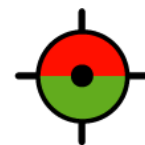


# **GUIDELINES REGARDING THE CO<sub>2</sub> SAFETY REGULATIONS**

**(Last updated 25 February 2020)**



**PETROLEUM SAFETY AUTHORITY  
NORWAY**

**Guidelines regarding the CO<sub>2</sub> safety regulations**

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## RE CHAPTER I INTRODUCTORY PROVISIONS

### Re Section 1 Purpose

No comment.

### Re Section 2 Scope

#### **About the scope in general**

The regulations apply to safety and working environment for transport and injection of CO<sub>2</sub> into submarine geological formations on the continental shelf.

The authority responsibility for handling CO<sub>2</sub> on land at the catchment facilities and for any intermediate storage prior to transport by pipeline to landfill, is added to the Norwegian Directorate for Civil Protection and Emergency Planning. The Petroleum Safety Authority Norway is responsible for transport in the pipeline from the upstream of the export pump and downstream to the outlet of the CO<sub>2</sub> well injection pipe. The geographical boundary between the authorities' areas of responsibility will be specified in the cooperation agreement between the Directorate for Civil Protection and Emergency Planning and the Petroleum Safety Authority.

Pursuant to Section 3 of the *Act 21 June 1963 No. 12 relating to scientific research and exploration for and exploitation of subsea natural resources other than petroleum resources*, the Ministry of Labour and Social Affairs is delegated authority for the safety of transport and storage of CO<sub>2</sub> in subsea geological formations on the continental shelf. Reference is made to the *Royal Decree of 13 March 2009 No. 321 on delegation of authority to the Ministry of Petroleum and Energy and the Ministry of Labour and Social Inclusion in accordance with the Act relating to scientific research and exploration for and exploitation of subsea natural resources other than petroleum resources Section 2 second subsection and 3 on exploration for and exploitation of subsea natural resources for CO<sub>2</sub> storage (in Norwegian only)*. The delegation of the Ministry of Labour and Social Affairs was passed on to the Petroleum Safety Authority by a decision of 23 March 2018 and includes authority pursuant to Section 11-23 first subsection of the *Regulations 5 December 2014 No. 1517 relating to exploitation of subsea reservoirs on the continental shelf for storage of CO<sub>2</sub> and relating to transportation of CO<sub>2</sub> on the continental shelf*.

The transport and injection of CO<sub>2</sub> into subsea geological formations on the continental shelf has many similarities to the petroleum activities. This includes, among other things, activities related to drilling activity, development and injection of CO<sub>2</sub> into geological formations, installation and operation of pipelines for CO<sub>2</sub> and cessation of the storage site. The regulation of safety and working environment is thus based on the same principles that are used in the HSE regulations for the petroleum activities, adapted to the risk conditions represented by CO<sub>2</sub> transport and injection.

*Regulations relating to exploitation of subsea reservoirs on the continental shelf for storage of CO<sub>2</sub> and relating to transportation of CO<sub>2</sub> on the continental shelf* facilitate a resource management system for transport and exploitation of subsea reservoirs on the continental shelf for injection and storage of CO<sub>2</sub>. The system is largely similar to that applicable to the petroleum activities. The requirements for safety in the regulations, in conjunction with these regulations, form a comprehensive regulatory regime for safety and working environment for CO<sub>2</sub> transport and storage.

When transport and injection of CO<sub>2</sub> are part of the petroleum activities, this is regulated by the petroleum legislation, including the HSE regulations for the petroleum activities.

The concept of safety in these regulations shall be understood in the same way as in the Petroleum Act. The regulations also include the working environment, which, according to the Working Environment Act, is a collective term for all factors in the work situation that can have an impact on the physical and mental health and welfare of employees. The content of the term is stated in Section 1-1 of the Working Environment Act. In addition to safety for health, for example as regards physical, chemical, biological and ergonomic factors, the term also includes psychological influences and welfare conditions. The most important working environment factors are mentioned in Chapter 4 of the Working Environment Act. See, in particular, Section 4-1 of the Working

Environment Act, which requires a fully satisfactory working environment. For further discussion of this requirement, reference is made to Ot.prp. No. 3 (1975-76) (i.e. a proposition), Innst.O. No. 10 (1976-77) (i.e. a recommendation) and Ot.prp. No. 49 (2004-05) (i.e. a proposition).

### **Pipelines**

The regulations apply to pipeline systems that are covered by Regulations relating to storage and transport of CO<sub>2</sub> on the shelf.

Domestic pipeline systems for CO<sub>2</sub> distribution do not fall within the scope of these regulations.

### **Re Section 3**

#### **Relation to other legislation**

Health conditions and the external environment when transporting and injecting CO<sub>2</sub> on the continental shelf, are regulated by the respective authorities' regulations.

### **Re Section 4**

#### **Definitions**

#### **Re litera c on injection**

The definition of injection is the same as in the Regulations relating to storage and transport of CO<sub>2</sub> on the shelf Section 1-6 litera h.

#### **Re litera d on facility**

The definition of facility is the same as in the Regulations relating to storage and transport of CO<sub>2</sub> on the shelf Section 1-6 litera i.

It is emphasized that, among other things, detached well structures of various types that are placed on the seabed with, among other things, wellhead, christmas tree and well template, fall under the facility concept. The same applies to equipment in the well and the well itself. That is, unless otherwise stated in the context, requirements for facilities will also apply to this equipment, etc.

By pipelines is meant pipelines for the transport of CO<sub>2</sub> and other fluids with associated safety systems, valves, locks, corrosion protection systems and other equipment.

#### **Re litera f on operator**

The definition of operator is the same as in the Regulations relating to storage and transport of CO<sub>2</sub> on the shelf Section 1-6 litera r.

#### **Re litera h on licensee**

The definition of licensee is the same as in the Regulations relating to storage and transport of CO<sub>2</sub> on the shelf Section 1-6 litera u.

#### **Re litera k on exploitation**

The definition of exploitation is adapted to the scope of these regulations based on Regulations relating to storage and transport of CO<sub>2</sub> on the shelf Section 1-6 letter t.

#### **Re litera m on transport**

The definition of transport is the same as in the Regulations relating to storage and transport of CO<sub>2</sub> on the shelf Section 1-6 litera v.

### **Re Section 5**

#### **Responsibilities pursuant to these regulations**

The duty to ensure also follows from Sections 11-2 and 11-8 of the Regulations relating to storage and transport of CO<sub>2</sub> on the shelf.

For other comments on the provision, see the guidelines for Section 7 of the Framework Regulations.

**RE CHAPTER II**  
**BASIC REQUIREMENTS FOR SAFETY AND WORKING ENVIRONMENT AND FOR**  
**MANAGEMENT OF THE ACTIVITIES**

**Re Section 6**  
**Principles for safety**

Requirements for prudent activities, risk reduction and organization and competence also follow from Sections 10-1, 11-1, 11-2 and 11-6 of the Regulations relating to storage and transport of CO<sub>2</sub> on the shelf.

For other comments on the provision, reference is made to the guidelines for the provisions in Chapter II of the Framework Regulations.

**Re Section 7**  
**Management of the activities**

The requirements in Chapters II through VI of the Management Regulations are taken into account with adaptation to the risk conditions represented by transport and injection of CO<sub>2</sub>.

Requirements for managing the activities and for qualifications also follow from Sections 11-8 and 11-6 of the Regulations relating to storage and transport of CO<sub>2</sub> on the shelf.

For other comments on the provision, reference is made to the guidelines for the provisions of Chapter III of the Framework Regulations and Chapters II through VI of the Management Regulations.

**RE CHAPTER III**  
**MATERIAL AND INFORMATION**

**Re Section 8**  
**Documentation, etc.**

Requirements for documentation and for material and information also follow from Sections 10-6 and 11-7 of the Regulations relating to storage and transport of CO<sub>2</sub> on the shelf.

For other comments on the provision, reference is made to the guidelines for Sections 23, 24 and 26 of the Framework Regulations and Section 24 of the Management Regulations.

**Re Section 9**  
**Notification and reporting**

The requirements in Chapter VIII of the Management Regulations are, as far as transport and injection of CO<sub>2</sub> are concerned, limited to those covered by the safety legislation.

For other comments on the provision, reference is made to the guidelines for the provisions of Chapter VIII of the Management Regulations.

**Re Section 10**  
**Reporting and information**

The requirements in Chapter IX of the Management Regulations are, as far as transport and injection of CO<sub>2</sub> are concerned, limited to those covered by the safety legislation.

For other comments on the provision, reference is made to the guidelines for the provisions of Chapter IX of the Management Regulations.

**Re Section 11**  
**Matters relating to safety and working environment in the plan for development and operation**  
**of a subsea reservoir for injection and storage of CO<sub>2</sub> and specific licence for the installation and**  
**operation of facilities for transport**

The provision elaborates Section 4-5 on plan for development and operation of a subsea reservoir for injection and storage of CO<sub>2</sub> and 6-1 on specific licence to install and to operate facilities of the Regulations relating to storage and transport of CO<sub>2</sub> on the shelf, by imposing supplementary

requirements on the documents that are related to safety and working environment, and which are to follow the plans. The provision is harmonized with corresponding documentation provisions in Sections 4-6 and 6-2 of the Regulations relating to storage and transport of CO<sub>2</sub> on the shelf. Among other things, these provisions explicitly state that the documentation shall be adapted to the development or the scope of the project. *Guidelines for plan for development and operation of a petroleum deposit (PDO) and plan for installation and operation of facilities for transport and utilisation of petroleum (PIO)* can be used as far as is appropriate.

By existing wells is meant wells that are in use and temporarily or permanently abandoned wells. By storage complex is meant storage location and the geological environment that may have an impact on the safety of storage.

To assess the well barriers to existing wells when storing CO<sub>2</sub>, DNVGL-RP-J203 Section 7 and ISO 27914 Chapter 7.6 should be used.

For other comments on the provision, reference is made to the guidelines for Section 27 of the Framework Regulations.

### **Re Section 12 Consent to certain activities**

The provision complements Section 5-2 on consent for injection and storage of CO<sub>2</sub> of the Regulations relating to storage and transport of CO<sub>2</sub> on the shelf by setting requirements for which activities to seek consent for. Sufficient time means the necessary time to process applications for consent and any complaints before the scheduled start date for the activity. Normal case processing time is nine weeks. Other deadlines should be clarified with the Petroleum Safety Authority Norway in each case. If the deadlines are not met, one cannot expect the application to be processed by the desired date.

Information in the application for consent as mentioned in the fifth subsection, is limited in these regulations to safety and working environment.

For other comments on consent and contents of applications, reference is made to the guidelines for Sections 25 and 26 of the Management Regulations.

### **Re Section 13 Cessation plan**

No comment.

## **RE CHAPTER IV DESIGN AND OUTFITTING OF FACILITIES AND CONDUCT OF ACTIVITIES**

### **Re Section 14 Design and use of facilities**

For comments on the first subsection of the provision, reference is made to the guidelines for Sections 45, 47 and 49 of the Framework Regulations.

For design as mentioned in the second subsection, NORSOK U-001 and ISO 13628 should be used for subsea installations.

By status as mentioned in the fourth subsection, is meant, among other things, the backlog of preventive maintenance and the outstanding corrective maintenance.

### **Re Section 15 Safety functions and safety systems**

By safety functions as mentioned in the first subsection, is meant technical barrier elements that shall reduce the possibility of specific failures, hazard and accident situations occurring, or which limit or prevent harm or inconveniences. Safety functions can be divided into active and passive.

For designing active safety functions as mentioned in the first subsection, the standards IEC 61508 and ISO 13849 should be used. For the active safety functions to be able to fulfil their functions

at all times, as mentioned in the first subsection, they should be designed so that they can be tested and maintained without compromising the performance of the functions.

To determine the performance of safety functions as mentioned in the second subsection, the IEC 61508 standard should be used where electrical, electronic and programmable electronic systems are used in the design of the functions.

By safety systems as mentioned in the fourth subsection, is meant technical barrier elements that are realized in a common system. The requirement in the fourth subsection means that the measures and limitations shall lead to a risk reduction that is relevant and proportionate to the barrier functions that are affected. In order to fulfil the requirements of the measures and limitations, the standards IEC 61508-1 Chapter 7.7 and IEC 61508-2 Chapter 7.6 should be used for electrical, electronic and programmable electronic safety systems.

**Re Section 16  
Pipeline systems**

For pipeline systems, ISO 13623 with the ISO 27913 supplement and DNVGL-ST-F101 with the DNVGL-RP-F104 supplement should be used.

The pressure in the locks should be readable both before start-up and during operation.

By failure modes as mentioned in the third subsection, is meant both external and internal failure modes.

**Re Section 17  
Drilling and well systems and drilling and well activities**

For comments on the provision, reference is made to the guidelines for the provisions in Chapter VIII of the Facilities Regulations and Chapter XV of the Activities Regulations.

**Re Section 18  
Mobile facilities**

No comment.

**Re Section 19  
Manned underwater operations and diving operations**

For comments on the provision, reference is made to the guidelines for Section 4 first subsection of the Framework Regulations, Section 1 second subsection, Section 41a and Chapter XIII of the Facilities Regulations, Section 21 second subsection and Chapter XIX of the Activities Regulations, and Section 63 of the Technical and Operational Regulations.

**Re Section 20  
Emergency preparedness at sea**

Requirements for emergency preparedness also follow from Sections 10-2 and 10-3 of the Regulations relating to storage and transport of CO<sub>2</sub> on the shelf.

For other comments on the provision, reference is made to the guidelines for Section 77 of the Activities Regulations.

**RE CHAPTER V  
CLOSING PROVISIONS**

**Re Section 21  
Supervisory authority, etc.**

For comments on exceptions, reference is made to the guidelines for Section 70 of the Framework Regulations.

**Re Section 22  
Means of reaction and penalties**

No comment.

**Re Section 23  
Entry into force**

No comment.



## REFERENCE LIST

### 1. Regulations and instructions issued by the authorities

#### **Ministry of Petroleum and Energy and Ministry of Labour and Social Affairs**

*Regulations 5 December 2014 No. 1517 relating to exploitation of subsea reservoirs on the continental shelf for storage of CO<sub>2</sub> and relating to transportation of CO<sub>2</sub> on the continental shelf (Regulations relating to storage and transport of CO<sub>2</sub> on the shelf),  
Guidelines for plan for development and operation of a petroleum deposit (PDO) and plan for installation and operation of facilities for transport and utilisation of petroleum (PIO).*

#### **Ministry of Labour and Social Affairs**

*Regulations 12 February 2010 No. 158 relating to health, safety and the environment in the petroleum activities and at certain onshore facilities (the Framework Regulations).*

#### **Petroleum Safety Authority Norway**

*Regulations 29 April 2010 No. 611 relating to management and the duty to provide information in the petroleum activities and on certain onshore facilities (the Management Regulations),  
Regulations 29 April 2010 No. 634 relating to design and outfitting of facilities, etc. in the petroleum activities (the Facilities Regulations),  
Regulations 29 April 2010 No. 613 relating to conducting petroleum activities (the Activities Regulations),  
Regulations 29 April 2010 No. 612 relating to technical and operational matters at onshore facilities in the petroleum activities, etc. (Technical and Operational Regulations).*

### 2. Standards and guidelines

#### **DNV GL**

*DNVGL-ST-F101 Submarine pipeline systems, Edition October 2017, Amended December 2017,  
DNVGL-RP-F104 Design and operation of carbon dioxide pipelines, Edition November 2017,  
DNVGL-RP-J203 Geological storage of carbon dioxide, Edition June 2017.*

#### **International Electrotechnical Commission (IEC)**

*NEK IEC 61508 Functional safety of electrical/electronic/programmable electronic safety-related systems, first edition, Part 1-7, Edition 2, 2010,  
Part 1: General requirements,  
Part 2: Requirements for electrical/electronic/programmable electronic safety-related systems,  
Part 3: Software requirements,  
Part 4: Definitions and abbreviations,  
Part 5: Examples of methods for the determination of safety integrity levels,  
Part 6: Guidelines on the application of IEC 61508-2 and 61508-3,  
Part 7: Overview of techniques and measures.*

#### **International Organization for Standardization (ISO)**

*ISO 13623:2017 Petroleum and natural gas industries - Pipeline transportation systems, Edition 3, 2017,  
ISO 27913:2016 Carbon dioxide capture, transportation and geological storage – Pipeline transportation systems, Edition 1, 2016,  
ISO 27914:2017 Carbon dioxide capture, transportation and geological storage – Geological storage, Edition 1, 2017,  
NS-EN ISO 13628 Petroleum and natural gas industries – Design and operation of subsea production systems, Part 1:2005 and Amd 1:2010, Part 3:2000, Part 4:2010 and Cor 1:2011, Part 5:2009, Part 6:2006, Part 7:2006, Part 8:2006, Part 9:2006, Part 15:2011.*

#### **Norwegian Standard (NS)**

*NS-EN ISO 13849-1 Safety of machinery - Safety-related parts of control systems Part 1: General principles for design.*

**NORSOK standards**

*NORSOK U-001 Subsea production systems, Edition 4, October 2015.*