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Environmental care

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NORSOK S-003:2017

Foreword

NORSOK S-003:2017 was adopted as NORSOK Standard in October 2017.

NORSOK S-003:2017 supersedes NORSOK S-003 Rev. 3, December 2005.

NORSOK is an acronym for the competitive position of the Norwegian continental shelf and comprise petroleum industry standards in Norway. The collaboration initiative in 1993 between the authorities and the petroleum industry initiated the development of NORSOK standards.

Reducing the project execution time and developing and operating cost for petroleum installations on the Norwegian shelf was the target.

The intention for the Petroleum industry is to develop and use standards providing good technical and cost effective solutions to ensure that the petroleum resources are exploited and managed in the best possible way by the industry and the authorities. The industry will actively contribute to the development and use of international standards in the global market.

The NORSOK standards shall:

- bridge the gap based on experiences from the Norwegian continental shelf where the international standards are unsatisfactorily;
- replace oil company specifications where possible;
- be available as references for the authorities' regulations;
- be cost effective; and
- promote the Norwegian sector as an attractive area for investments and activities.

Developing new NORSOK standards and regular maintenance of existing standards shall contribute to maintain the competitiveness both nationally and internationally for the Norwegian petroleum industry.

The NORSOK standards are developed by experts from the Norwegian petroleum industry and approved according to the consensus principles as laid down by the guidelines given in NORSOK A-001 N:2016 directive (URL: http://www.standard.no/Global/PDF/Petroleum/2016-06-27%20NORSOK_A-001_2016%20Final%203.pdf)

The NORSOK standards are owned by the Norwegian Oil and Gas Association, the Federation of Norwegian Industries and the Norwegian Shipowners' Association. They are managed and published by Standards Norway.

This NORSOK standard has been revised by the NORSOK committee EG-S.

[Annexes A](#) and B are informative.

Main changes from the Rev. 3, December 2005 in summary:

- The main purpose of the revision has been to make the standard easier to use.
- This new revision puts an increased focus on Best Available Techniques and on Barrier Management. Therefore, [clause 4](#) on general principles was entirely revised and now includes guidance on those two topics.
- Two new sections were introduced: [clause 5](#) on energy management, and [clause 8](#) on monitoring and control.
- [Clause 10](#) on spill prevention and barriers has been entirely revised and expanded.
- Causes [6](#) to [11](#) have been revised and clarified.

All annexes have been entirely revised. Most relevant requirements for drilling units (formerly Annex C) were transferred to the relevant [clauses 5](#) to [11](#), and the remaining requirements were removed.

Introduction

The fourth edition of this Document is a complete revision of the previous edition. The main purpose of the revision has been to make the standard easier to use.

The main document is organized in two main parts: [clause 4](#) includes general methodology principals on how to manage environmental aspects during design or modification, and [clauses 5](#) to [11](#) stipulate specific technical requirements.

[Annex A](#) provides key definitions for barriers, and an overview of typical spill scenarios and associated barriers in a table format.

The following annexes in the previous revision have been voided:

- [Annex A](#) (Informative) Best available technique (BAT) determining factors (Now included in main document [subclause 4.4](#)).
- Annex B (Informative) Environmental budget (Now partially included in [subclause 4.3](#)).
- Annex C (Informative) Environmental requirements for drilling rigs (Now partially included in [clauses 5](#) to [10](#)).
- Annex D (Informative) Summary of analytical tools (Now completely removed).

This Document is published without marking of changes, compared to Rev. 3, as the modifications are comprehensive.

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1 Scope

This Document applies to the design and modification of installations for offshore drilling and production of petroleum, including pipelines.

The requirements in this standard are primarily defined for new designs. Therefore, for modification projects the relevance and applicability of the different requirements should be reviewed in context with the scope of each project.

This standard stipulates design requirements related to the environment as well as requirements regarding systematic management of environmental aspects in project development and the design process.

Requirements from applicable governing documents, in the form of acts, regulations, standards, recognized practices, are not repeated in this standard. Those governing documents shall be identified, listed, and applied during the design process.

More stringent requirements than those of this standard can apply to certain license areas, and the conditions of the exploitation license shall be observed.

The purpose of this standard is to ensure that the design of the facilities minimises impacts to the environment during the operational and decommissioning phases.

2 Normative 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. For dated references, only the edition cited applies. Other recognized standards may be used provided it can be shown that they meet the requirements of the referenced standards.

The following list of references are applicable to Natural Environment work in design and modification of offshore installations:

ISO 3170:2004, *Petroleum liquids – Manual sampling*.

ISO 3171:1988, *Petroleum liquids – Automatic pipeline sampling*.

NORSOK P-002, *Process system design*.

3 Terms, definitions and abbreviated terms

3.1 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1.1

shall (requirement)

expression in the content of a document conveying objectively verifiable criteria to be fulfilled and from which no deviation is permitted if compliance with the document is to be claimed

Note 1 to entry: Requirements are expressed using the verbal forms specified in ISO/IEC Directives, Part 2 [Clause 7.2](#) Table 3.

3.1.2**should (recommendation)**

expression in the content of a document conveying a suggested possible choice or course of action deemed to be particularly suitable without necessarily mentioning or excluding others

Note 1 to entry: Requirements are expressed using the verbal forms specified in ISO/IEC Directives, Part 2 [Clause 7.3](#) Table 4 .

Note 2 to entry: In the negative form, a recommendation is the expression that a suggested possible choice or course of action is not preferred but it is not prohibited.

3.1.3**may (permission)**

expression in the content of a document conveying consent or liberty (or opportunity) to do something

Note 1 to entry: Permissions are expressed using the verbal forms specified in ISO/IEC Directives, Part 2 [Clause 7.4](#) Table 5 .

3.1.4**can (possibility and capability)**

1: expression in the content of a document conveying expected or conceivable material, physical or causal outcome. 2: expression in the content of a document conveying the ability, fitness, or quality necessary to do or achieve a specified thing.

Note 1 to entry: Possibility and capability is expressed using the verbal forms specified in ISO/IEC Directives Part 2 [clause 7.5](#) Table 6 .

3.1.5**ALARP**

ALARP Principle requiring the risk level to be reduced as low as reasonably practicable

Note 1 to entry: ALARP expresses that the risk is reduced (through a documented and systematic process) so far that it is not justifiable to implement any additional risk reducing measures.

Note 2 to entry: The term reasonably practicable implies that risk reducing measures shall be implemented until the cost (in a wide sense, including time, capital costs or other resources/assets) of further risk reduction is grossly disproportional to the potential risk reducing effect achieved by implementing any additional measure.

3.1.6**barrier**

Technical, operational and organizational elements which are intended individually or collectively to reduce possibility/ for a specific error, hazard or accident to occur, or which limit its harm/disadvantages

3.1.7**closed drain system**

system that collects hydrocarbon liquid drains from equipment and piping, safely dispose and degas the liquid, and operates at the same pressure as the flare header connected to the systems flash drum

3.1.8**cold venting**

release to atmosphere of unburned gases or vapours from equipment, which are collected to a flare or an atmospheric vent

3.1.9**energy efficiency**

ratio or other quantitative relationship between an output of performance, service, goods or energy, and an input of energy

3.1.10 ENVID

environmental hazard identification, a multi-disciplinary process for identifying the environmental aspects in order to plan for, avoid, or mitigate their potential impacts. These environmental aspects can be both as a result of planned or unplanned events

3.1.11 environment

surroundings in which an organization operates, including air, water, land, natural resources, flora, fauna, humans and their interrelationships

Note 1 to entry: Surroundings can extend from within an organization to the local, regional and global system.

Note 2 to entry: Surroundings can be described in terms of biodiversity, ecosystems, climate or other characteristics.

3.1.12 environmental aspect

element of an organizations activities or products or services that interacts or can interact with the environment

Note 1 to entry: An environmental aspect can cause (an) environmental impact(s). A significant environmental aspect is one that has or can have one or more significant environmental impact(s).

Note 2 to entry: Significant environmental aspects are determined by the organization applying one or more criteria.

3.1.13 environmental impact

change to the environment, whether adverse or beneficial, wholly or partially resulting from an organization's environmental aspects

3.1.14 foreseeable

a foreseeable event or time is one that can easily be anticipated before it happens

3.1.15 fugitive emissions

emissions of gases or vapours from pressurized equipment due to leaks and other unintended or irregular releases of gases, which are not collected to a flare or an atmospheric vent

3.1.16 hazardous area

area in which a flammable atmosphere may be expected to be present at such frequencies as to require special precautions for the control of potential ignition sources

3.1.17 non-hazardous area

area in which an explosive gas atmosphere is not expected to be present in quantities such as to require special precautions for the construction, installation and use of electrical apparatus and equipment in "normal operation"

3.1.18 open drain

the open drain system shall handle rainwater, firewater, wash down water including spillage from equipment drip trays and banded areas. Design is based on two segregated systems; hazardous open drain for classified areas and non-hazardous open drain for non-classified areas. The system operates at atmospheric pressure. The open drain treatment system is not intended to remove chemicals before discharge

3.1.19**production profile**

The rate of fluid production varying along the expected production life of the facility. This is typically split between oil, water and gas phases, and may also include other parameters such as and total liquid production, seawater injection, total water injection, where applicable

3.1.20**risk**

effect of uncertainty on objectives

Note 1 to entry: An effect is a deviation from the expected — positive and/or negative.

Note 2 to entry: Objectives can have different aspects (such as financial, health and safety, and environmental goals) and can apply at different levels (such as strategic, organization-wide, project, product and process).

Note 3 to entry: Risk is often characterized by reference to potential events and consequences, or a combination of these.

Note 4 to entry: Risk is often expressed in terms of a combination of the consequences of an event (including changes in circumstances) and the associated likelihood of occurrence.

Note 5 to entry: Uncertainty is the state, even partial, of deficiency of information related to, understanding or knowledge of an event, its consequence, or likelihood.

3.1.21**spill kit**

a compilation of absorbent materials, cleaners, and personal protective equipment - used to contain accidental spills topsides. Spill kits may be separated or apply for both chemical and oil spills

3.2 Abbreviated terms

ALARP	as low as reasonably practicable.
BAT	best available techniques
BOP	blow out preventer
BTEX	Benzene, Toluene, Ethylbenzene and Xylene (light aromatic oil components)
CAPEX	capital expenditure
DLE	dry low emissions
DST	drill stem test
EIF	environmental impact factor
ENVID	environmental hazard identification / environmental aspect identification
FEED	front end engineering and design
FPSO	floating, production, storage and off-loading
FSU	floating storage units
HAZOP	hazard and operability study
HOCNF	harmonized offshore chemical notification format
HSE	health, safety and environment

IMO	international maritime organization
NMVOC	non-Methane volatile organic compound
NORM	naturally occurring radioactive material
OPEX	operational expenditures
OSPAR	Oslo and Paris convention
VOC	volatile organic compound
WLE	wet low emissions

4 General principles for managing environmental aspects

4.1 General

This document relies on the overall principle that the mitigation hierarchy shall be followed when managing environmental aspects:

1. avoid;
2. minimize;
3. compensate / remedy.

It is recommended that environmental aspects are managed using the four main principles, further described in the following subclauses and as illustrated by [Figure 1](#):

1. Identify and assess significance of environmental aspects.
2. Quantify planned emissions and discharges.
3. Apply Best Available Techniques.
4. Apply barriers to prevent spills.

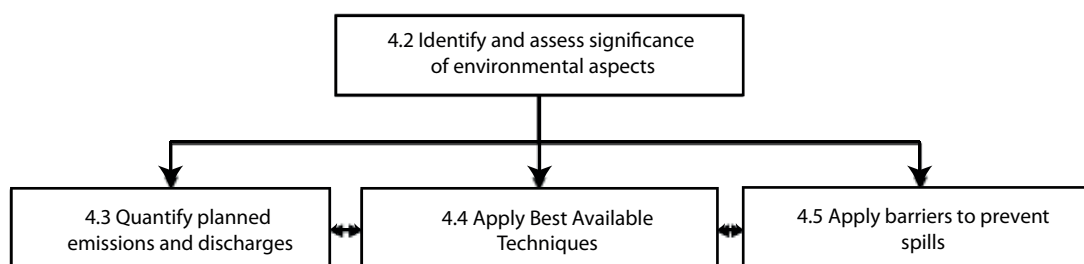


Figure 1 Main principles for managing environmental aspects

When assessing environmental aspects and evaluating design choices, the entire lifetime of the project shall be considered, taking into account foreseeable changes over time, e.g. for the oil, gas and water production profile.

4.2 Identify and assess significance of environmental aspects

Environmental aspects shall be identified and documented early in the design process. ISO 14001:2015 provides further guidance for environmental aspects identification and assessment.

The scope of the identification shall be clearly defined and documented, and shall at least cover environmental aspects, their associated environmental impacts and risks during the operation of installations for offshore drilling, production and transportation of petroleum. The scope may also include other phases, such as construction, installation, planned modification and decommissioning.

The aspect identification and prioritization should take into account local and regional conditions, such as environmental sensitivities, the geological, physical and regulatory context for the project.

Environmental aspects in this context shall include as a minimum:

- energy demand;
- emissions to air;
- use of resources, including chemical and hazardous substances;
- discharges to sea;
- injection to formations;
- waste generation; and
- use of areas.

The environmental aspects identification should consist of a systematic review of the design and operations, at each phase in the project, and may be organized as an ENVID. The results should be documented into an aspect register. The register should be updated if there are significant changes to its basis, e.g. more detailed information available, changes to the design solutions.

Aspects shall be prioritised based on a ranking of the expected environmental impacts and risks. That ranking may be based on qualitative or quantitative evaluations.

Mitigation and control measures shall be identified. Mitigation measures include appropriate alternatives for field development concepts, site selection, system design and technical solutions. Measures should be implemented according to the principle of Best Available Techniques (BAT) in [4.4](#) or barrier risk assessment in [4.5](#) methodologies.

4.3 Quantify planned emissions and discharges

An environmental budget shall be established as early in the design process as possible. The objective is to obtain chemical consumption, emission, discharge and waste data in order to implement BAT. The environmental budget may also be used in order to measure project performance indicators.

The environmental budget shall quantify emissions, discharges and other data, as applicable, related to the environmental aspects as listed in [4.2](#). It shall cover the entire lifetime of the project, taking into account foreseeable changes over time. The Norwegian Oil and Gas Association guideline #044 [2] provides methods and factors for quantifying environmental aspects. The environmental budget shall be documented, and should be used in the BAT evaluation where appropriate.

The need for update shall be reviewed at each stage in the project, and the budget should be updated if there are significant changes to its basis, e.g. more detailed information available, changes in the planned production profile, etc.

4.4 Apply Best Available Techniques

The selection of mitigation measures to manage environmental aspects shall be based on the principle of assessing and applying Best Available Techniques (BAT).

BAT is defined in the Directive 2010/75/EU on industrial emissions (integrated pollution prevention and control), [Article 2](#) and Annex IV:

'best available techniques' means the most effective and advanced stage in the development of activities and their methods of operation which indicates the practical suitability of particular techniques for providing the basis for emission limit values and other permit conditions designed to prevent and, where that is not practicable, to reduce emissions and the impact on the environment as a whole:

- 'techniques' includes both the technology used and the way in which the installation is designed, built, maintained, operated and decommissioned;
- 'available techniques' means those developed on a scale which allows implementation in the relevant industrial sector, under economically and technically viable conditions, taking into consideration the costs and advantages, whether or not the techniques are used or produced inside the Member State in question, as long as they are reasonably accessible to the operator;
- 'best' means most effective in achieving a high general level of protection of the environment as a whole.

In practice, this means that option analyses shall be performed at the different stages of the design development, from concept evaluation through detailed design. In those analyses, various technical alternatives are compared and ranked. The purpose is to select the preferred option in line with the BAT requirements. [Figure 2](#) illustrates the process elements involved for selecting the BAT (BAT assessment).

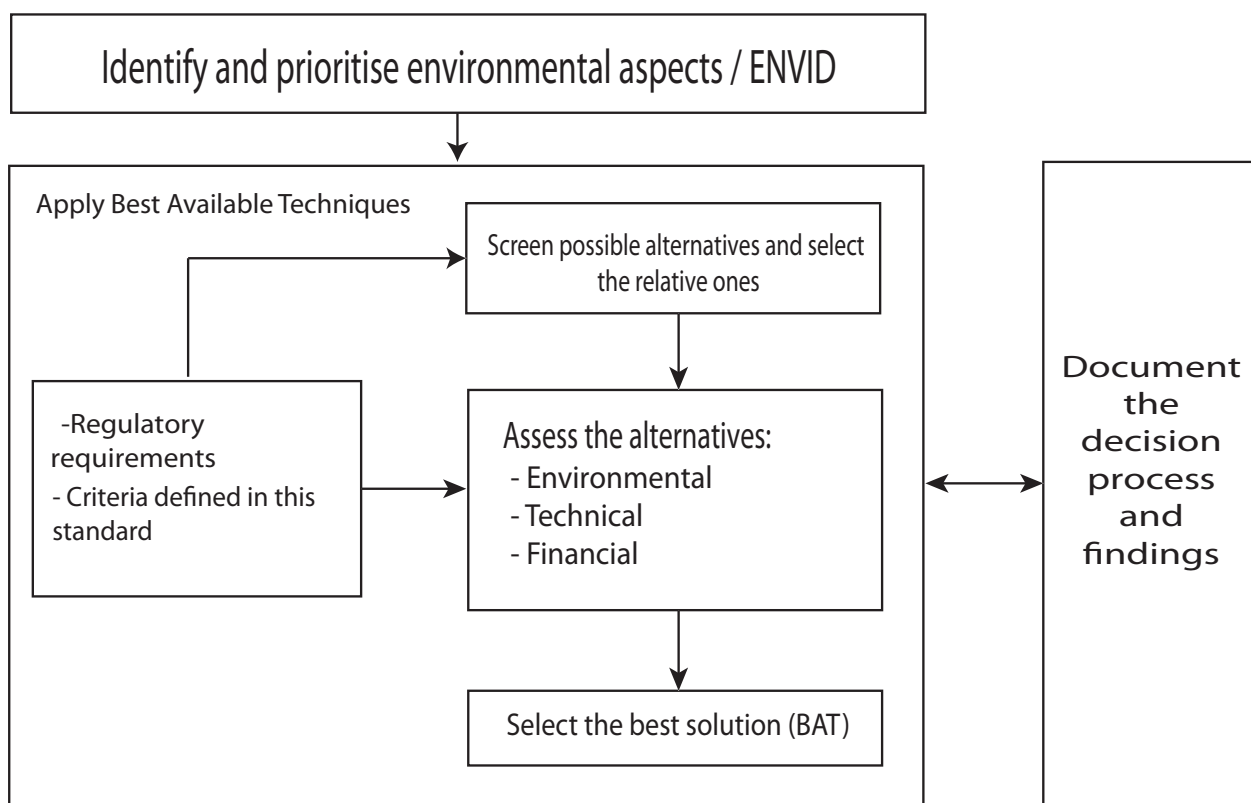


Figure 2 Process for selection of best solution (BAT)

The BAT evaluation systemises the positives and negatives of each technical alternative for comparison. The following should be assessed for each alternative: environmental performance, costs, working environment, safety, and technical aspects, both positive and negative, as well as regulatory requirements.

The key criteria that will support the evaluation should be defined at the beginning of the BAT evaluation, along with the method for the comparison of alternatives. The criteria will vary with the type of project and facility location.