

Environmental care

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Foreword

The NORSOK standards are developed by the Norwegian petroleum industry to ensure adequate safety, value adding and cost effectiveness for petroleum industry developments and operations. Furthermore, NORSOK standards are, as far as possible, intended to replace oil company specifications and serve as references in the authorities' regulations.

The NORSOK standards are normally based on recognised international standards, adding the provisions deemed necessary to fill the broad needs of the Norwegian petroleum industry. Where relevant, NORSOK standards will be used to provide the Norwegian industry input to the international standardisation process. Subject to development and publication of international standards, the relevant NORSOK standard will be withdrawn.

The NORSOK standards are developed according to the consensus principle generally applicable for most standards work and according to established procedures defined in NORSOK A-001.

The NORSOK standards are prepared and published with support by The Norwegian Oil Industry Association (OLF) and Federation of Norwegian Industry.

NORSOK standards are administered and published by Standards Norway.

Introduction

The third edition of this NORSOK standard is a complete revision of the previous edition, focusing on the following elements:

- to describe the decision process at the various stages of design development and the environmental issues related to these;
- to identify the main criteria for the decisions to be made;
- to identify analytical tools and methods that can be used to arrive at specific requirements for the individual contracts;
- to provide a format for documenting the output of these decision processes which can be used in different contract forms for the execution phase of a project.

The rationale for this structure, which differs considerably from other NORSOK standards, is that there are few pre-accepted solutions that are applicable to all projects with respect to environmental issues. Previous editions of this NORSOK standard have also included many options to explore and solutions to consider. Many of these considerations have to be done in an early stage of the project development, and are usually performed by the operating company internally and/or by a FEED contractor prior to project execution. Many of the statements in this NORSOK standard are difficult to handle contractually, and it is therefore necessary to supplement this NORSOK standard with specific requirements in the execution contracts.

The intention with the third edition is that this NORSOK standard is considered to be a guideline for use internally in the operating companies and possibly in FEED contracts. It will have to be supplemented by other contract documents, such as the design basis and/or other specifications during execution. The functional requirements in this NORSOK standard are listed in tabular form in 5.2 to 9.3, and the blank column to the right may be used to fill in brief statements regarding the conclusions of studies, analyses and decisions with references to other contract documents when relevant. Thus this NORSOK standard constitutes a template for creating an operator's document for documenting and tracing the environmental decisions that are made during the project cycle.

The objective of this NORSOK standard is to achieve implementation of technology that minimizes adverse impacts on the environment. The most cost effective technical and/or operational solutions should be sought, based on the principle of BAT and life cycle cost analyses.

This NORSOK standard includes criteria and methods for establishing limitations for emissions to air, discharges to sea, for selection and handling of chemicals and for waste management. Furthermore, some options regarding technologies that may be applied to achieve the environmental objectives are listed. Project specific requirements will be the result of analyses and evaluations for the actual project, and these results can be entered into an open column adjacent to the functional requirement/objective in this NORSOK standard with a reference to more detailed contract documents, when relevant.

Guidelines for drilling rigs are presented, which may be used in drilling contracts, are presented in Annex C. This is also in the form of optional requirements, where the operating company has to select the relevant level of protection according to the sensitivity of the drilling site and other criteria.`

This NORSOK standard is published without marking of changes, compared to Rev 2, as the modifications are comprehensive.

1 Scope

This NORSOK standard is a guideline that applies to field development, design, construction, installation, modification and decommissioning of installations for offshore drilling, production and transportation of petroleum.

The principles of this NORSOK standard are applicable to new developments as well as modifications and tie-in projects. However, the relevance and applicability of the different requirements will have to be reviewed in context with the scope of the project.

This NORSOK standard covers offshore activities in areas of "normal" environmental sensitivity. More stringent requirements apply to certain licence areas, and the conditions of the exploitation licence shall be observed.

2 Normative and informative references

The following standards include provisions and guidelines which, through reference in this text, constitute provisions and guidelines of this NORSOK standard. Latest issue of the references shall be used unless otherwise agreed. Other recognized standards may be used provided it can be shown that they meet or exceed the requirements and guidelines of the standards referenced below.

2.1 Normative references

Council Directive 96/61/EC,	Integrated Pollution Prevention and Control
IMO International Convention for the Prevention of Pollution from Ships (MARPOL 73/78), Annex 1	
IMO MEPC.107(49),	Revised guidelines and specifications for pollution prevention equipment for machinery space bilges of ships
IMO Regulations	
IMO Requirements,	International Oil Pollution Prevention (IOPP)
ISO 14001:2004,	Environmental management systems
The Framework Regulations,	Regulations relating to health, environment and safety in the petroleum activities
The Activity Regulations	

2.2 Informative references

IMO Guidelines and Standards for The Removal of Offshore Installations and Structures on The Continental Shelf, Assembly Resolution A672, 1989	
OLF Handbook in Environmental Impact Assessment for Offshore Decommissioning and Disposal (2001)	
OLF Guideline on waste management	
OSPAR Decision 98/3,	Disposal of Disused Offshore Installations.
UKOOA Drill Cuttings Initiative, Final Report, Feb. 2002	
White Paper No 21 (2004 – 2005),	St.meld. nr. 21 (2004-2005) Regjeringens miljøvernpolitikk og rikets miljøtilstand (The governments environmental policy and the state of environment in Norway)

NOTE Many useful environmental reports are to found on web-sites of

OLF: <http://www.olf.no/miljo/miljorapporter/> ,
 NPD: <http://www.npd.no/Norsk/Emner/Ytre+miljo/Miljo/coverpage.htm>
 SFT: <http://www.sft.no/publikasjoner/> .

Since these pages are continuously being updated, no specific reports are listed.

3 Terms, definitions and abbreviations

For the purposes of this NORSOK standard, the following terms, definitions and abbreviations apply.

3.1 Terms and definitions

3.1.1

shall

verbal form used to indicate requirements strictly to be followed in order to conform to this NORSOK standard and from which no deviation is permitted, unless accepted by all involved parties

3.1.2

should

verbal form used to indicate that among several possibilities one is recommended as particularly suitable, without mentioning or excluding others, or that a certain course of action is preferred but not necessarily required

3.1.3

may

verbal form used to indicate a course of action permissible within the limits of this NORSOK standard

3.1.4

can

verbal form used for statements of possibility and capability, whether material, physical or casual

3.2 Abbreviations

BAT	best available techniques
BOP	blow out preventer
BTEX	benzene, toluene, ethylbenzene and xylene (light aromatic oil components)
DREAM	dose related risk effect assessment model
EIA	environmental impact assessment
EIF	environmental impact factor
FEED	front end engineering and design
FPSO	floating, production, storage and off-loading
HSE	health, safety and environment
IMO	International Maritime Organization
NMVOC	non methane volatile organic compound
NORM	naturally occurring radioactive material
NPD	Norwegian Petroleum Directorate (Oljedirektoratet)
NPV	net present value
OLF	Oljeindustriens landsforening (Norwegian Oil Industry Association)
OSPAR	Oslo and Paris Convention
PDO	plan for field development and operation
SFT	Statens forurensningstilsyn (The Norwegian Pollution Control Authority)
VOC	volatile organic compound

4 Guiding principles

4.1 General

This NORSOK standard assumes that an environmental management system satisfying the principles in ISO 14001 or equal has been established and is maintained.

Governing documents, in the form of acts, regulations, standards, recognized practices and company requirements shall be identified, listed, and applied in the design process.

It should be noted that some of the technologies mentioned in this NORSOK standard as possibilities to be explored, may not be commercial or proven at the time of issue of this NORSOK standard. The responsible for design has to evaluate the maturity of these technologies for application when relevant.

Operational and/or accidental discharges to sea and emissions to air shall be eliminated or minimized through design, choice of chemicals and materials as well as operation and maintenance philosophies.

4.2 Framework conditions

The application of BAT is a bearing principle of the environmental regulations. BAT is further defined in the Council Directive 96/61/EC, Article 2 and Annex IV. The criteria that are part of determination of BAT according to the directive are summarized in the figure in Annex A of this NORSOK standard. However, the functional requirements stated in these regulations and the directive has to be adopted by the operating company into explicit requirements at concept and system level.

The use of this NORSOK standard may help operators and contractors in systematically addressing and documenting the environmental issues and hence obtaining the approvals and permits.

4.3 Decision process

4.3.1 Setting of objectives and goals

The operating companies will usually have environmental policies, strategies and objectives on different levels of the organisation. The company should define project specific objectives and goals based on these general statements in an early project phase.

4.3.2 Option identification and analyses

At the different stages of the design development, from concept evaluation through detailed design, option analyses should be performed where the expected environmental performance is compared between the various alternatives and against regulatory requirements, criteria defined in this NORSOK standard and the specific objectives and goals defined by company.

An example of such a decision process at the concept level follows as shown in Figure 1.

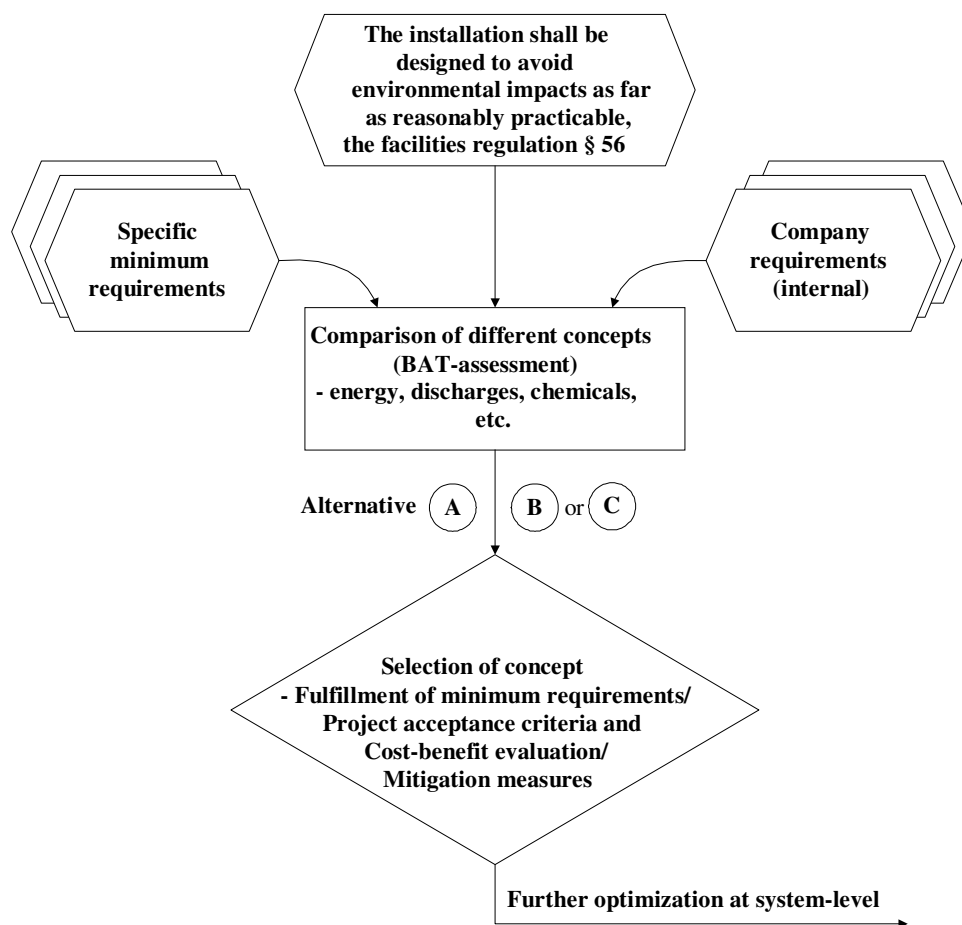


Figure 1 – Example: Integration of environmental aspects in concept selection process

In the decisions, a balance has to be found between environmental objectives and other project objectives related to e.g. cost, schedule, safety, technical performance and working environment. Also, when there are conflicting environmental objectives (e.g. reduction of discharges to sea at the expense of increased energy demand and air emissions), a balance has to be found between such objectives.

Finding the right balance is consistent with the The Framework Regulations and the Council Directive 96/61/EC, Article 2 and Annex IV. See Annex A which illustrates the factors that determine BAT.

4.3.3 Environmental budget

An environmental budget shall be established in order to compare and optimize alternative concepts, technical solutions and designs, or alternative decommissioning and disposal options. The budget shall include life cycle aspects such as expected energy demand and use of chemicals, and estimates for emissions to air and discharges to sea. When chemicals enter the product stream, downstream environmental consequences shall be considered. Annex B outlines the content of an environmental budget. The budget should be updated at appropriate stages in the project.

When a contractor is making an environmental budget during the execution phase, the boundaries of the system has to be clearly defined.

4.3.4 Cost-benefit evaluation

When specific minimum requirements are not established or when there is a need to consider measures beyond such minimum requirements, cost-benefit evaluations should be used to establish the proper level of environmental protection measures. The cost/benefit evaluations should include life cycle aspects. The operating company should establish methods and criteria for such evaluations. The recommended methods and criteria are shown in Annex D.

4.4 Project phases

4.4.1 General

Most operating companies have formally defined project phases and associated decision gate processes when passing from one phase to the next. Evaluation of environmental aspects of each option should be an integral part of each decision gate process. Figure 2 shows a generic project phase flow sheet and the associated decisions related to environment for each phase.

It is important to identify the key environmental aspects for each project phase and especially evaluate all possible concepts that could be relevant as early as possible in order to avoid later costly modifications. It is recommended to perform environmental design reviews at appropriate stages of the project development, e.g. in connection with concept selection, pre-engineering/FEED and during detail engineering. The main aspects to be looked at are listed below.

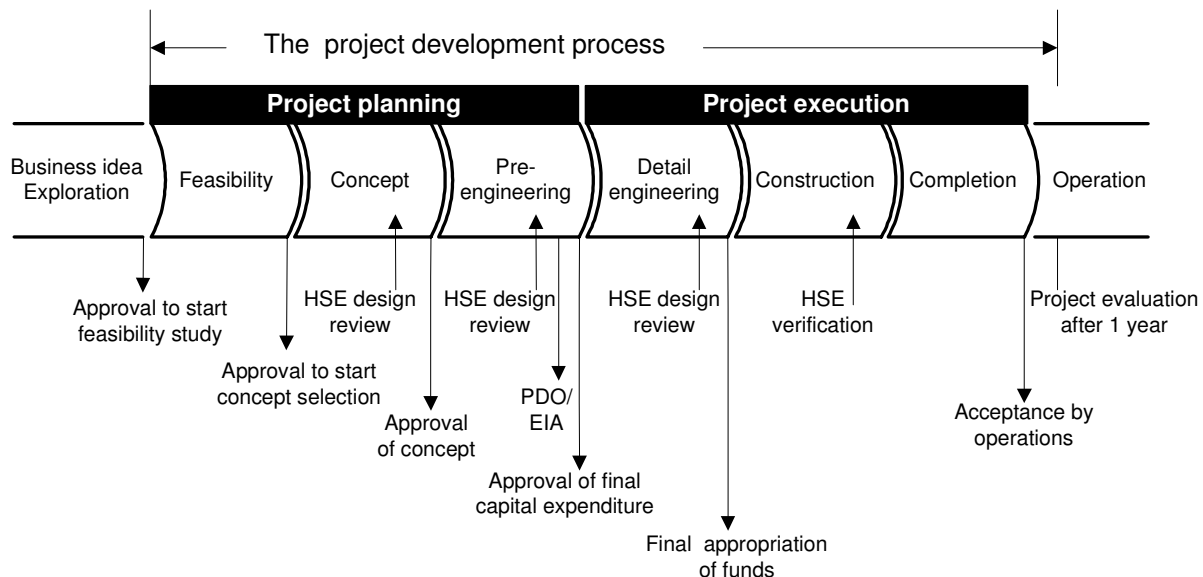


Figure 2 – The project development process

4.4.2 Concept selection

The selection of project concept shall include environmental considerations. The following are examples of main conceptual decisions that will have different impacts on the air emissions and discharges to sea:

- stand-alone development or subsea tie-in to existing platform(s);
- platform or subsea-to-land solution;
- integration with existing platform(s) or infrastructure, e.g. wellhead platform, partial processing, full processing;
- power from land or from other platforms;
- transport solution for oil (pipeline transport or offshore loading);
- transport solution for gas (compression demand, processing requirements);
- reservoir drainage strategy (water and/or gas injection, increased oil recovery, definition of plateau rate);
- possibilities for well stream energy conservation or utilization;
- platform concepts, e.g. floating or fixed, with and without drilling facilities;
- possibilities for injection of produced water, either as a part of pressure maintenance strategy or as a disposal option;
- possibilities for injection of cuttings and excess mud;
- design for easy decommissioning and removal.

The EIA shall document the evaluations and choices made in this phase, and the approval of the PDO/EIA will be an important confirmation of the decisions.

4.4.3 Pre-engineering or FEED

In the pre-engineering or FEED phase the chosen concept is elaborated further to a level of detail and confidence that is required for deciding on execution. The environmental aspects to be looked at this stage are typically related to

- main process design and energy balance,
- power supply configuration,
- flaring philosophy and flare system design,
- identification of main chemicals for e.g. hydrate control, corrosion control, emulsion breaking etc.,
- well program including types of drilling fluids to be used for each section,
- well testing and well clean-up strategy,
- sand control,
- basic design of produced water treatment or injection system,
- basic design of drain systems (segregation etc.),
- basic design of systems for injection or disposal of drilling wastes,
- VOC recovery systems (for offshore loading of oil),
- material quality selection (in order to minimize the use of corrosion inhibitors and other chemicals).

All conditions of the PDO approval and plan for installation and operation approval will have to be considered and implemented.

4.4.4 Detail design

In the detail design phase, the design is further detailed until fabrication drawings can be issued. In this phase the key issue is to avoid changes to the basis already established, and from an environmental point of view confirm that changes do not reduce the environmental performance level. Furthermore, some decisions with environmental significance are usually made, such as

- complete evaluation, selection and documentation of chemicals, including budgets for use and discharge (basis for discharge permit application),
- selection and design of sampling points,
- detailed design of wastewater treatment systems and drain systems,
- detailed spill prevention issues,
- design of waste handling systems.

5 Emissions to air

5.1 General

Emissions to air include CO₂, NO_x, methane, NMVOC, and SO_x. Field development concepts and technology that minimizes these emissions at the source shall be preferred. Focus shall be given to reduce atmospheric emissions by process design and through energy optimisation.