

---

## Guidelines for the management of obsolescence in subsea facilities

# GUIDELINES FOR THE MANAGEMENT OF OBSOLESCENCE IN SUBSEA FACILITIES

1st edition

May 2011

Published by

**ENERGY INSTITUTE, LONDON**

The Energy Institute is a professional membership body incorporated by Royal Charter 2003

Registered charity number 1097899

The Energy Institute (EI) is the leading chartered professional membership body supporting individuals and organisations across the energy industry. With a combined membership of over 14 000 individuals and 300 companies in 100 countries, it provides an independent focal point for the energy community and a powerful voice to engage business and industry, government, academia and the public internationally.

As a Royal Charter organisation, the EI offers professional recognition and sustains personal career development through the accreditation and delivery of training courses, conferences and publications and networking opportunities. It also runs a highly valued technical work programme, comprising original independent research and investigations, and the provision of EI technical publications to provide the international industry with information and guidance on key current and future issues.

The EI promotes the safe, environmentally responsible and efficient supply and use of energy in all its forms and applications. In fulfilling this purpose the EI addresses the depth and breadth of energy and the energy system, from upstream and downstream hydrocarbons and other primary fuels and renewables, to power generation, transmission and distribution to sustainable development, demand side management and energy efficiency. Offering learning and networking opportunities to support career development, the EI provides a home to all those working in energy, and a scientific and technical reservoir of knowledge for industry.

This publication has been produced as a result of work carried out within the Technical Team of the EI, funded by the EI's Technical Partners. The EI's Technical Work Programme provides industry with cost-effective, value-adding knowledge on key current and future issues affecting those operating in the energy sector, both in the UK and internationally.

For further information, please visit <http://www.energyinst.org>

The EI gratefully acknowledges the financial contributions towards the scientific and technical programme from the following companies

BG Group	Murco Petroleum Ltd
BP Exploration Operating Co Ltd	Nexen
BP Oil UK Ltd	Premier Oil
Centrica	RWE npower
Chevron	Saudi Aramco
ConocoPhillips Ltd	Shell UK Oil Products Limited
EDF Energy	Shell U.K. Exploration and Production Ltd
ENI	Statoil Hydro
E. ON UK	Talisman Energy (UK) Ltd
ExxonMobil International Ltd	Total E&P UK plc
Kuwait Petroleum International Ltd	Total UK Limited
Maersk Oil North Sea UK Limited	World Fuel Services

However, it should be noted that the above organisations have not all been directly involved in the development of this publication, nor do they necessarily endorse its content.

Copyright © 2011 by the Energy Institute, London.  
The Energy Institute is a professional membership body incorporated by Royal Charter 2003.  
Registered charity number 1097899, England  
All rights reserved

No part of this book may be reproduced by any means, or transmitted or translated into a machine language without the written permission of the publisher.

ISBN 978 0 85293 610 8

Published by the Energy Institute

The information contained in this publication is provided for general information purposes only. Whilst the Energy Institute and the contributors have applied reasonable care in developing this publication, no representations or warranties, express or implied, are made by the Energy Institute or any of the contributors concerning the applicability, suitability, accuracy or completeness of the information contained herein and the Energy Institute and the contributors accept no responsibility whatsoever for the use of this information. Neither the Energy Institute nor any of the contributors shall be liable in any way for any liability, loss, cost or damage incurred as a result of the receipt or use of the information contained herein.

Further copies can be obtained from: Portland Customer Services, Commerce Way, Whitehall Industrial Estate, Colchester CO2 8HP, UK.  
t: +44 (0)1206 796 351 e: [sales@portland-services.com](mailto:sales@portland-services.com)

Electronic access to EI and IP publications is available via our website, [www.energyinstpubs.org.uk](http://www.energyinstpubs.org.uk).  
Documents can be purchased online as downloadable pdfs or on an annual subscription for single users and companies.  
For more information, contact the EI Publications Team.  
e: [pubs@energyinst.org](mailto:pubs@energyinst.org)

# CONTENTS

	Page
<b>Foreword</b> .....	<b>vi</b>
<b>Acknowledgements</b> .....	<b>vii</b>
<b>Publication format</b> .....	<b>viii</b>
<b>Part A Management policy</b>	
<b>1 Introduction</b> .....	<b>1</b>
1.1 Obsolescence .....	1
1.2 Key principles .....	1
<b>2 Outline of obsolescence management</b> .....	<b>3</b>
2.1 The impact of unreliability and obsolescence .....	3
2.2 What may be affected .....	3
<b>3 Key issues in obsolescence management</b> .....	<b>5</b>
3.1 Obsolescence management strategy .....	5
3.2 Life cycle management of obsolescence .....	5
3.3 Tasks and responsibilities .....	7
3.4 Obsolescence monitoring and reviews .....	7
3.5 Failure modes, effects and criticality analysis (FMECA) .....	8
<b>Part B Detailed guidance</b>	
<b>1 Introduction</b> .....	<b>9</b>
<b>2 Aims and objectives</b> .....	<b>10</b>
<b>3 Scope</b> .....	<b>11</b>
3.1 Physical scope .....	11
3.2 Scope of this publication .....	11
<b>4 Definitions</b> .....	<b>12</b>
<b>5 Application</b> .....	<b>14</b>
<b>6 Legislative framework</b> .....	<b>15</b>
<b>7 Obsolescence</b> .....	<b>16</b>
7.1 Description .....	16
7.1.1 Obsolete and obsolescent .....	16
7.1.2 Product life cycle .....	16
7.1.3 Rate of obsolescence .....	17
7.2 Particular issues regarding subsea facilities .....	18
7.3 The impact of unreliability and obsolescence .....	19
7.4 What may be affected .....	20

<b>8</b>	<b>Obsolescence management strategy</b>	<b>22</b>
8.1	Introduction	22
8.2	Requirement to define a strategy	22
8.3	Proactive strategy - operator	22
8.3.1	Agreement with the supplier	23
8.3.2	Operator managed	23
8.4	Recovery from obsolescence	23
<b>9</b>	<b>Life cycle management of obsolescence</b>	<b>25</b>
9.1	Phases of the life cycle	25
9.2	Corporate	26
9.2.1	Introduction	26
9.2.2	Operators of subsea facilities	26
9.2.3	First tier suppliers	27
9.3	Feasibility and concept	28
9.4	Front end and detailed design	29
9.4.1	Introduction	29
9.4.2	Operators of subsea facilities	29
9.4.3	First tier suppliers	32
9.5	Fabrication	33
9.6	Installation and commissioning	34
9.7	Operations	34
9.7.1	Obsolescence management cycle	34
9.7.2	Definition and planning	34
9.7.3	Implementation	35
9.7.4	Feedback	35
9.8	Decommissioning	36
<b>10</b>	<b>Tasks and responsibilities</b>	<b>37</b>
10.1	Introduction	37
10.2	The operator	37
10.2.1	At corporate level	37
10.2.2	At asset operations level	37
10.2.3	At project level	38
10.3	The first tier supplier	39
10.3.1	At corporate level	39
10.3.2	At asset operations support level	40
10.3.3	At project level	40
<b>11</b>	<b>Obsolescence monitoring and reviews</b>	<b>41</b>
11.1	Introduction	41
11.2	Combined probability of failure and obsolescence	41
11.3	Obsolescence monitoring	42
11.3.1	Active and passive elements	42
11.3.2	Life-of-field agreement	43
11.3.3	Operator managed	43
11.3.4	Obsolescence monitoring process	44
11.4	Obsolescence reviews	45
11.4.1	Functions	45
11.4.2	Assessment of the OM strategy and plan	45
11.4.3	Review of the obsolescence monitoring process and procedures	45
11.4.4	Independent assessment of the consequences of obsolescence	45

11.4.5	Frequency of reviews . . . . .	46
11.4.6	Three-dimensional risk matrix . . . . .	47
11.4.7	Obsolescence review process . . . . .	49
<b>12</b>	<b>Information management . . . . .</b>	<b>50</b>
 <b>Annexes:</b>		
<b>Annex A</b>	<b>Management strategies . . . . .</b>	<b>51</b>
A.1	Requirement to define a strategy . . . . .	51
A.2	Strategy options . . . . .	52
A.2.1	Reactive or proactive . . . . .	52
A.2.2	Proactive strategy options . . . . .	53
A.2.3	Technology transparency . . . . .	53
A.2.4	Obsolescence monitoring . . . . .	53
A.2.5	Planned system upgrades . . . . .	54
A.2.6	Lifetime buy . . . . .	55
A.3	Strategy selection . . . . .	56
<b>Annex B</b>	<b>Review of equipment . . . . .</b>	<b>57</b>
B.1	Introduction . . . . .	57
B.2	SPCS equipment review . . . . .	58
B.2.1	Topsides equipment . . . . .	58
B.2.2	Subsea equipment . . . . .	60
B.2.3	Software . . . . .	61
B.2.4	Control fluids . . . . .	62
B.3	Mechanical equipment . . . . .	63
<b>Annex C</b>	<b>Further examples of obsolescence . . . . .</b>	<b>64</b>
<b>Annex D</b>	<b>Risk assessment - assignment of values . . . . .</b>	<b>65</b>
D.1	Introduction . . . . .	65
D.2	Suggested approach . . . . .	65
<b>Annex E</b>	<b>References . . . . .</b>	<b>70</b>
<b>Annex F</b>	<b>Abbreviations . . . . .</b>	<b>71</b>

## FOREWORD

These guidelines provide all those with an involvement in subsea systems - designers, equipment manufacturers, fabricators, installers, operators, integrity and maintenance engineers, etc. - whether in operators or supply companies, with guidance on how to manage obsolescence in subsea equipment. Note that, in this regard, subsea equipment refers to any equipment dedicated to the operation and control of subsea facilities, even if the equipment itself is located topsides. The equipment of greatest interest in this respect is the subsea production control system (SPCS) and the chemical injection system (CIS), although mechanical equipment may also be affected, and may become more critical as more complex functions (e.g. separation and processing) are located subsea.

Although instigated by, and produced for, the UK offshore industry, it is regarded as being applicable to similar industries throughout the world.

This publication was written and compiled under the direction of a steering group comprising personnel from a cross section of UK offshore operators, specialist service contractors and independent verification bodies who play a key role in the design and operation of subsea facilities for the offshore oil and gas industry. The steering group members also provided input to the development via discussion at meetings, individual contributions and with provision of industry experience and other selected information.

This publication has been compiled for guidance only and while every reasonable care has been taken to ensure the accuracy and relevance of its contents, the Energy Institute (EI), its sponsoring companies, the publication writer and the Steering Group members listed in the Acknowledgements who have contributed to its preparation, cannot accept any responsibility for any action taken, or not taken, on the basis of this information. The EI shall not be liable to any person for any loss or damage which may arise from the use of any of the information contained in any of its publications.

These guidelines may be reviewed from time to time and it would be of considerable assistance for any future revision if users would send comments or suggestions for improvements to:

The Technical Department  
Energy Institute  
61 New Cavendish Street  
London  
W1G 7AR  
e: **technical@energyinst.org**

## ACKNOWLEDGEMENTS

This publication has been compiled by Atkins who has also contributed to its development through provision of resource in kind. The EI wishes to record its appreciation of the work carried out by the following contributors:

Dr Jerry Baker principal author and manager of the project assisted by Rob Law (controls), Neil Robertson (subsea) and Professor John Strutt (reliability) for compiling this publication and for input of expertise into its detail and content.

Members of the EI's subsea obsolescence steering group, which was set up to direct the programme and who provided valuable expertise through meeting attendance and correspondence. In particular, those who have provided contributions that were key to the development of this publication:

Greg Jones	Total E&P UK Ltd (Chairman)
Linda Masson	BP
John Bairstow	Talisman
Paul Broadbent	Chevron
Alan McAra	Shell
John Thornton	Lloyd's Register EMEA
Gordon Drummond	Subsea 7
Alan Gillen	Nexen Petroleum UK Ltd
Keith Hart	Energy Institute (manager and secretary)

The EI also wishes to recognise the contribution made by those who have provided input and guidance on the various draft documents which were issued during the development period:

Tom McCargle	BG Group
Viv Fallon	Nexen
Alex Green	Chevron
Robin Slater	Aker Solutions
Tony Pincombe	GE
Andy MacGill	JP Kenny
Don Middleton	iicorr
Cameron Stewart	Energy Institute

The project has been sponsored by Subsea UK through provision of meeting facilities and promotion within its membership and the EI is grateful for the support given by Alistair Birnie and Bill Edgar.



## **PUBLICATION FORMAT**

Part A presents the high level management policy and principles, and the framework under which a successful obsolescence management process can be achieved. It is recommended reading for all senior managers whose responsibilities are associated with the design or operation of offshore assets. Part B provides detailed guidance for practitioners of obsolescence management. It addresses the selection of a management strategy (with supporting information in Annex A), and describes the activities associated with all phases of the life cycle of a subsea system. Key tasks and responsibilities are described. The section on obsolescence monitoring and reviews also develops the idea of a three-dimensional risk matrix (with supporting information provided in Annex D).

Annex B provides a review of the various equipment and its tendency to obsolescence, although this is only provided as a guide and should not replace robust obsolescence management.

Throughout the publication, where there is a difference in the guidance between operators and suppliers, this is highlighted; otherwise it is considered to be equally applicable.

## **PART A MANAGEMENT POLICY**

### **1 INTRODUCTION**

#### **1.1 OBSOLESCENCE**

A component or module is 'obsolete' when it can no longer be procured, or support has been withdrawn. In the context of subsea facilities, this means that like-for-like replacement of a failed component is no longer possible. 'Obsolescence' refers to the period after the manufacturer has announced that production will be discontinued, or that support will be withdrawn, during which remaining stocks are run down.

The management policy defines the basis upon which the requirement for an obsolescence management (OM) process for a subsea facility (as defined in section 3.1 of Part B) is established. For a full understanding of the process, Part B should be consulted.

Typical policy recommendations follow:

- All components of every asset shall be designed in full accordance with the relevant codes and standards applicable. Similarly, obsolescence management practice shall adhere to the relevant codes and standards and recognised good practice.
- All risks to safety or the environment that arise due to the operation of any asset shall be identified and quantified (numerically or subjectively), and the asset shall be managed so as to reduce or mitigate these risks to be as low as reasonably practicable (ALARP).
- The obsolescence strategy shall be defined (in accordance with these guidelines) and shall be promulgated around the organisation, and to all suppliers, potential or actual. This shall include guidance on life-of-field agreements.
- The obsolescence management process shall be subject to regular review (to make sure the strategy and processes remain fully applicable and effective).
- Lessons learnt from every asset shall be communicated throughout the organisation (and around the wider subsea community, as appropriate) so that the performance of all assets is continually improved, and lessons learnt with regard to the impact of obsolescence.
- Any asset has been designed, installed and commissioned, and is now operated, to be reliable, maintainable and cost-effective, and not impaired by obsolescence, throughout the field life.
- It is recognised that the cost of repeated intervention throughout the life cycle, especially in deep water, will exceed by many times the incremental costs associated with achieving, through good design, fabrication and installation, a reliable and maintainable subsea facility.

## 1.2 KEY PRINCIPLES

The key principles for a successful and effective OM process follow:

- The policy, and the obsolescence management strategy, should be authorised at the highest level in the organisation and should be promulgated to every person who has an involvement with subsea operations, in every asset, as a fundamental aim of the organisation.
- The organisation should provide adequate resources, in terms of both personnel and equipment (including software), for the achievement of the policy.
- The organisation should define key OM roles, and their responsibilities, in accordance with these guidelines, and with its management structure.
- The organisation should require the definition of the obsolescence management plan (OMP) by the designated responsible individual(s).
- The organisation should ensure that the processes are reviewed regularly.
- The reports required by senior management should be clearly defined.
- Particular attention should be paid to managing interfaces in the system - e.g. between technical groups, between the organisation and third parties, and between project phase and operations.
- The term 'failure' should be clearly defined, in the context of obsolescence, as any condition in which a system, process, equipment or component no longer has the ability to perform its intended or required function such that target production performance cannot be achieved.
- Obsolescence may also be revealed by upgrades to systems to accommodate changes to field architecture (e.g. a brownfield tie-in).
- All circumstances where obsolescence impacts performance should be fully investigated and the outcomes communicated to ensure that lessons are learnt and good practice updated.
- It should be emphasised that OM commences during the design phase, and continues throughout the life cycle until the decommissioning phase.
- Obsolescence, especially of software, may be brought about by the loss of skills, knowledge or experience, leading to loss of support by a supplier.
- Ideally, reliability, obsolescence and integrity should be treated as an integrated whole and managed in parallel.
- This guideline should be consulted by every engineer involved with reliability or obsolescence at any point in the life cycle of a subsea facility, from conceptual design to decommissioning. It aims to be the primary guide for design engineers, installation engineers, and those engineers working in the supply chain during projects; and for reliability, integrity and subsea maintenance engineers during operations. It should also be consulted by all asset managers and project managers, who should fully understand the potential impact of obsolescence on production.