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# 122 – Offshore Norge Recommended Guidelines for the Management of Life Extension

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Original version

## PREFACE

These guidelines are supported by Offshore Norge Forum for the HSE regulation and by the Offshore Norge Operations Committee. They have also been approved by the Offshore Norge director general.

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These guidelines are owned by Offshore Norge.

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## CONTENTS

PREFACE.....	2
CONTENTS.....	3
1 INTRODUCTION.....	4
1.1 Purpose .....	4
1.2 Definitions and abbreviations .....	4
1.3 References.....	5
1.4 Management of Life Extension.....	5
2 LICENCE MANAGEMENT.....	7
2.1 Facility Life.....	7
2.2 Life Extension .....	7
2.3 Risk Management.....	7
2.4 Licence Planning.....	7
3 OPERATORS MANAGEMENT SYSTEM.....	9
3.1 Plans .....	9
3.2 Assessment of technical lifetime of a System.....	9
3.3 Design Life.....	10
3.4 Initiation of Life Extension Process.....	10
4 MANAGEMENT OF LIFE EXTENSION.....	11
4.1 Introduction.....	11
4.2 Initiation of Life Extension .....	11
4.3 Uncertainty in Life Extension Management.....	12
4.4 Life Extension Process.....	12
4.4.1 Assessment of System condition and functionality.....	14
4.4.2 Assessment of technical lifetime of Systems .....	14
4.4.3 Identification of life extension measures .....	15
4.4.4 Life Extension Programme .....	15
4.5 Extended Life .....	15
4.6 Approval and Verification.....	16
APPENDIX A - SPECIFICATION OF AMENDMENTS TO THE GUIDELINES	
19	
APPENDIX B - APPLICABLE STANDARDS FOR LIFE EXTENSION .....	20

# 1 INTRODUCTION

## 1.1 Purpose

These guidelines describe the process for management of life extension of a Facility and determining the Extended Life.

The guidelines also describe the processes and decisions relevant to life extension for a Facility in licence management and in the operator's management system.

## 1.2 Definitions and abbreviations

Acceptance Level	A specific Condition associated with measurable parameters on a System that are considered acceptable in order for that System to fulfil its function.
Barrier	Technical, operational and organisational elements on an offshore facility, that, individually or collectively, reduce the possibility of concrete failures, hazard and accident situations occurring, or that limit or prevent harm/inconveniences. Ref. Guidelines to Management Regulations section 11.
Critical System	Any System with components that the operator determines to be critical for the safe and reliable operation of the Facility
Condition	The physical state of a System that determines its ability to fulfil its function. Condition may be related to the System or the components that make up the System.
Degradation	Detrimental change in physical Condition due to time, use or external cause. Ref. NS-EN 13306:2010
Design Life	The specified period for which the integrity of the Facility is documented in the original design, with anticipated maintenance and within specific operational limits. Ref. NORSOK Y-002
Extended Life	The period for which the integrity of the Facility is documented in the life extension process, with anticipated maintenance and modification and within specified operational limits. Ref. NORSOK Y-002 (based on definition of Design Life)
Facility	Installation, plant and other equipment for petroleum activities. Facilities also comprise subsea installations,

	pipeline, wells, and cables unless otherwise provided. Ref. Framework Regulations section 6.
Facility Life	The length of time the Facility is intended to operate. Ref. NORSOK Y-002 (based on definition of service life for a system).
Obsolescence	Inability of an item to be maintained due to the unavailability on the market of the necessary resources, including spares, at acceptable technical and/or economic conditions. Ref. NS-EN 13306:2010
Performance standards	Verifiable requirements related to Barriers to ensure that the Barrier is effective. They can include such aspects as capacity, integrity, reliability, accessibility, availability, ability to withstand loads, robustness, expertise and mobilization time. Ref. Guidelines to Management Regulations section 5.
System	A group of related parts and equipment that performs a structural, safety, processing or utility function.
EPIM	Exploration & Production Information Management Association
JOA	The Joint Operating Agreement
PDO	Plan for Development and Operation of a petroleum deposit
PIO	Plan for Installation and Operation of facilities for transport and utilisation of petroleum
TRA	Total Risk Assessment

### 1.3 References

- NORSOK Y-002, Edition 1, September 2010
- NORSOK D-001, Edition 3, December 2012
- NORSOK D-010, Rev. 4, June 2013
- NS-EN 13306:2010

### 1.4 Management of Life Extension

Facilities installed on the Norwegian Continental Shelf are designed to be used for a period defined as the Design Life. The Design Life is normally based on the predicted economic life of the fields associated with that Facility when the plan for development and operation (a) and plan for installation and operation (PIO) was approved. The Design Life may be related to the Facility or may be related to parts of the Facility, for

example topsides, jacket, hull, wells, pipelines. These Design Life periods may not be the same.

The economic life of a field(s) may change, requiring a life for the Facility(s) that exceeds the Design Life. When this occurs, there shall be a process to extend the life of the Facility. The life extension process should demonstrate that safe and reliable operation for the extended period is achievable.

Facilities degrade with use and with exposure to internal and external factors that affect the facilities. The operator of the facilities has processes in place to monitor and control Degradation and assure that the facilities are operated safely and reliably throughout the period they are required.

Life extension requires assessments that are in addition to those normally carried out to assure the technical integrity of the Facility.

## 2 LICENCE MANAGEMENT

Companies awarded a production licence enter into an agreement for petroleum activities, the Licence Agreement. The Joint Operating Agreement (JOA) is an attachment to the Licence Agreement and describes how the production licence is governed. The licence management committee is responsible for ensuring the requirements in the JOA are complied with. Information on the licence governance process can be found through EPIMs web site; <http://veileded.epim.no/>

The most relevant JOA sections related to life extension are:

- Requirements for corporate governance
- Long-term plans
- Risk management

### 2.1 Facility Life

The Facility Life is normally determined by the life of the field(s) dependent on the Facility for production, processing, transportation and/or storage. The life of the field(s) is based on updated production profiles and product price scenarios given by long-term plans and approved by the licence partners.

The assessment of the period the Facility is required for should include the potential for further development of the field(s) and area development and the potential for third party production through the facilities.

### 2.2 Life Extension

The licence management committee should endorse any life extension process.

The licence management committee should approve the Extended Life and ensure that the Extended Life is in accordance with the objectives for the asset.

### 2.3 Risk Management

The licence management committee ensures the operator has a process to manage the risks associated with the Facility and that risk mitigation measures are implemented. Risks identified in the life extension process of the facilities should be included in the licence risk management process.

### 2.4 Licence Planning

The licence management committee approves work programs and budgets and endorses long-term plans including activities required for the safe and reliable operation of the Facilities. The need to update the long-term plans is decided annually and will normally occur as the result of significant changes that affect the Facilities. The requirement to carry out a life extension process should follow from the update of the long-term plans.

The operator is responsible for developing and executing the plans and for managing any changes to the plans.

The licence management committee should ensure that the activities identified in the life extension process are prioritized and included in the work plans, and should verify that these plans are implemented.

The licence management committee should ensure that there is a verification plan in place that includes follow up of the measures identified in the life extension process.

### 3 OPERATORS MANAGEMENT SYSTEM

The operator has a management system that includes processes to ensure the Facility can be operated safely and reliably. Through these processes, the operator ensures that there is control over the Condition of the facilities, that the Barriers in place to protect the facilities function as required, and that changes that directly or indirectly affect the facilities are managed.

The management system should include a process to identify, if and when, the Design Life of the Facility, or parts of the Facility, is expected to be exceeded. The operator should then initiate a life extension process for the Facility, or the relevant parts of the Facility.

#### 3.1 Plans

The operator develops plans for activities that assure the Facility is operated safely and reliably. The plans include activities such as:

- Modifications that are needed to adapt the System to future needs
- Replacement of systems and equipment
- Requirement and strategic choices regarding maintenance

The activities in the plan can be at different maturity, and can be matured to initiate a repair, replacement or modification in time. The plans for maintaining the integrity throughout the life of the Facility are regularly reviewed and updated as a result of any changes.

#### 3.2 Assessment of technical lifetime of a System

The technical lifetime of a System can be determined by predicting when the Condition reaches the Acceptance Level. The assessment of technical lifetime of a System should be based on Degradation from operational use, prediction models, maintenance and inspection experience and Obsolescence.

Operators do not however always estimate a specific lifetime for each System. The lifetime of components in the System with significant Degradation, is normally evaluated to ensure replacement before the Condition deviates from the Acceptance Level.

Unexpected changes in the Condition of Critical Systems or equipment by damage or accidents should require an assessment of the implications for the lifetime of these Systems. Unexpected changes in the internal and external factors can also affect Degradation and Obsolescence.

New knowledge and/or technology may be relevant for Degradation and Obsolescence and should be evaluated in any assessment of technical lifetime. This may come from research and development, from experience from other facilities and operators and may be the result of incidents and accidents. Technology assessment and possible technology qualification(s) may need to be developed for the assessment of technical lifetime.

### 3.3 Design Life

There may be different Design Life periods stated for different parts of the Facility, e.g. pipelines, topsides etc. The Design Life for the load bearing structures is normally the basis for the assessment of the need for a life extension process on the Facility.

The operator should determine the start of the Design Life period and hence when the Design Life is exceeded. The start of the Design Life period is normally when the Facility becomes exposed to the factors that cause Degradation.

### 3.4 Initiation of Life Extension Process

In the event that the Design Life is likely to be exceeded then a life extension process should be initiated. In the event of different Design Life periods for different parts of the facilities, then the operator may need to initiate life extension processes for these parts at different times.

Experience indicates that the life extension should be initiated at least 2 years before the Design Life is exceeded. For simple facilities, or for some parts of the facilities (if there are different Design Life periods), the life extension process may be managed in a shorter time. For some facilities, it may be necessary to start the life extension process earlier for example if the facilities are complicated, there are poor records and documentation or there is a need for any technological development to assess technical lifetimes for some Systems. Life extension may also be required earlier if a significant change in the Facility Life is identified and/or there is a strategic need to determine an Extended Life.

## 4 MANAGEMENT OF LIFE EXTENSION

### 4.1 Introduction

The management of life extension needs to consider two levels, a Facility level and a System level. The Design Life and Facility Life, and hence the need for a life extension are related to the Facility level. The life extension assessments and methodologies are related the System level. Based on these assessments an Extended Life for the Facility is determined. This consideration is described in figure 1.

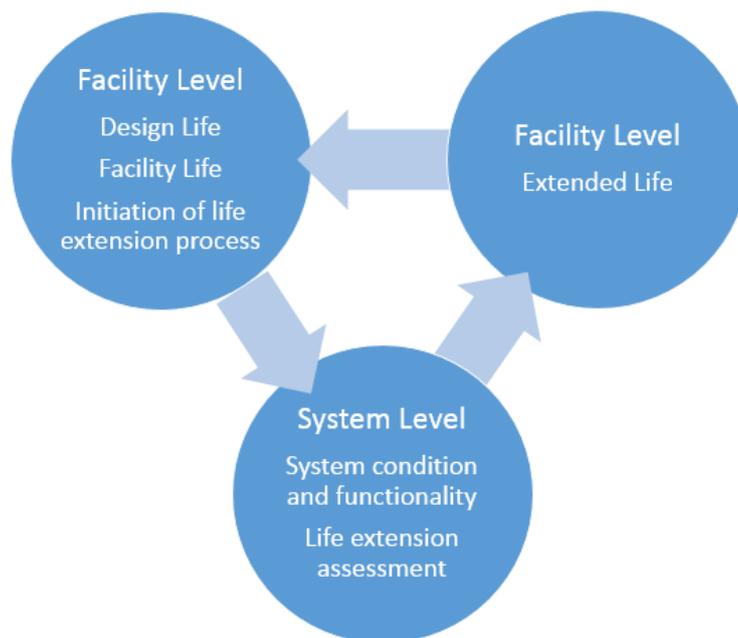


Figure 1. – Relationship between Facility and System level

The initiation of, the process for, and the approval and verification of life extension are described in sections 4.2, 4.4 and 4.6 and shown in the corresponding figures. For each of these the operator should define and refer to governing documents relevant to life extension and should specify any records required to document the life extension.

### 4.2 Initiation of Life Extension

A life extension process is required when the Facility Life exceeds the Design Life and there is an intention to operate the Facility beyond the Design Life. As stated in the introduction to section 3 the operator initiates the life extension process and as stated in section 2.2 the licence management committee endorses this process. The initiation of the life extension is included in the process to develop a plan for life extension as described in figure 2.

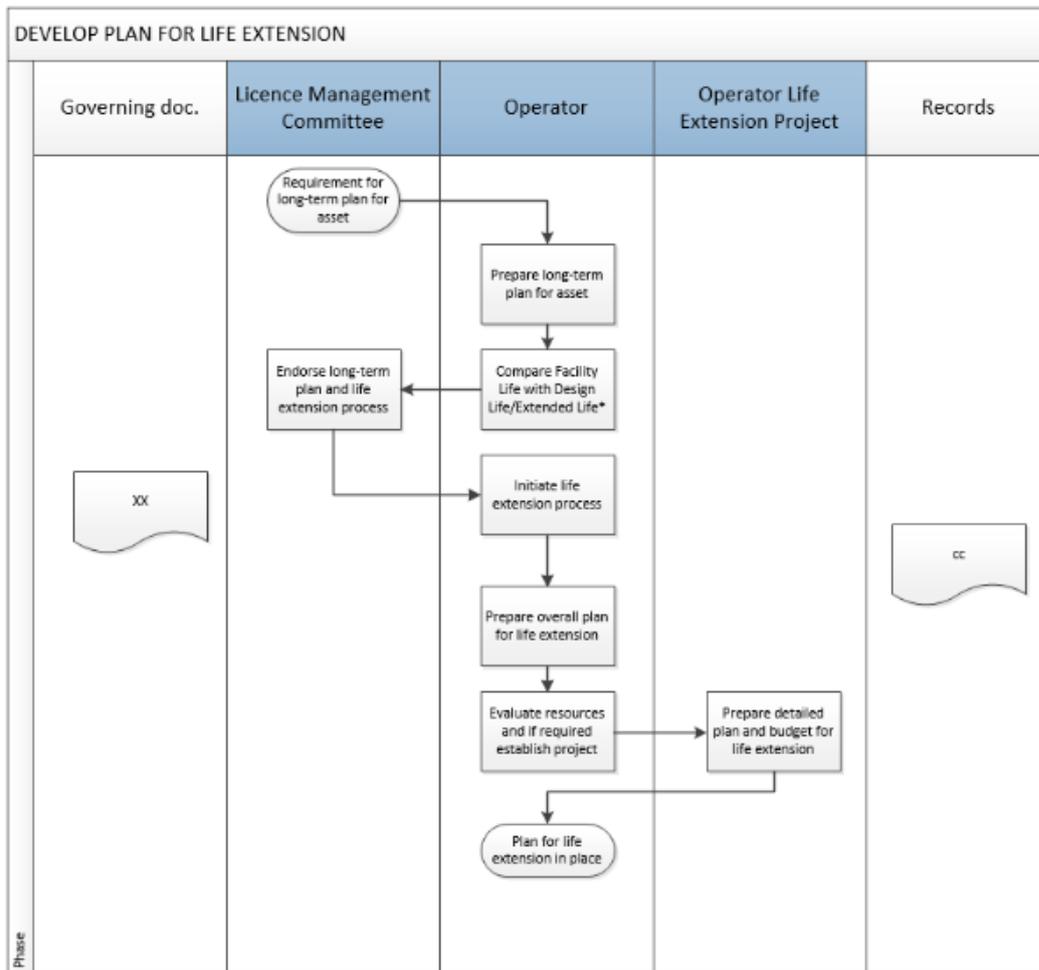


Figure 2 Develop plan for life extension

\*Extended Life applies if a life extension process has previously been carried out.

### 4.3 Uncertainty in Life Extension Management

Prediction of the lifetime of individual Systems on a Facility is challenging, and there are uncertainties related to these predictions that need to be recognized and managed as part of the life extension process. The operators should recognize that further information on the Condition of some Systems cannot be obtained with existing technology and techniques. Sometimes a judgement has to be made on the technical lifetime of these Systems that in turn provides input to the determination of the Extended Life. The life extension process should identify information that is required to reduce the uncertainty related to the assessments carried out. This is a key factor in the risk management of the life extension.

### 4.4 Life Extension Process

Life extension assessments may be required on many Systems and it may be appropriate to establish a project. A project for life extension may require significant resources, both internally and externally and this needs to be addressed in the planning of the life extension process.

The life extension process is part of the development of the business case for life extension described in figure 3.

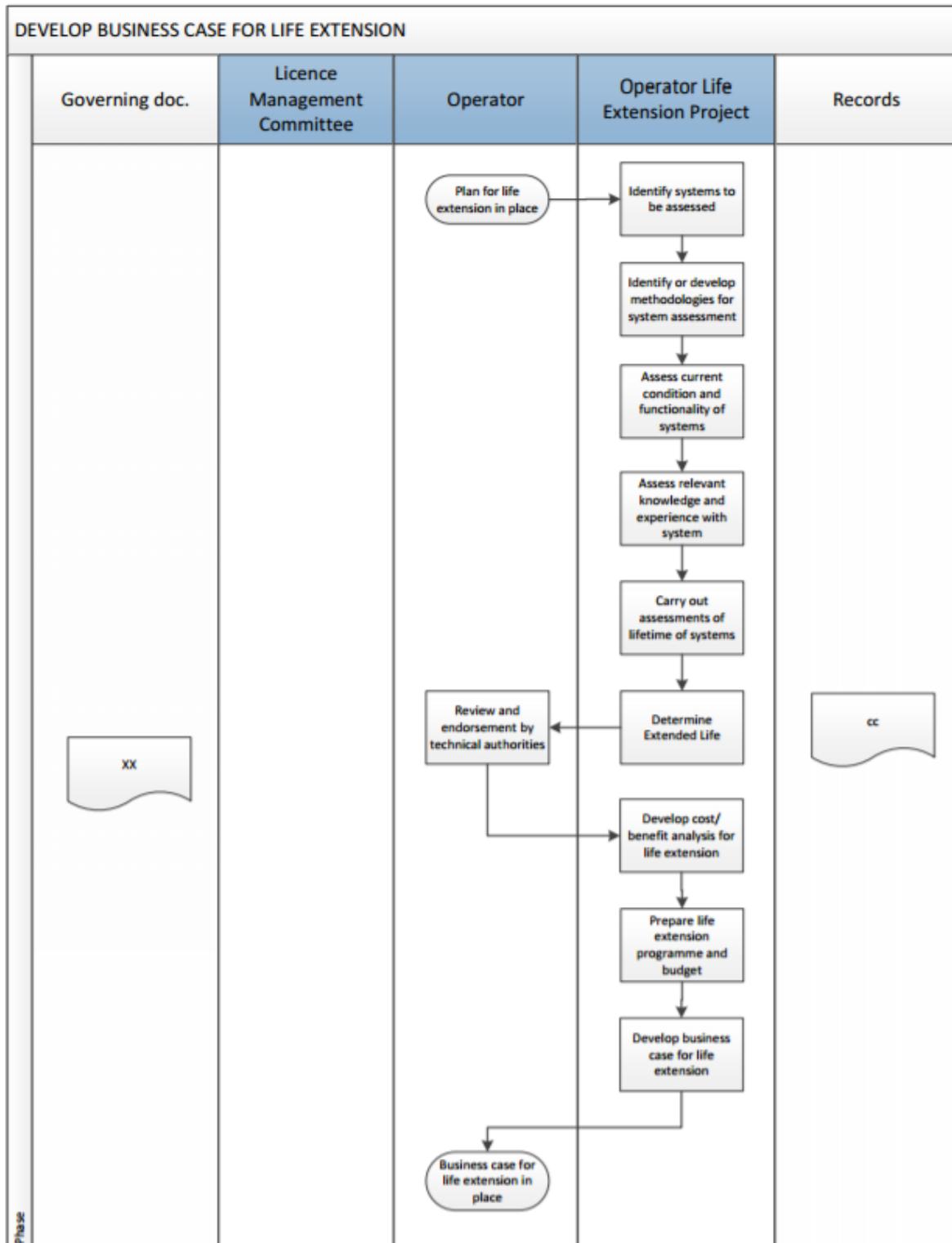


Figure 3. Develop Business Case for Life Extension.

The operator should develop a plan for the life extension activities.

The operator should identify Systems that should be assessed in the life extension process. This will normally include Systems required for safe and reliable operation, and Systems where Degradation and Obsolescence have already been identified as issues.

The operator should define the methodologies and/or standards to be used to assess the life of each System, see Appendix 2 Applicable standards for life extension. If there is not a recognized methodology/standard for life extension of a particular System, then the operator should develop one.

#### 4.4.1 Assessment of System condition and functionality

The operator should assess the current condition and functionality of the systems. The following activities should be considered, but not limited to, in this assessment:

- Review of operational history and maintenance and inspection records to assess condition for life extension.
- Assessment of the need for further inspections and/or condition measurements needed to supplement and/or complete maintenance and inspection records.
- The need to consult the Original Equipment Manufacturers of, and/ or service providers for, the Systems and equipment to identify the information relevant to the life extension.
- Review of the operational limits for the Facility and assess the need to change these.
- The assessment of life extension for wells should include waste injection wells and temporary abandoned wells. A review of the well barriers should be carried out with reference to NORSOK D-010.
- Life extension on drilling facilities and development of any specific methodology for life extension of a drilling system should be carried out with reference to NORSOK D-001.
- Review the deviations and exemptions related to the System and determine if these are still valid for the life extension.
- Review the assumptions in the Facility Total Risk Assessment (TRA) to assess the impact on life extension.

The operator should carry out a review of new information and knowledge, and technology development that may be relevant to the Condition of the Systems.

#### 4.4.2 Assessment of technical lifetime of Systems

The operator should carry out the life extension assessments on the selected systems. The following activities should be included in this assessment:

- Review of maintenance strategies to ensure they are suitable for an extended period.
- For Systems where predictable degradation mechanisms are dominating, quantitative analyses should be carried out.
- Assess the need for modifications, upgrades or downrating of the Systems or to the components in the Systems.
- Assess the need to change operational limits for the Facility.
- Development of a strategy for how the well integrity is secured for the future use of wells including plug and abandonment.
- Highlight key assumptions that influence the uncertainty related to the life extension.

The operator should consider new information and knowledge, and technology development that may be relevant to the life extension of the Systems and the Facility as a whole.

#### 4.4.3 Identification of life extension measures

The life extension process may identify major modifications that will require a review and update of the TRA. The need for a review is dependent on the operator's system for managing changes. The life extension assessments and identified measures should be reviewed and verified by the relevant technical authorities in the operator's organization.

The operator should identify changes to procedures and other working documents and implement these at the appropriate time.

#### 4.4.4 Life Extension Programme

The operator should develop a programme and budget for the measures identified in the life extension process. Based on this programme the operator should develop a business case for the life extension for presentation to the licence management committee.

### 4.5 Extended Life

The life extension process should result in a recommendation from the operator on an Extended Life for the Facility.

The Extended Life should be based on the following criteria:

- Compliance with the applicable regulations.
- Compliance with Operators own requirements for safe and reliable operations.
- Acceptable control of Condition throughout the Extended Life.

- Acceptable management of the Barriers throughout the Extended Life.
- Acceptable safety level throughout the Extended Life.
- Maintaining acceptable risk levels throughout the Extended Life.
- Acceptable monitoring and control of degradation through maintenance management.
- Acceptable management of change throughout the Extended Life.
- Operational limits as specified for the Facility.

The operator shall ensure the Extended Life and the main assumptions for the Extended Life are approved and documented before the Design Life is exceeded.

The recommendation may specify different Extended Life periods for different parts of the Facilities. For example, the life of infield pipelines may be predicted to be less than the rest of the facilities. The operator should ensure that the Extended Life of these parts is not exceeded without a further life extension process.

The Operator is responsible for ensuring the Facility is not used beyond the Extended Life until a further life extension process has been completed.

#### 4.6 Approval and Verification

The approval and verification of the Extended Life is described in figure 4. This also includes the implementations of measures identified in the life extension.

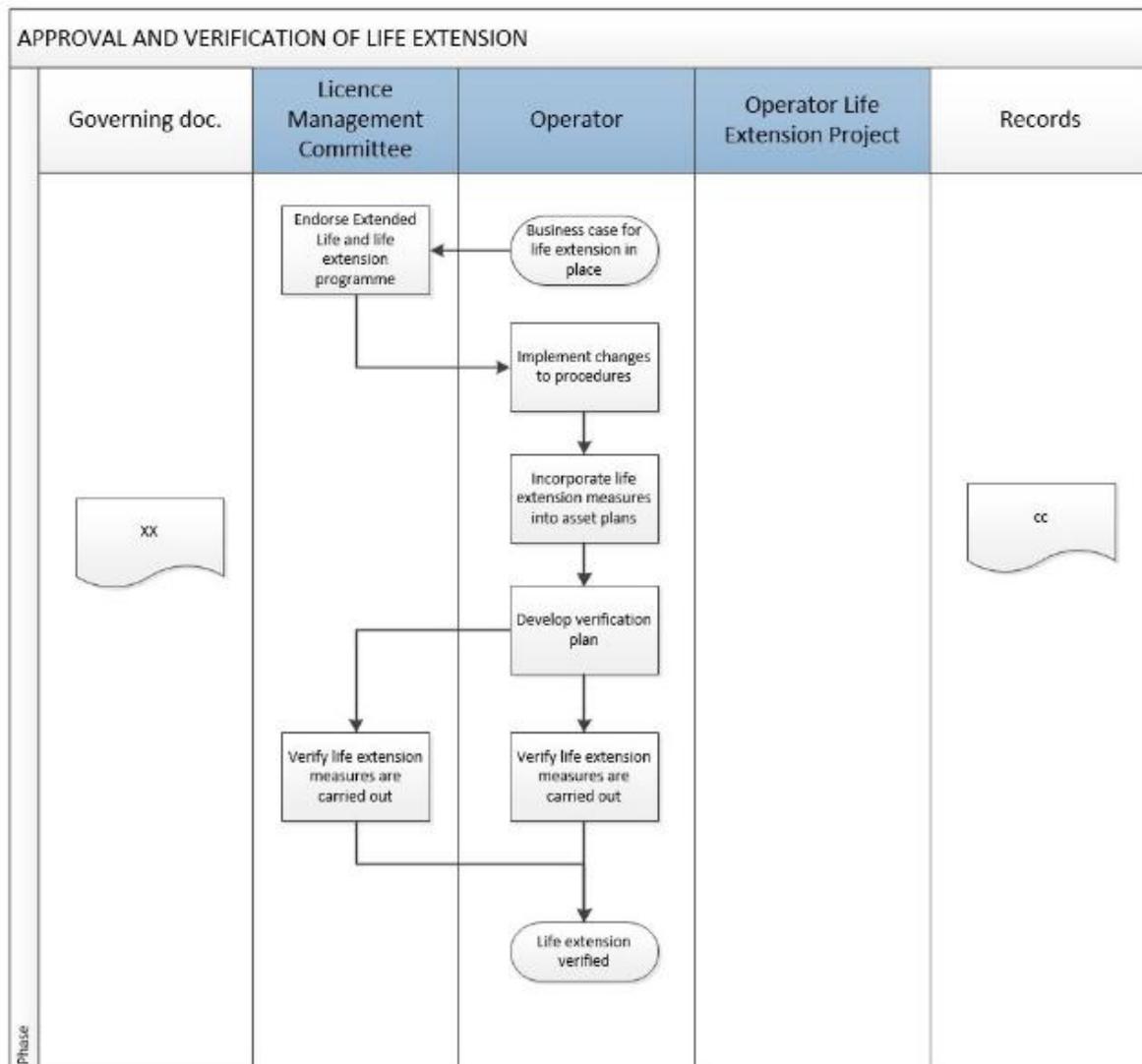


Figure 4. Approval and Verification of Life Extension

The licence management committee approves the business case for the life extension, including the operators' recommendations on the Extended Life and the programme for the measures identified in the life extension process.

Measures in the life extension programme should be incorporated into the existing plans for the Facility. These measures should be tagged as life extension activities in order to make it easier for internal and external parties to audit the life extension process.

The operator should determine the need for and scope of verifications, as well as the verification method and its degree of independence. The verifications should ensure that:

- The measures identified in the life extension process are followed up and implemented.
- Operational processes and procedures, related to any changes identified in the life extension process are updated.
- The assumptions in the life extension process are still valid.

The operator should also carry out an overall assessment of the results of the verifications that have been carried out.

The operator will continue to develop long-term plans for the Facility and these plans may indicate a further change to the Facility Life. As part of this process, the Extended Life should be compared to the Facility Life and a further life extension process initiated if the Facility Life is likely to exceed the Extended Life.

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## **APPENDIX A - SPECIFICATION OF AMENDMENTS TO THE GUIDELINES**

Guidelines 122 was originally developed to describe the methodology for how the operator should carry out a life extension process to prepare an application for consent for lifetime extension.

These guidelines have been updated to describe the process for life extension and the processes and decisions relevant to life extension in licence management and in the operator's management system. The guidelines contains new text compared to the previous version.

## APPENDIX B - APPLICABLE STANDARDS FOR LIFE EXTENSION

The following standards and methodologies are relevant for life extension:

Drilling Systems	NORSOK D-001, rev. 3, December 2012 NORSOK D-010, rev. 4, June 2013
Production assurance and reliability management	ISO 20815:2008
Collection of reliability and maintenance (RM) data	ISO 14224:2016
Risers and Pipeline Transportation Systems	NORSOK Y-002, rev. 1, September 2010
Risk Based Maintenance and Inspection	NORSOK Z-2008, Rev. 3, June 2011 If criticality assessment is considered necessary as part of the life extension.
Obsolescence of Systems	IEC 62402:2007
Offshore cranes	ISO 12482:2014. NORSOK R-002:2012
Offshore Load bearing Structures	NORSOK N-006, edition 2, April 2015
Subsea Systems	NORSOK U-009, Edition 1, March 2011
Wells	NORSOK D-010, rev. 4, June 2013