end a system has been put in place to allow reporting of accidents, incidents and near events for onshore and offshore wind projects, together with wave and tidal on a non-attributable basis. The information gathered, which will be subject to confidentiality provisions, will enable BWEA to assess the industry health and safety performance and issue periodic reports on key issues via the associations website. Health and Safety activity will be reviewed, event root causes assessed and statistical analysis posted on the website for the benefit of members who have signed up to use the database. In significant cases, Safety Alerts will be issued to members. BWEA strongly recommends that companies, particularly developers, contractors and owners use this free database package and that clients and their contractors have provisions in contracts to facilitate health and safety information being submitted to the BWEA database. Further details and arrangements for submitting and accessing data are contained in the “Health & Safety Database” area of the BWEA website.

