Guidance on integrity management for subsea production control systems

energy institute

GUIDANCE ON INTEGRITY MANAGEMENT FOR SUBSEA PRODUCTION CONTROL SYSTEMS

November 2018

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 chartered professional membership body for the energy industry, supporting over 20 000 individuals working in or studying energy and 250 energy companies worldwide. The EI provides learning and networking opportunities to support professional development, as well as professional recognition and technical and scientific knowledge resources on energy in all its forms and applications.

The EI's purpose is to develop and disseminate knowledge, skills and good practice towards a safe, secure and sustainable energy system. In fulfilling this mission, the EI addresses the depth and breadth of the energy sector, from fuels and fuels distribution to health and safety, sustainability and the environment. It also informs policy by providing a platform for debate and scientifically-sound information on energy issues.

The EI is licensed by:
– the Engineering Council to award Chartered, Incorporated and Engineering Technician status, and
– the Society for the Environment to award Chartered Environmentalist status.

It also offers its own Chartered Energy Engineer, Chartered Petroleum Engineer, and Chartered Energy Manager titles.

A registered charity, the EI serves society with independence, professionalism and a wealth of expertise in all energy matters.

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

Andeavor
Apache North Sea
BP Exploration Operating Co Ltd
BP Oil UK Ltd
Centrica
Chevron North Sea Ltd
Chevron Products Company
Chrysaor
CLH
ConocoPhillips Ltd
DCC Energy
EDF Energy
ENI
E. ON UK
Equinor
ExxonMobil International Ltd
Innogy
Kuwait Petroleum International Ltd
Nexen CNOOC
Ørsted
Perenco
Phillips 66
Qatar Petroleum
Repsol Sinopec
RWE npower
Saudi Aramco
Scottish Power
SGS
Shell UK Oil Products Limited
Shell U.K. Exploration and Production Ltd
SSE
TAQA Bratani
Total E&P UK Limited
Total UK Limited
Tullow Oil
Uniper
Valero
Vattenfall
Vitol Energy
Woodside
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.

ISBN 978 1 78725 048 2

Published by the Energy Institute

Hard copy and electronic access to EI and IP publications is available via our website, **https://publishing.energyinst.org**.
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**

CONTENTS

LIST OF FIGURES AND TABLES

Page

Figures

Tables

FOREWORD

The North Sea oil and gas industry has pioneered the use of subsea production control systems (SPCSs) and has driven the development of the technology to enable the efficient commercial exploitation of smaller reservoirs tied back to existing platforms.

This publication aims to raise awareness amongst subsea engineers and non-specialists across the industry on good integrity management practices for SPCSs and its associated subsystems and components. This publication does not seek to replicate or replace existing industry standards covering the design of subsea production control systems. It should be noted that subsea production control systems are diverse in their design, age and operation and consequently not all of the good practices in this publication will be technically feasible or cost-effective in every situation.

By following integrity management good practice, it is possible to assess the in-service operating behaviour of subsea production control systems to identify anomalies, faults and, where possible, predict incipient failures whilst presenting the opportunity for proactive planning and maintenance.

ACKNOWLEDGEMENTS

The Energy Institute (EI) wishes to record its appreciation of the work carried out by the following individuals over the project duration:

ALECOM Members (Technical Partners)

Don Smith (Chair), ENI

Richard McKeown, Chevron

Kingsley Anunobi, ConocoPhillips

Konstantinos Vatopoulos, Aramco

Steve Temple, Total

Terry Rhodes, Shell

Jim Saunderson, Apache

Richard Bailey, Nexen CNOOC

Tim Leicester, BP

Alex Stacey, HSE

In addition, thanks to the ALECOM observer members of ALECOM for comment, feedback and review.

Technical drafting and editing: Dr Jesse Andrawus, Aker Solutions.

This first edition guidance was coordinated and managed by Dr Cameron Stewart, Energy Institute, Upstream Technical Manager.

1 INTRODUCTION

This integrity management guidance recommends the design, implementation, monitoring and continuous improvement of a subsea asset integrity management programme to ensure subsea production control systems (SPCS) function, operated and maintained in accordance with the required design and operating performance standard throughout their whole life cycle. The guidance is intended to be used by those in the oil and gas industries, including:

- operators of oil and gas facilities;
- providers of asset integrity management services for the oil and gas industry;
- providers of inspection and maintenance services for the oil and gas industry;
- designers and manufacturers of subsea production control systems, and
- providers of installation and commissioning services for the oil and gas industry.

The guidance provides good practices to satisfy, if any, regulatory and stakeholders' requirements for effective management of the integrity of SPCSs through design, manufacture, installation, operation, maintenance and decommissioning. The guidance is designed to enable the integration of the SPCS integrity management system with other existing management systems such as Coabis, thus providing a holistic solution that maximises production availability through minimisation of equipment downtime.

This guidance outlines key criteria for developing a robust integrity management strategy for SPCSs. It describes how asset owners or stakeholders can plan and execute integrity management activities for SPCSs.

1.1 PURPOSE

This guideline outlines good practice for integrity management of subsea production control systems. It provides guidance on how in-service faults, failures, deterioration and degradation of subsea production control systems (SPCSs) are appropriately monitored, allowing effective diagnosis, prognosis and management of subsea production control systems in terms of optimised up time.

The guidance is intended to satisfy (as required) any regulatory and stakeholders' requirements by defining a programme to provide assurance that asset owners are meeting the minimum requirements for managing the integrity of SPCSs. In the event of a conflict between this guidance and any relevant regulatory and/or stakeholders' requirements, the relevant regulatory and stakeholders' requirements should take precedence. If the guidance provides a better assistance for managing the integrity of subsea production control systems, then the guidance can be used to supplement any existing requirements.

1.2 SCOPE

The guidance provides good practice for effective and efficient management of the integrity of subsea production control systems throughout the whole life cycle. The whole life cycle in this context includes ageing lifecycle extension (ALE) as defined in the Health and Safety Executive (HSE) Key Programme 4 [HSE *Key programme 4 (KP4) – Ageing and life extension programme*].

The guidance is applicable to the integrity management of both topside and subsea-located production control system equipment on all installations.

Topside-located production control system equipment comprises as a minimum:

– electrical power unit (EPU);
– master control station (MCS);
– hydraulic power unit (HPU), and
– subsea power and communication unit (SPCU).

The subsea-located production control system equipment comprises as a minimum:

– subsea distribution module (SDM);
– subsea router module (SRM);
– remote power controller (RPC);
– subsea control module (SCM);
– subsea electronic module (SEM);
– subsea umbilical;
– hydraulic flying lead (HFL);
– electrical flying lead (EFL), and
– sensors.

Figure 1 shows the boundary definition of a subsea production control system.

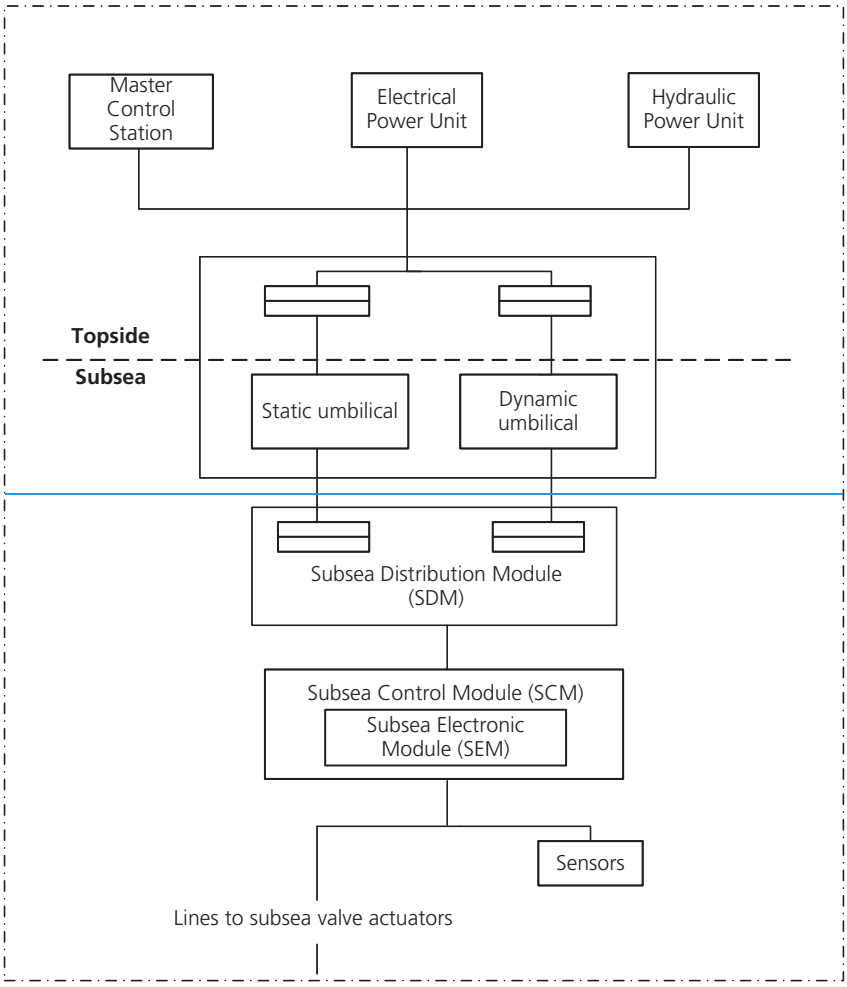

Figure 1: Boundary definition of a subsea production control system