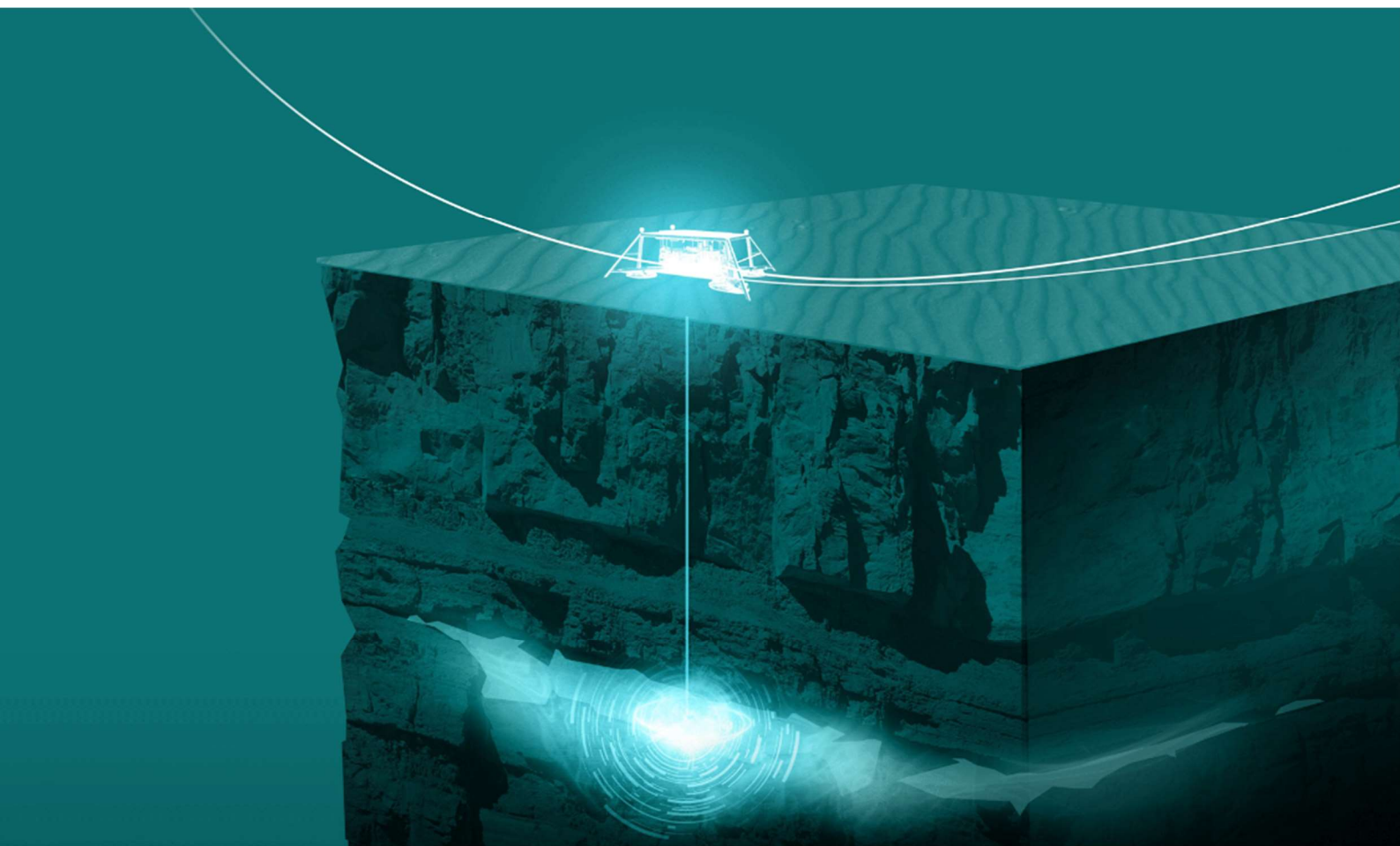


Guidelines for application of licence



Award of area for storage of CO₂ 2023-1
on the Norwegian continental shelf



NORWEGIAN PETROLEUM
DIRECTORATE

Table of Contents

General information about submitting documents	3
Submitting the application	3
Overview of submissions to the MPE, NPD and PSA.....	3
Overview and naming the content of each application	3
Forms.....	4
Application for stratigraphic acreage	5
Application for acreage contains discoveries/shut down fields.....	5
Application content	5
1 Application summary	5
1.1 Overview	5
1.2 Project description.....	5
1.3 Potential for CO ₂ storage	6
1.4 Maps	6
1.5 Work program and duration	6
2 Description of the CCS project.....	6
3 Geological and technological assessment	6
3.1 Databases and utilising data	7
3.2 Geological overview.....	7
3.3 Evaluation of storage capacity.....	8
3.4 Coexistence	10
3.5 Technological assumptions and development plan.....	10
3.6 Monitoring	11
4 Work program.....	11
5 Environmental factors.....	11
6 References	11

General information about submitting documents

Submitting the application

Each application letter, company information and application(s) with appendices must be submitted to the Ministry of Petroleum and Energy (MPE) with copies to the Norwegian Petroleum Directorate (NPD) and the Petroleum Safety Authority (PSA). When submitting via L2S Authority Communication or Altinn, both the MPE, the NPD and the PSA can be chosen as recipients of the same submission.

The NPD and PSA

All the documents with appendices must be placed in a folder named CO2 2023-1-"*CompanyName*"-"*ApplicationNumber*"of"*TotalNumber*" and compressed ("zip format"). The "*TotalNumber*" must reflect the number of applications your company is actually submitting via L2S or Altinn. There must be no sub-folders and the zip file must not be password-protected.

Title the submission CO2 2023-1-"*CompanyName*"-"*ApplicationNumber*"of"*TotalNumber*" and submit it via L2S Authority Communication or Altinn to the NPD and PSA. Example for company "CCS AS" submitting an application: CO2 2023-1-CCS AS-1of1.zip

The MPE

The documents must be submitted to the MPE in electronic formats as described. L2S Authority Communication or Altinn can be used.

Please deliver the files well before the application deadline.

Overview of submissions to the MPE, NPD and PSA

- Application letter
- Company information
- Application(s) with appendices

The total size of the application should not exceed 600 MB.

Shapefiles

Shapefiles for the applied area must be named minimum "AppliedArea". If there are several elements in naming, use underscore as a separator in the naming. The shapefile must contain a polygon showing the area applied for. The shapefile should also contain information regarding whether the area applied for is stratigraphic acreage or not.

Overview and naming the content of each application

- Appendix:
 1. Application
 2. Form
 - a. ApplicationData
 - b. Geological Storage location and Quantities Stored potential data
 - c. CompanyInformation
 3. Maps of relevant application acreage
 4. Shapefile with polygon of area applied for
-

- Name the files as listed below:

File name	Format	Description
<i>Application_ "BlockNumber"</i>	.pdf	Application
<i>"BlockNumber" _ApplicationData</i>	.xlsx	Filled out Excel workbook "ApplicationData", one Excel workbook per application
<i>"BlockNumber" _ "StorageComplex_name" _ Geological Storage complex and Quantities Stored potential.data</i>	.xlsx	Filled out Excel workbook "Geological Storage complex and potential capacity for Quantities Stored"; one Excel sheet per storage complex (copy the sheet in the same workbook if you need more complexes)
<i>"BlockNumber" _ "CompanyName" _ CompanyInformation</i>	.xlsx	Filled out Excel workbook "CompanyInformation"; one Excel workbook per application
<i>"BlockNumber" _ "CompanyName"</i>	.jpg	Maps of relevant application acreage with storage complex(es), max. 200 kb
<i>AppliedArea</i>	.shp	Shapefile with polygon of area applied for

Suggested maximums are indicated for the number of pages and number of figures/tables under the various chapters in the application. If there is a need to exceed the suggested number of pages and/or number of figures/tables, this must be substantiated. Use a font size equivalent to Times New Roman 12 and single/standard line spacing. All information in figures and maps must be legible. All maps must have coordinates as well as a scale.

Excel workbooks for use in the applications can be found on the NPD website along with these instructions. Do not change the Excel form formats. The only exceptions are adding additional rows to the forms Table 1, 2 and 3, and creating the necessary number of sheets for Table 4.

All units of measurement (depth, area, volume, etc.) must be stated in metric units.

Forms

The forms requested for applications are gathered in the Excel workbooks:

1. ApplicationData
 - a. Table 1: Application summary
 - b. Table 2: Quantities Stored Potential
 - c. Table 3: Work program and duration
2. Geological Storage complex and Quantities Stored potential data
 - a. Table 4: Geological Storage complex and potential capacity for Quantities Stored
3. Company Information
 - a. Table 5: Application list from company
 - b. Table 6: Size and experience related to petroleum and CCS
 - c. Table 7: Financial status
 - d. Table 8: Projected cash flow (only for companies without an international credit rating)

Application for stratigraphic acreage

When applying for stratigraphic acreage, the relevant application acreage must be stated in Chapter 1 (Application Summary).

Application for acreage contains discoveries/shut down fields

If the relevant application acreage contains existing discoveries and/or shut down fields, please include this. Information about geological, technical reservoir and potential resource-related contexts or impacts from previous or existing petroleum activity should be described.

Application content

1 Application summary

The application summary must be the first part of the application. It should be approximately three pages and must contain the following:

- A. Overview of applicants and acreage applied for with block designations in the completed form "Table 1: Application summary".
(Table 1 must also be included in the Excel workbook "ApplicationData")
- B. The purpose of the application in the form of a project description.
- C. Acreage description with completed form "Table 2: Quantities Stored potential".
(Table 2 must also be included in the Excel workbook "ApplicationData")
- D. Maps with geographical coordinates, block numbers and a scale showing the relevant application acreage with outlines of the storage complexes, discoveries and shut down fields listed in the form "Table 2: Quantities Storage potential" and presented in the application.
(The map must also be enclosed as a separate .jpg file)
- E. Completed form "Table 3: Work program and duration".
(Table 3 must also be included in the Excel workbook "ApplicationData")

1.1 Overview

Give a brief presentation of the licence pursuant to the Regulations relating to exploitation of subsea reservoirs on the continental shelf for storage of CO₂ and relating to transport of CO₂ on the continental shelf (the CO₂ Storage Regulations) that is the subject of the application, applicants and the relevant application acreage. If the application is for stratigraphic acreage, state the relevant interval. Fill out the form "Table 1: Application summary" with necessary data.

1.2 Project description

A description of the planned project, including CO₂ source, transport and development concept.

The Norwegian authorities want to facilitate socio-economically profitable storage of CO₂ on the Norwegian shelf. Companies with the necessary expertise and which have matured industrially sound and profitable projects can apply for a licence tailored to the activity's needs.

1.3 Potential for CO₂ storage

Briefly summarise the potential for CO₂ storage in the relevant application acreage and display it on maps with outlines of the storage complexes referenced in the application and which are listed in the form "Table 2: Quantities Stored potential". Also include any discoveries/abandoned fields which are relevant application acreage for CO₂ storage. Use different coloured outlines for different stratigraphic levels. Key data for storage complexes, discoveries and abandoned fields which are referenced in the application must be listed in the form "Table 2: Quantities Stored potential".

1.4 Maps

The relevant application acreage and outlines of the mapped storage complexes, in addition to discoveries and abandoned fields that are relevant for CO₂ storage, must be displayed in maps with geographical coordinates, block numbers and a scale. Geographical coordinates for the relevant application acreage should be listed in table format. The summary must state the potential in the storage complex. As regards applications for stratigraphic licences, the relevant acreage must be shaded. The applicant must show how it expects to reflect the geological and acreage-related distribution of injected CO₂ in the relevant application acreage. Acreage that is not described as a need in relation to the project will normally not be awarded.

1.5 Work program and duration

The applicant's proposed work program for and duration of the licence must be stated in the form "Table 3: Work program and duration". Examples of/proposed work programs, and decisions that must be used, are provided under the form. Other activities can also be entered. A more detailed description of the work program must be provided in Chapter 4 of the application.

2 Description of the CCS project

The applicant must document that awarding a new licence is a necessary prerequisite for implementing and further developing specific, profitable projects for capture, transport and storage of CO₂.

A description of the value chain for the most relevant project, including one or more capture sites, transport solution, injection solution and storage location. If subcontractors will be used for transport, onshore plants or other key elements, this must be described. If different business models and solutions are being considered, the most relevant ones must be described.

Profitability calculations with preconditions (such as tariffs, discount rate and price assumptions for CO₂) must be presented for relevant solutions, with plans and status of any agreements for access to CO₂ for storage. Briefly address any plans for commercial negotiations.

3 Geological and technological assessment

The applicant's description should generally use what is described in Appendix I to the CO₂ Storage Regulations – *'Criteria for describing and assessing the potential storage location and surrounding area'*. The applicant must document a sufficient geological understanding of the area, thereby substantiating that the area can be matured into a secure storage complex.

Definitions must conform with international standards. Specifications and definitions conform with [the UN classification system](#).

3.1 Databases and utilising data

This should inform about seismic data, well data and other types of data that are used to evaluate the area and the potential for CO₂ storage. Emphasis will be on how the data is utilised and to what extent the applicant(s) has carried out new interpretations and analyses on its own.

Any consultant reports, purchased studies and other non-public information used in the application must be acknowledged. Chapter 2.1 should not exceed 5 pages including maps and tables.

Seismic database Seismic data included in the evaluation must be listed with survey name and type of seismic survey, and must be clearly indicated on a database map of the relevant application acreage. It will be beneficial to address data quality and data improvement measures here.

Well database Well data used in the evaluation must be listed by name and clearly indicated on a database map of the relevant application acreage. Key wells must be marked and commented on/substantiated.

Studies Acknowledge internal or purchased relevant academic studies with clear references, e.g. reprocessing/geophysical special studies, geochemistry studies, sealing analyses / leakage studies, geomechanical studies, etc.

3.2 Geological overview

The documentation in this chapter will involve seismic survey and reservoir conditions critical for evaluation of the storage potential. Critical factors for the integrity of the storage complex should be addressed. Examples of critical factors that must be described include reservoir properties and dispersion, sealing and pressure conditions in the relevant application acreage. The documentation should not exceed 5 pages of text in addition to up to 20 figures.

Seismic mapping Describe which horizons have been interpreted, “well tie” and depth conversion method. As a minimum, the following figures must be included:

- Synthetic seismogram documenting “well tie”
- Seismic line showing calibration of seismic interpretation in relation to well(s)

Regional geology Briefly describe the area's primary stratigraphic, sedimentological and structural features. As a minimum, the following figures must be included:

- Chrono- and lithostratigraphic column showing levels for identified primary and secondary storage complex(es)
- Palaeogeographical maps illustrating the extent of the primary reservoir for mapped storage complexes
- Map showing the structural framework in the area

Seal / leak

Describe the storage complex's sealing and integrity. Factors that may be critical for safe storage over time must be addressed and a plan for monitoring and handling of a potential leakage must be presented. If there are adjacent petroleum fields and / or existing wells, describe any potential risk of leakage to or impact on these existing fields or wells.

3.3 Evaluation of storage capacity

Mapping and evaluation of the storage capacity of the primary and secondary storage complex in the relevant application acreage. Complexes may also include discoveries and abandoned fields.

The primary storage complex must be described in detail, while any secondary storage complexes can be described in less detail. The primary storage complex in the application is defined as the complex where the applicant considers there to be the highest probability of further maturing to a secure storage complex with sufficient capacity.

The documentation should not exceed 10 pages of text in addition to up to 10 figures, including:

- 5 pages for the primary storage complex(es), in addition to relevant figures/maps
- 1 page of text in addition to figures for each secondary storage complex

The form "Table 4: Geological Storage complex and potential capacity for Quantities Stored" must be filled out with the data/parameters used to evaluate the mapped primary and secondary storage complexes. Information must also be entered regarding relevant data/parameters associated with discoveries and abandoned fields. As regards secondary storage complexes, the table must be completed with as much data as possible. In "Table 4", the pore volume (row 6) must be filled out with the water volume in the pores in relevant reservoirs in the application acreage. Please state which percentiles are used for low, basis and high values. The applicant must add comments in rows 21-29. These comments must be no longer than a line (for example: good, satisfactory, uncertain, needs more investigation). As regards the database, it is sufficient to fill out what seismic data the applicant has access to (2D/3D) and whether the applicant has access to well data in addition to what has been released in the area. Additional information must be described in the application text.

Mapping

As regards the primary and secondary storage complexes, as well as any discoveries/abandoned fields, describe how these were mapped, the type of trap and sealing, expected reservoir properties, volume capacity and the presumed migration of injected CO₂.

The evaluation must particularly address aspects deemed to be critical for the injected volume over time, pressure build-up, migration, sealing, etc. The following documentation must be included for primary and secondary storage complexes, as well as any discoveries/abandoned fields:

- An overview map with coordinates and outlines of storage complexes, as well as the position of seismic lines and geological profiles
- Two seismic and geological profiles in intersecting directions
- Time maps and depth maps in the same scale for the reservoir horizon(s)
 - Time maps are not necessary if depth-converted seismic is used in mapping
- Any seismic attribute maps/time intersections

- The NPD may request geological and dynamic models of the storage complex(es)

Other figures can be included to the extent they are relevant for describing the primary and secondary storage complexes, as well as any discoveries/abandoned fields. As regards discoveries and abandoned fields, please state well correlations and interpreted well logs, reservoir zoning, as well as illustrations from the static reservoir model.

Storage capacity

For each storage complex, you must describe the procedure(s) for calculating

- rock volume with range of uncertainty
- potential for storage capacity with range of uncertainty

The description must include the method used to calculate uncertainty, and substantiate the choice of reservoir and fluid parameters as well as storage capacity.

The storage capacity that the applicant can commit to, and the total potential of storage capacity must be listed in the form "Table 4: Geological Storage complex and potential capacity for Quantities Stored" for primary storage complexes, as well as any discoveries/abandoned fields. As regards secondary storage complexes, the table should be completed with the maximum level of detail.

If the relevant application acreage only includes parts of the primary or secondary storage complexes and there are any discoveries/abandoned fields in the relevant application acreage, this must be clearly indicated in the form "Table 2: Quantities Stored potential", alongside the total storage capacity.

Discovery probability

Discovery probability for the storage complex is the overall likelihood of secure storage of the volume of CO₂ the applicant is seeking to store ("committable storage capacity"). For the discovery probability, the applicant must describe risk evaluation and critical factors regarding the storage complex. Plans for how to reduce the risk must be described.

Examples of critical factors include the integrity of existing wells in the area, sealing and pressure development in the reservoir over time. This likelihood must be listed in the form "Table 2: Quantities Stored Potential" and "Table 4: Geological Storage complex and potential capacity for Quantities Stored".

The probability should be calculated based on probability for

- suitable reservoir for CO₂-storage in place ($P_{\text{reservoir}}$)
- no leakage pathways of CO₂ from the reservoir ($P_{\text{containment}}$)
- reservoir conditions for effective injectivity ($P_{\text{injectivity}}$)

The three numbers must be calculated and reported in the «Table 2: Quantities Stored Potential» and "Table 4: Geological Storage complex and potential capacity for Quantities Stored".

The probability must be commented on and justified. It should be described how the risks may be reduced by the work program.

If a reservoir model is developed, results from simulations may also be included with explanations.

Technical reservoir aspects

Provide a description of the planned injection strategy for the storage complexes, the presumed migration of injected CO₂, the most important reservoir uncertainties and expected challenges. An injection profile must be included.

If a discovery/abandoned is the primary focus of the application, you must provide a more detailed description. You must present reservoir data (SCAL, PVT, etc.) of importance for the choice of injection strategy. Explain how uncertainties, such as reservoir communication, aquifer support and pressure development, may affect the course of injection and how these challenges can be handled.

Leakage risk

Describe the potential leakage routes that have been assessed with associated basic data, including risk in relation to existing wells (active/shut down/abandoned). Please comment specifically on key wells described in Chapter 3.1 of the well database.

3.4 Coexistence

An evaluation of how the suggested activity in the area applied for will influence or be influenced by nearby and/or overlapping licences. This includes active production licences, licences for offshore wind or licences for CO₂ storage. Considerations to be described are CO₂ migration, pressure communication between nearby licences and possible limitations in data gathering and monitoring.

3.5 Technological assumptions and development plan

As regards the mapped primary storage complex or group of complexes, a description must be provided of what is presumed to be the most optimal development solution for the area. Relevant alternative solutions can also be addressed. The description must be limited to about three pages including illustrations.

In connection with planned utilisation of facilities in use in other activities on the shelf, provide a more detailed description of opportunities, technical or commercial challenges, lifetime, etc. Relevant development alternatives must be presented and compared. The injection strategy, operating model, wells, facilities, transport solution and potential cooperation with other players should be part of the description. New solutions or new technology should be particularly emphasised.

3.6 Monitoring

A plan for monitoring the injection facilities and storage complex, including the dispersion of CO₂, must be described in the application. Also describe the proposed process to establish this in potential subsequent phases of the project, cf. Sections 5-4 and 5-7 of the CO₂ Storage Regulations, as well as Appendix II.

4 Work program

Information about the work program for the relevant application acreage, listed in the form "Table 3: Work program and duration", must be addressed in more detail and substantiated. The entire work program must be described, with emphasis on the first phase. See examples and wording in the form "Table 3: Work Program and duration". The applicant must clearly show how the work program provides an optimal process for reducing uncertainties, as well as any critical factors identified for the storage complexes.

Briefly address the following:

- Relevant seismic data sets being considered / planned for use
- The schedule for the different phases of the research and/or development plans for the storage complexes

If the application comprises secondary storage complexes, please describe how they will be matured.

If significant parts of the primary or secondary storage complexes, or any discoveries/abandoned fields in the relevant application acreage extend into in an already existing production licence or research licence, please indicate how this will impact the plans.

The description can be limited to approx. two pages of text. If the focus of the application is to develop a discovery/abandoned field, we expect a detailed schedule for studies, decisions and area clarifications leading up to a PDO.

5 Environmental factors

Comment on any special environmental provisions associated with the relevant application acreage, and how this will be handled during the research phase and during development and injection.

6 References

References to reports, studies and publications used in the evaluation work.