



North Sea
Transition
Authority

Guidance on Applications for a Carbon Storage Permit

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Contents

Introduction	7
Scope and purpose of this guidance	8
Carbon storage permit road map	10
Governance	13
Scalability of the process	13
Charging	13
NSTA framework	14
Stewardship Expectations	14
Considerations relevant to all carbon storage developments	15
Environmental impact and health and safety assessments	15
Net zero	15
Re-purposing	16
Transboundary stores	16
Multiple store developments	16
Measurement of CO₂ stream and compositional analysis	16
Operating pressure	17
Financial criteria	17
Appraise Phase Requirements	18
Early Risk Assessment	18
i. Early Risk Assessment Report	18
ii. Risk Assessment Workshop	20
Site Characterisation Review Report	21
Work programme commitments	22

Engagement Schedule	23
Stakeholder Engagement Plan	23
Commercial and other conditionality	23
Project governance and organisation	24
Project management	24
Assess Phase Plan	24
Assess Phase Requirements	25
Assess Phase Report	25
i. Site Characterisation	25
ii. Preliminary Containment Risk Assessment	25
iii. Concept-select assessment	26
Preliminary Monitoring Plan (MP)	26
Corrective Measures feasibility study	27
Provisional Post-Closure assessment study	28
End Assess Phase Review	28
Consultation on Supply Chain Action Plan (SCAP)	29
Consultation on Project Execution Plan (PEP)	29
Technology screening	30
Environmental Statement (ES) preparation	30
Marine Licence preparation	30
Define Phase Plan	30
Define Phase Requirements	31
Content of the Storage Permit Application	31
Define Phase Review	32
Storage permit draft application documents	32
i. Carbon storage project overview	32

ii. Storage Site and Complex Characterisation	32
iii. Carbon Storage Development Plan	33
iv. Containment Risk Assessment	33
v. Monitoring Plan	34
vi. Corrective Measures Plan	35
vii. Provisional Post-Closure Plan	36
viii. Proposal for financial security	37
Draft Storage Permit Application Review	37
Economic assessment	38
Net zero evaluation	38
The Supply Chain Action Plan (SCAP)	39
Project Execution Plan (PEP)	40
Environmental Statement consultation	40
Marine Licence application	40
Operator approval	40
Decommissioning security arrangements	41
Submit Storage Permit Application	41
Granting a storage permit	41
Execute Phase requirements	42
Monitor project execution	42
Pipeline Works Authorisation	42
Compliance with the approved storage permit	43
Reporting	43
Financial Security (come into effect)	43
Extraction of stored CO ₂	43
Definition of terms	44
Annex A – Carbon Storage Permit Operator Guidelines	46

List of Abbreviations	
Abbreviation	Definition
CO₂	Carbon Dioxide
CS	Carbon Storage
BHP	Bottom Hole Pressure
CM	Corrective Measures
CMP	Corrective Measures Plan
EIA	Environmental Impact Assessment
ES	Environmental Statement
FID	Final Investment Decision
GHG	Greenhouse Gas
MP	Monitoring Plan
PEP	Project Execution Plan
PPC	Provisional Post-Closure
PPCP	Provisional Post-Closure Plan
PWA	Pipeline Works Authorisation
SCAP	Supply Chain Action Plan
T&S	Transport and Storage
UK ETS	United Kingdom Emissions Trading Scheme

Introduction

1. The Oil and Gas Authority (**'OGA'**) is now operating as the North Sea Transition Authority (**'NSTA'**) and will be referred to as the NSTA in this document. The OGA remains the legal name of the company, and all licences and other legal documentation will continue to refer to the OGA.
 2. The storage of carbon dioxide in the United Kingdom's territorial waters and on the United Kingdom Continental Shelf (**'UKCS'**) is subject to a licensing regime overseen by the NSTA¹. Anyone who wishes to explore for or use a geological feature for the long-term storage of carbon dioxide in a UK offshore area must hold a Carbon Dioxide Appraisal and Storage Licence (**'CS Licence'**), pursuant to section 18 of the Energy Act 2008² (the **'Act'**). Under a CS Licence, Licensees require the grant of a storage permit by the NSTA for the construction of facilities for the purpose of injection of carbon dioxide with a view to storage within the licensed area and for such storage.
 3. A Licensee must submit to the NSTA a Storage Permit Application. The Storage Permit Application is made up of eight key documents which must fulfil the requirements of The Storage of Carbon Dioxide (Licensing etc.) Regulations 2010³ (the **'Storage Regulations'**) and are described within this document (Define Phase Requirements section).
- A CS Licence will expire at the end of the appraisal/initial term if an application for a storage permit is not made before that date or if the Storage Permit Application is refused by the NSTA.
4. From the issue of a CS Licence to a Licensee submitting a Storage Permit Application, the Licensee must complete the work programme set out in its CS Licence. Before granting a storage permit, the NSTA must be satisfied of certain matters in accordance with regulations 6 and 7 of the Storage Regulations. These include, but are not limited to:
 - a) The storage complex and surrounding area have been sufficiently characterised and assessed in accordance with the criteria set out in Annex I to the Directive 2009/31/EC of the European Parliament and of the Council⁴ (the **'Directive'**)
 - b) No part of the storage complex extends beyond the territory of the United Kingdom
 - c) Under the proposed conditions of use of the storage site, there is no significant risk of leakage or of harm to the environment or human health

¹ [Carbon Storage licence guidance \(nstauthority.co.uk\)](https://www.nstauthority.co.uk)

² [Energy Act 2008 \(legislation.gov.uk\)](https://www.legislation.gov.uk)

³ [The Storage of Carbon Dioxide \(Licensing etc.\) Regulations 2010 \(legislation.gov.uk\)](https://www.legislation.gov.uk)

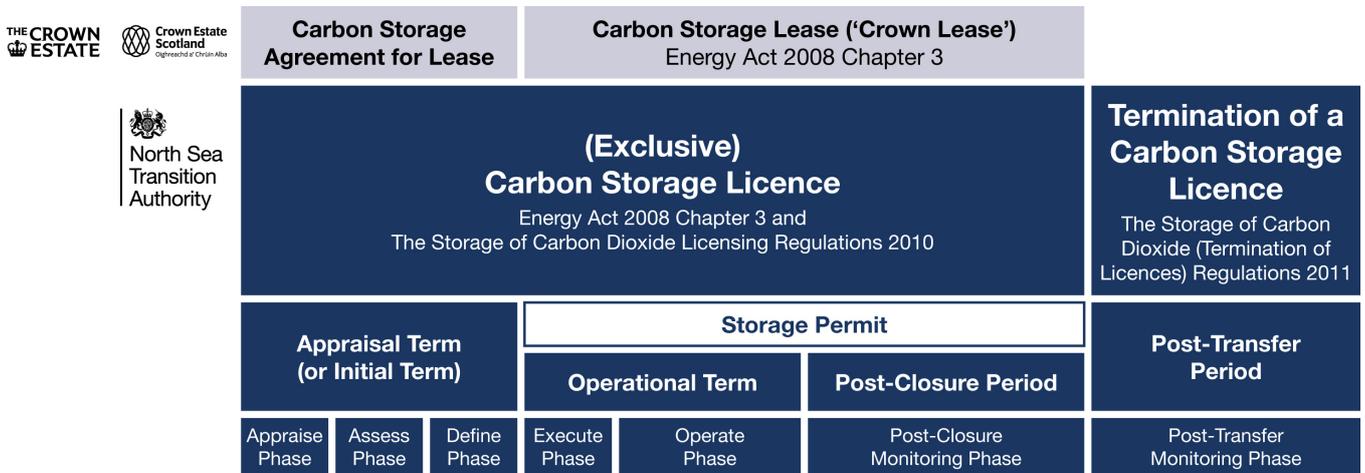
⁴ [Directive 2009/31/EC of the European Parliament and of the Council](https://eur-lex.europa.eu)

- d) The proposed operator is technically competent (including in the operation of environmental management systems), financially sound, and can be relied upon to carry out the functions of an operator; and
- e) The proposed operator has in place an appropriate programme of professional and technical development and training
5. The Licensee will also need to submit to the NSTA, for its approval, a Monitoring Plan, and a Corrective Measures Plan. A Provisional Post-Closure Plan must also be drawn up in accordance with regulation 13(1) of the Storage Regulations. Each of these is discussed in more detail below.
6. In addition to a CS Licence, a Crown Lease from The Crown Estate ('**TCE**') or Crown Estate Scotland ('**CES**') is also required to undertake any intrusive exploration or appraisal (including the drilling of a well) or storage activities for all UK offshore areas, including the territorial sea adjacent to Scotland, as the right to store gas (including carbon dioxide) in the offshore area is vested in the Crown by virtue of section 1 of the Energy Act 2008. TCE and CES are statutory bodies which act on behalf of the Crown in its role as landowner within the area of the territorial sea and as owner of the sovereign rights of the UK seabed beyond territorial waters. TCE and CES operate as a commercial landowner under the provisions of the Crown Estate Act 1961⁵. The NSTA cannot provide guidance on a Crown Estate Lease. Anyone who wishes to apply for a CS Licence and a storage permit should also contact TCE/CES as appropriate at the earliest opportunity.
7. The Licensee should liaise with any other regulators or bodies in order to obtain all the necessary consents, authorisations, approvals, and other requirements to enable it to undertake carbon storage operations as proposed in its Storage Permit Application.

Scope and purpose of this guidance

8. A CS Licence is required for the whole duration of a carbon storage development and covers three distinct periods each consisting of multiple phases leading to the termination of the licence and the post-transfer period (Figure 1 – see page 9):
- **Initial or Appraisal Term** – the period during which exploration, appraisal, and project 'assess' and 'define' phase activities may be carried out to evaluate the potential for a storage project, and/or an application for a storage permit is made. This term ends with either the grant of a storage permit (if applied for) or the expiry of the CS Licence either because no storage permit was applied for or because such application was refused. Note that where there is a work programme in place then this term will be the 'Appraisal term', and where there is no such work programme it will be the 'Initial term'.
 - **Operational Term** – the period beginning with the date on which the storage permit is granted and ending with the closure of the storage site.

⁵ [Crown Estate Act 1961 \(legislation.gov.uk\)](https://legislation.gov.uk)

Figure 1: Main periods and phases in a CS Licence

- **Post-Closure Period** – the period beginning immediately after the closure of the storage site and continuing until the termination of the CS Licence outlined in The Storage of Carbon Dioxide (Termination of Licences) Regulations 2011 (the '**Termination Regulations**')⁶.
 - **Post-Transfer period** – the period after the licence is terminated and transferred to government, which involves a financial contribution to be paid by the Storage Operator⁷ to cover at least the anticipated cost of monitoring for a subsequent period of 30 years.
9. This document is intended to assist those involved in the planning of a carbon storage development and the application process for a carbon storage permit which, if granted, gives the Licensee consent to the injection of CO₂ into a suitable underground geological formation in the UKCS. This guidance primarily covers the Appraisal Term or Initial Term of a licence and additionally covers the Execute Phase of the Operational Term and details the following:
- An overview of the NSTA's objectives and considerations relevant to all new Carbon Storage Permit Applications and developments
 - The **Appraise Phase** which in some circumstances may require geological evaluation through exploration/appraisal of the store and includes delivery and review of an Early Risk Assessment and Site Characterisation Review Report
 - The **Assess Phase** which is to fully assess and characterise the storage site and complex and demonstrate that the CO₂ transportation and facilities 'concept' has been selected by the Licensee
 - The **Define Phase** leading to the submission of the Storage Permit Application
 - The **Execute Phase** leading to the safe injection of CO₂ in the Operate Phase
 - The process of revising a previously granted storage permit

⁶ [The Storage of Carbon Dioxide \(Termination of Licences\) Regulations 2011 \(legislation.gov.uk\)](https://legislation.gov.uk)

⁷ This role has a meaning specific to carbon storage activity and is defined in the Storage Regulations as meaning "...the person who carries on or (where different) controls activities at the storage site"

10. This guidance sets out the process that the NSTA will generally apply in considering whether to grant a storage permit. It is not a substitute for any other risk or other assessments that may be carried out by other regulators and Government Departments, including but not limited to, the Health and Safety Executive ('**HSE**'), His Majesty's Treasury ('**HMT**'), the Department for Business, Energy and Industrial Strategy's ('**BEIS**') Offshore Petroleum Regulator for Environment and Decommissioning ('**OPRED**'), and the Office of Gas and Electricity Markets ('**Ofgem**'), insurance providers or others, who may separately seek to satisfy themselves that an applicant and storage site will meet their criteria.
11. Any assessment made by the NSTA in respect of a CS Licence and storage permit, is made specifically and exclusively for the NSTA's own purposes in line with its regulatory role and should not be relied on by any third parties (including other regulators and public bodies) in any manner whatsoever. Any such reliance is at the sole risk of that third party and the NSTA does not accept any responsibility for such reliance.
12. This guidance is not a substitute for any regulation or law and is not legal advice. It does not have binding legal effect. Where the NSTA departs from the approach set out in this guidance, the NSTA will endeavour to explain this in writing to the person seeking a decision from the NSTA.
13. The guidance will be kept under review and amended as appropriate in the light of further experience and developing law and practice, and any changes to the NSTA's powers and responsibilities. If the NSTA changes its guidance in a material way, it will publish a revised document.

Carbon storage permit road map

14. The 'road map' (Figure 2 – see page 11) sets out the main stages of the NSTA's typical process from the point where a CS Licence is awarded to the application for a storage permit, and if such permit is granted the execution of the project in line with the conditions set out in the permit and other relevant documents.
15. The NSTA expects the Licensee to prepare and submit the Storage Permit Application. The Licensee should engage with the NSTA early and frequently in the planning of a Storage Permit Application, including to discuss:

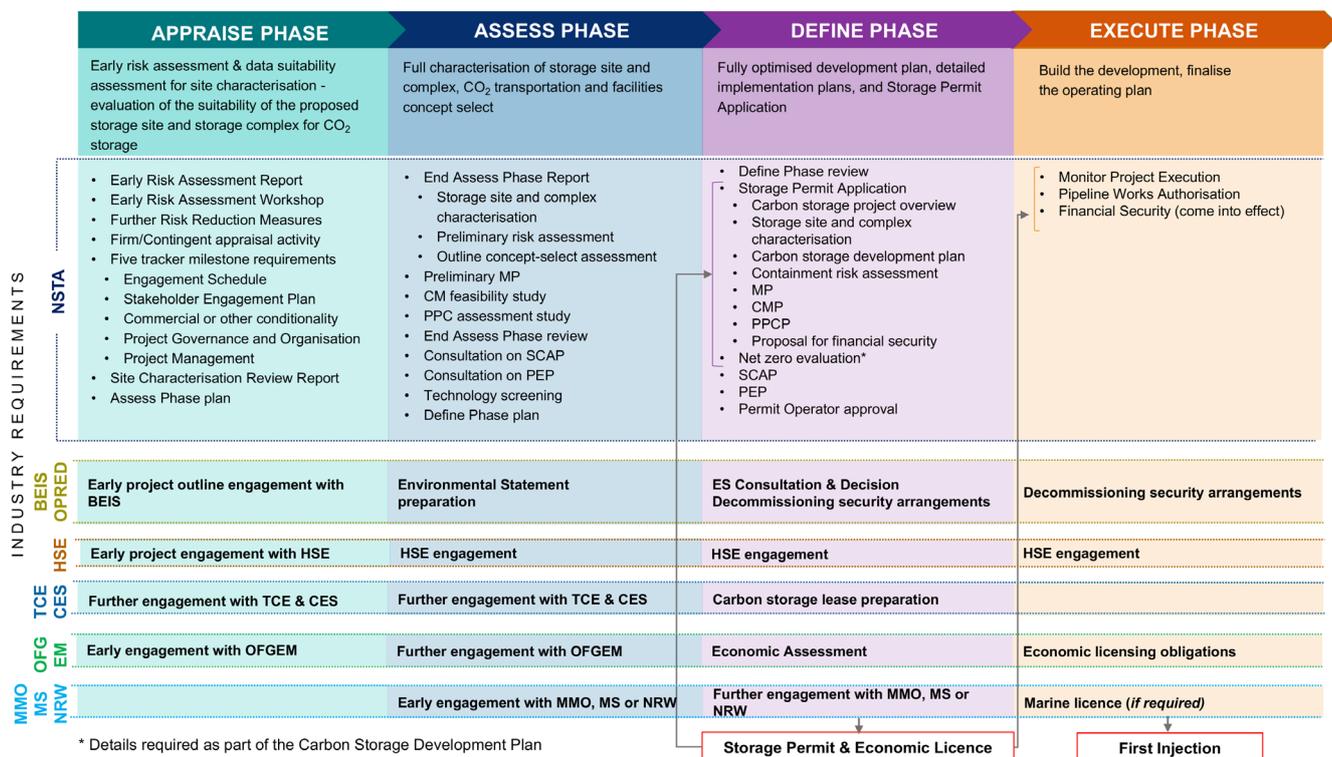
- a) The approach to assessing the containment of CO₂ of the store; and
- b) The assessment of the uncertainties in defining and characterising the storage site and complex

The Licensee should thereafter engage with the NSTA on the following (each as defined in the Storage Regulations):

- c) The development concept and plan
- d) Proposed Monitoring Plan ('**MP**')
- e) Proposed Corrective Measures Plan ('**CMP**')
- f) Proposed Provisional Post-Closure Plan ('**PPCP**')
- g) Proposal for Financial Security

Engagement should build towards developing the content of the Storage Permit Application. The NSTA expects all of the requirements mentioned above to mature over time and indeed the Licensee's progress from one phase to the next should not be construed as indicating that the NSTA is satisfied with or has no objection to the approach set out.

Figure 2: Carbon storage permit road map



The NSTA retains its discretion, having regard to relevant matters, as to whether or not to grant a storage permit and it will make such a decision only when it is in receipt of the complete and finalised Storage Permit Application. The NSTA will appoint a single point of contact for all discussions relating to the preparation and submission of a Storage Permit Application.

16. The NSTA will undertake a review of the Licensee’s Storage Permit Application, which may include amongst other matters the emissions impact of the work programme and project lifecycle. Alongside regulatory requirements, the NSTA will review the Storage Permit Application considering any applicable guidance published by the NSTA (including this guidance), and any relevant Stewardship Expectations. The Licensee will be expected to update and amend the Storage Permit Application as appropriate.

17. At an early stage, the Licensee should discuss with the NSTA its requirements for the grant of a storage permit authorising the use of a place as a storage site for CO₂. The Licensee should also contact other relevant regulators and bodies at an early stage to discuss their regulatory requirements, including BEIS OPRED on its requirements for an Environmental Statement (‘ES’), the HSE, and Ofgem on the requirements of an Economic Licence. The relevant regulators will work together during the applicable phases of the licence Appraisal Term to align (as far as is practicable) the award of any required permits or licences.

18. The **Appraise Phase** is the first phase of the CS Licence and in which the Licensee will carry out any exploration and appraisal activities to assist in characterising the storage site and complex such as geophysical surveys and drilling, while also identifying potential threats to storage capacity and injectivity and any critical risks to the containment of CO₂.

19. The Licensee must develop and present to the NSTA for review, an **Early Risk Assessment** which captures:

- a) The identified potential threats to storage capacity, injectivity, and containment of CO₂
- b) An assessment of the uncertainties in defining the storage site and storage complex
- c) Identification of any further studies, data gathering and/or appraisal required to address any storage risks or uncertainties

and a **Site Characterisation Review Report** which demonstrates:

- a) The Licensee's assessment as to whether the current subsurface database is sufficient and suitable to deliver a subsurface characterisation of the proposed storage site and complex and surrounding area
- b) The integration of site-specific data, including but not limited to seismic data and other static and dynamic subsurface data, into an evaluation of the suitability of the proposed storage site and complex for the storage of CO₂

20. Within the Appraise Phase, the Licensee should also provide the NSTA with:

- a) An **Engagement Schedule** of proposed meetings with the NSTA leading up to a Storage Permit Application
- b) A **Stakeholder Engagement Plan**, to demonstrate to the NSTA that the Licensee will consult and, as applicable, has consulted with other interested parties that might be affected by the proposed appraisal activities and any subsequent development activities under any storage permit (if granted)

- c) The status of any **commercial or other conditionality** that may have a material impact on the timely delivery of a Storage Permit Application (to be updated every six months)
- d) Demonstration that the appropriate **Project Governance and Organisation** is in place
- e) Demonstration that an appropriate **Project Management** process is in place

The above five requirements are intended to assist the Licensee to demonstrate to the NSTA that the appropriate progress is being achieved in the project leading up to the submission of a Storage Permit Application at the end of the Define Phase of the CS Licence. They should be updated and provided to the NSTA throughout the full Appraisal Term of the licence up to the grant of a storage permit.

21. The **Assess Phase** of the licence is where the proposed storage site and complex are fully characterised, building on the work undertaken in the Appraise Phase. An assessment of the Carbon Storage Development Plan is also carried out at this stage, including plans for development drilling, construction, and commissioning. This is informed by the detailed static and dynamic reservoir modelling that should be completed as part of the site characterisation work. The Assess Phase should continue to develop the Risk Assessment, which at this stage will also inform the requirements for the MP and CMP, and the PPCP and obligations.

22. The **Define Phase** includes the Define Phase review, where the Licensee should demonstrate that the Carbon Storage Development Plan is optimised and fully outlined in the Storage Permit Application documents. The Define

phase review is intended to allow sufficient time for the review of the draft documents and that the documents are of sufficient maturity for consideration by the NSTA. This phase should aim to ensure a robust project can be delivered with clear scope, cost estimate, and schedule; along with drafts of the Project Execution Plan ('**PEP**'), Supply Chain Action Plan ('**SCAP**'), Storage Operator Application, and proposal for Financial Security.

23. In the Define Phase once the project has matured toward a decision by the Licensee(s) to invest in the project, the Final Investment Decision ('**FID**'), the Licensee must submit the finalised Storage Permit Application. This suite of documents comprising the application will include a detailed description of the development and the principles and objectives that will govern the project over its full lifecycle.
24. The **Execute Phase** of a project is only relevant where a storage permit has been granted and is where an approved Storage Operator will implement the project scope set out in the storage permit and the PEP. The purpose of the Execute Phase is to carry out all required activities (e.g., well construction, engineering, procurement, construction, commissioning/start-up etc.) required to achieve first injection.

Governance

25. The Storage Permit Application should represent a single view of the project by the Licensees, who are jointly and severally liable under the terms of the CS Licence. The Licensees should appoint a single point of contact

(who is someone on the licence) for the development of the Storage Permit Application. If and when a storage permit is granted, there will also be an approved Storage Operator for the site. This role has a meaning specific to carbon storage activity and is defined in the Storage Regulations as meaning "...the person who carries on or (where different) controls activities at the storage site". The Storage Operator must be a Licensee (see regulation 8(1) of the Storage Regulations) and Licensees should be aware that this is a significant role with many of the responsibilities set out in the Storage Regulations falling on the Storage Operator.

Scalability of the process

26. The elements in the storage permit road map and the project phases described above are intended to guide industry to an efficient and timely carbon storage development. It is recognised that for smaller projects (for example a subsea tie-back into existing injection facilities), some elements of the road map can be streamlined, however all elements of the approval road map are applicable, and for any storage permit, the applicable regulatory requirements, including as set out in the Storage Regulations, will need to be met.

Charging

27. The NSTA charges a fee for Storage Permit Applications, including the review of draft documents and (if appropriate) the granting of any storage permit. Further details of these charges can be found in the NSTA's guidance note on fees⁸.

⁸ [North Sea Transition Authority \(NSTA\): Charging regime – Legislative context – Regulatory framework \(nstaauthority.co.uk\)](https://www.nsta.gov.uk/guidance/charging-regime-legislative-context-regulatory-framework)

NSTA framework

28. The NSTA is fully committed to enabling the achievement of the UK government's commitment to reach net zero emissions by 2050, while supporting energy resilience and the drive to develop home-grown hydrogen and carbon storage, including government targets to capture and store ~20 to 30 MtCO₂/yr by 2030 and ~50 MtCO₂/yr by the mid-2030s.
29. The NSTA regulates offshore CO₂ storage and is the licensing authority who approves, and issues storage permits and maintains the carbon storage public register. The NSTA is responsible for stewarding project developers through the NSTA licence and permitting process as outlined in this guidance.
30. This guidance sets out the current best understanding of the detailed technical and subsurface considerations the NSTA may assess when reviewing a Storage Permit Application, the scope for carbon storage projects to contribute to emissions reduction, energy integration opportunities, and opportunities for the re-purposing of existing infrastructure for carbon capture and storage projects.

Stewardship Expectations

31. In order to promote good industry practice and the drive to net zero carbon by 2050, the NSTA has developed a number of Stewardship Expectations⁹. Although not all components of the Stewardship Expectations are applicable to carbon storage, many components of each of the current Stewardship Expectations are relevant and provide clarity on expected behaviours and good practices across the whole oil and gas lifecycle, which can in many areas be applied to carbon storage projects. The Licensee should maintain awareness for any future published Stewardship Expectations applicable to carbon storage.

⁹ <https://www.nstauthority.co.uk/exploration-production/asset-stewardship/expectations/>

Considerations relevant to all carbon storage developments

Environmental impact and health and safety assessments

32. BEIS OPRED is the environmental regulator for the offshore storage of carbon dioxide in the territorial sea adjacent to the UK (with the exception of Scottish Territorial Sea) and on the UK Exclusive Economic Zone. The Offshore Oil and Gas Exploration, Production, Unloading and Storage (Environmental Impact Assessment) Regulations 2020 (**'2020 EIA Regulations'**) apply to certain carbon storage activities and set out the requirements for an Environment Impact Assessment (**'EIA'**) or screening direction for such projects. Where the 2020 EIA Regulations apply, the NSTA cannot grant consent for such a project unless the Secretary of State first agrees to the grant of consent for the project. More information can be found on BEIS's environmental legislation page¹⁰.
33. The HSE implements the applicable statutory and regulatory requirements for carbon storage well design and operational health and safety. For more information, the Licensee should contact the HSE.

Net zero

34. The Licensee, when preparing its Storage Permit Application, should include a summary of how greenhouse gas (**'GHG'**) emissions will be minimised throughout the CS Licence lifecycle in support of the UK government's 2050 net zero target. The Licensee is also expected to demonstrate that GHG emissions have been considered and evaluated as part of the Assess and Define Phases including how the Licensee will commit to reduce GHG emissions through its corporate culture and demonstrable action through all stages of a project lifecycle. This should include an indicative evaluation of the GHG emissions impact of the development as well as technical and economic assessments. While not directly applicable to carbon storage projects, the NSTA considers that its Net Zero Stewardship Expectation SE11¹¹ provides useful guidance in this regard.
35. In certain circumstances and operating conditions there may be a requirement for heating and/or compression of the CO₂ on the platform. In this instance, the Licensee should demonstrate to the NSTA the power requirements for heating, the forecasted duration for which heating is required and how the power will be sourced taking into consideration the impact of GHG emissions.

¹⁰ [Oil and gas: offshore environmental legislation – GOV.UK \(www.gov.uk\)](https://www.gov.uk/government/collections/oil-and-gas-offshore-environmental-legislation)

¹¹ [Stewardship Expectation 11 net-zero.pdf](#)

Re-purposing

36. The NSTA encourages Licensees to fully explore the opportunities to re-purpose existing suitable infrastructure within the carbon storage development concept. In most cases the opportunities will be from oil and gas infrastructure, and the Licensee should engage with the current owner in the early phases of the project.

Transboundary stores

37. The Licensee must satisfy the NSTA, in line with regulation 7(1)(b) of the Storage Regulations, that no part of the storage complex extends beyond UK territorial waters before the NSTA can grant a storage permit.

Multiple store developments

38. Where the initial focus of a development is on a single storage site but with scope to build out to multiple stores, information on any plans for future carbon store build outs may be described in the Carbon Storage Development Plan. However, a permit will not be granted for build out stores under the initial Storage Permit Application and the Licensee will need to make subsequent additional applications for build out store developments.
39. Licensees should clearly identify any pre-investment in facilities the purpose of which is to facilitate the potential future expansion of the current site or the build out to additional future stores. For the avoidance of doubt, the use of such facilities will require further application and permitting.

Measurement of CO₂ stream and compositional analysis

40. In order to be injected into the storage site, the CO₂ stream must consist overwhelmingly of carbon dioxide and must in particular satisfy the conditions outlined in schedule 2, paragraph 1 of the Storage Regulations which lays out the legal requirements for the CO₂ stream.
41. As outlined in schedule 2, paragraph 1 of the Storage Regulations, an analysis of the composition of the stream must be carried out to ensure that the provisions relating to the acceptance and injection of the CO₂ can be met. The type and concentration of incidental or trace substances must comply with the requirements as described in the Storage Regulations.
42. The Licensee should demonstrate to the NSTA the impact that the incidental or trace substances in the CO₂ stream may have on the capacity of the store as well as on the phase envelope of the CO₂ stream and any impact on transportation, injection, and flow assurance.
43. Schedule 2, paragraph 1 of the Storage Regulations outlines the requirements for the Storage Operator to maintain a register of quantities, properties and composition of the CO₂ stream delivered and injected. The quantity of the stream is likely to be measured by fiscal metering on the beach in line with the accuracy requirements of the UK ETS. UK ETS regulations set requirements for CO₂ storage.

The Storage Operator should have metering offshore for the purposes of allocation of injected volumes and for monitoring purposes either at the platform or on an individual well basis. Allocation metering may be required where shared transportation systems are used to deliver CO₂ to multiple offshore injection hubs. Where measurements are not used for ETS-reporting purposes, the required accuracy will be set by the relevant regulator on a case-by-case basis.

44. The NSTA intends to publish additional guidance notes for the measurement of the CO₂ stream in CS applications on its website.

Operating pressure

45. A proposed maximum well operating pressure should be submitted by the Licensee in the Storage Permit Application as outlined in regulation 8(1)(c) of the Storage Regulations. In many cases, a minimum well operating pressure may also be required whereby the minimum operating pressure consent may be the initial average reservoir pressure at the start of injection referenced to a datum depth.
46. The proposed maximum operating pressure should be a safe maximum well operating injection pressure. This must take into consideration the geomechanical regime; further technical guidance on this is detailed in the supplementary guidance on the content of Offshore Carbon Storage Permit Applications.

47. A Bottom Hole Pressure ('**BHP**') gauge should be used to measure the well injection pressure. The Licensee's MP should detail the procedure to be followed when a BHP gauge fails, including temporary procedures to allow safe operations and remediation activities.

Financial criteria

48. The NSTA will assess whether the proposed Storage Operator is financially sound, together with any other applicable financial assessment to be carried out on the Licensee. This is in addition to the financial security requirements as described in further detail in the Define Phase.

Appraise Phase Requirements

49. During the Appraise Phase, the Licensee will be required to carry out any exploration and appraisal activities as agreed under the work programme of the licence. These will be critical to assessing the viability of the storage site and storage complex as a potential site for the permanent storage of CO₂ and will provide important information in preparing the Storage Permit Application.
50. The Licensee will be required to demonstrate to the NSTA that the critical risks to containment of CO₂ have been identified as well as any potential risks to storage capacity and injectivity through an Early Risk Assessment as described in this section, while also identifying further studies, data gathering and/or appraisal required to address any risk or uncertainties.
51. At the end of the Appraise Phase the Licensee will have assessed and will demonstrate to the NSTA whether the current subsurface database is sufficient and suitable to deliver a subsurface characterisation of the proposed storage complex and surrounding area as set out in regulation 7(1)(a) of the Storage Regulations in a form and of a quality suitable for inclusion in an application for a storage permit or if further data acquisition and studies will be required.

Early Risk Assessment

52. The purpose of the Early Risk Assessment is to identify and define early on in the Appraisal term of a licence any potential threats to the containment of CO₂, storage capacity, and injectivity and the key uncertainties in defining the proposed storage site and storage complex in order to identify risk reduction measures, the need for further studies, data gathering and/or appraisal.
53. The results of the Early Risk Assessment will contribute to informing the requirements of the MP and CMP and develop over the subsequent phases of the Appraisal Term of the licence with the aim of demonstrating at Storage Permit Application that, under the proposed conditions of use of the storage site, there is no significant risk of leakage.

i. Early Risk Assessment Report

54. The Early Risk Assessment Report should form the basis of the Containment Risk Assessment Report submitted as part of the Storage Permit Application in the Define Phase. It will be updated throughout the different phases of the Appraisal Term of the licence as the technical work matures and to meet the requirements at each phase.

55. The Licensee should outline the following points in an executive summary at the beginning of the report:
- a) Project outline/overview
 - b) The current definition of the storage site and complex identifying the primary and secondary containment zones and seals and definition of lateral boundaries (this may change as the project matures)
 - c) Outline the current base case development to assist the NSTA with understanding what risks need to be considered, including but not limited to:
 - i. Storage capacity and final injection pressure
 - ii. Injection rates and number of wells over the development life
 - iii. Prospective CO₂ sources to achieve the injection rates
 - d) A table ranking and summarising the key identified risks to containment, capacity and injectivity
56. The NSTA expects the Licensee to present both the existing data, and the data which has been used in the analysis of potential threats to containment and the assessment of the uncertainties in defining the storage site and storage complex. If early work prior to licence award has been carried out on public domain data, the Licensee should seek to obtain and integrate any existing proprietary data to fulfil the requirements of the Early Risk Assessment. If data is missing, the Licensee should outline the impact to risk and uncertainty within the report and provide a plan on how it will address this.
57. Seismic data is essential to characterise the geological storage site and storage complex. The NSTA expects the Licensee to use it to map the storage site and complex, including any secondary containment zones, sealing units, potential leakage points and faults which will assist in assessing and defining the storage complex. The NSTA expects Licensees to use high-quality seismic data which will determine if and to what level of uncertainty the storage site and complex can be defined. This will further inform the analysis of potential threats to containment. Where the Licensee believes that the risk assessment and site characterisation can be carried out with a different view of data, the NSTA expects clear justification to be given. As outlined in regulation 7(1)(c) of the Storage Regulations, the NSTA must be satisfied before granting a storage permit that, under the proposed conditions of use of the storage site, there is no significant risk of leakage and therefore it expects any seismic or other subsurface data to be of high quality and to be used effectively and in accordance with best practice. Should the seismic data not be of sufficient quality, the Licensee should outline what further data is required and the forward plan to acquire it.
58. The NSTA expects all existing data from wells that penetrate either or both the storage site and complex to be used to assist in the characterisation and to address capacity, injectivity, and compartmentalisation uncertainties. The data should inform any preliminary static and dynamic modelling. Where existing well data is sparse or not available and there are no appraisal wells written into the licence work programme, the Licensee should outline the plan to appraise further, including any preliminary well locations, testing, and sampling programmes.

59. The report should clearly outline the Licensee's risk assessment methodology and risk analysis techniques used to assess and analyse the potential threats to the containment of CO₂, storage capacity, and injectivity. The NSTA expects the Licensee to apply a balanced approach of using different risk analysis techniques in its assessment which can be split into three different classes:
 - a) Qualitative risk analysis techniques
 - b) Semi-quantitative risk analysis techniques
 - c) Quantitative risk analysis techniques
 60. The analysis should include a risk register containing all identified risks to storage capacity, injectivity, and containment of CO₂ within the storage site and complex which should be ranked using appropriate risk analysis techniques with clear rationale for the ranking provided. This should highlight key areas and risks where further risk analysis is required.
 61. Particular attention should be paid to decommissioned wells or wells that have yet to be decommissioned that penetrate or are near to the storage site or complex. Well design, integrity reports and decommissioning reports and schematics should be reviewed and data uncertainty highlighted. Analysis should include the potential for leakage from one well via another well. Further risk assessment analysis techniques should be used, including but not limited to, bow tie analysis to better assess and identify controls and mitigation measures in place to limit the consequences of a legacy well leak.
 62. In cases where remediation of a decommissioned well is required, the remediation will, in many cases, need to be resolved before a storage permit can be awarded. At a minimum, the Licensee should demonstrate that a plan is in place to remediate the well effectively with clear responsibilities identified and an agreed timescale on when this work will be carried out.
 63. If the data does not exist to address the associated risks or the uncertainties in defining the storage site and storage complex, the Licensee should present further studies, data gathering and/or any appraisal required to do so. The early risk assessment should be sufficient to form the outline of work to be completed to support the Containment Risk Assessment required for the Storage Permit Application.
- ii. Risk Assessment Workshop**
64. The Early Risk Assessment Workshop will be held following submission of the Early Risk Assessment Report. The Licensee should provide a copy of the report along with any supporting documentation to at least two relevant independent technical experts, who have been agreed previously with the NSTA, at the same time they submit the report to the NSTA. The experts should each produce an independent written opinion on the Early Risk Assessment and present a summary of their findings at the workshop.

65. The purpose of the workshop is to provide the Licensee with an opportunity to review the Early Risk Assessment with the NSTA and external technical experts and should:
- a) Provide a progress update on the work programme and other Licensee work in respect of the project
 - b) Identify any risks to a future operational storage site including, but not limited to, any threats to containment of CO₂ in the storage site and storage complex and the uncertainties in defining the storage site and storage complex
 - c) Inform the NSTA of the Licensee's proposed criteria for the assessment of the storage site and storage complex as a suitable place to store CO₂ (which should comply with the requirements set out in the Storage Regulations) and the associated level of certainty as determined from the data
 - d) Identify and agree with the NSTA any further risk reduction measures to be taken
 - e) Inform the requirements for a potential future Storage Permit Application including, but not limited to, the Licensee's MP and CMP
66. Following the workshop, the external technical experts should submit their written opinion on the report to the NSTA.
67. The Licensee should demonstrate to the NSTA's satisfaction that any further risk reduction measures agreed at the workshop have been added to the work scope and captured in the Early Risk Assessment report by an agreed date.

Site Characterisation Review Report

68. Before the end of the Appraise Phase, the Licensee is required to submit a Site Characterisation Review Report which should:
- a) Assess whether the current subsurface database is sufficient and suitable to deliver a comprehensive subsurface characterisation of the proposed storage complex and surrounding area as set out in regulation 7(1)(a) of the Storage Regulations in a form and of a quality suitable for inclusion in an application for a storage permit as described in the Assess Phase of this guidance, or if further data acquisition will be required
 - b) Demonstrate the integration of site-specific data, including but not limited to seismic data and other static and dynamic subsurface data, into an evaluation of the suitability of the proposed storage site and storage complex for the storage of CO₂
69. Annex I to the Directive outlines the criteria for sufficiently characterising and assessing the storage complex and surrounding area. The Licensee should demonstrate to the NSTA in the Site Characterisation Review Report, whether the current subsurface database, inclusive of any appraisal work programme commitments carried out under the licence, is sufficient to deliver the requirements of all three steps in Annex I. This should be done through, at the very least, preliminary reservoir modelling as proof of initial concept, which will have been modified to include results of any detailed site characterisation studies.

70. In some potential storage sites, including but not limited to saline aquifers, there may be insufficient existing geological data to characterise the storage site and complex and in most cases no fluid flow data will exist to understand injectivity performance. It is therefore likely that further seismic acquisition and appraisal well data will be required, including injectivity and pressure testing to determine the stores' limitations and overall permeability. These will most likely be included in the licence work programme as either firm or contingent commitments but may also be added to the work scope if it is deemed at this stage, that the database is not sufficient to deliver a comprehensive subsurface characterisation of the proposed storage complex and surrounding area.
71. In the case of depleted hydrocarbon fields, the Licensee must consider that the data acquired throughout the life of the field, including exploration and appraisal, production, and end of field life, may not be representative of current subsurface conditions. Therefore, the fact that the storage site previously contained hydrocarbons may not be sufficient to demonstrate the effectiveness of the trap and seal for CO₂ storage or to characterise the storage site and complex.
72. Seismic data that adequately images the storage site and complex and surrounding area is critical to effective characterisation. The NSTA expects any seismic or other subsurface data to be of high quality and to be used effectively and in accordance with best practice. The Licensee should therefore demonstrate that the existing seismic database or any newly acquired or re-processed data are sufficient to fulfil the characterisation requirements of Annex I to the Directive.
- Should the seismic data not be of sufficient quality to deliver effective subsurface characterisation, the Licensee should outline what further data is required and the forward plan to acquire it before the NSTA will support progress to the Assess Phase.
73. A geomechanical characterisation is required to evaluate confining zone integrity as well as that of secondary reservoirs and setting safe operational parameters. If these data are not available for a storage site and complex, an appraisal well may be required.
74. For the avoidance of doubt, submission of the Site Characterisation Review Report does not mean that the requirements set out in the Storage Regulations for the grant of a storage permit have been satisfied and the Licensee should have no such expectations. The NSTA reserves its discretion as to whether or not to grant a storage permit and this decision will only be made once the complete and final Storage Permit Application has been submitted to NSTA.

Work programme commitments

75. Depending on the number of existing wells in the proposed store, the amount, age and quality of associated subsurface data, and the quality and coverage of seismic data over the storage site and complex, the licence work programme may include the requirement for a firm or contingent data acquisition programme in the Appraise Phase to assist in the adequate characterisation of the proposed storage site and complex or to sufficiently assess risks to containment, capacity or injectivity. This may include, but is not limited to:

- a) Appraisal well(s)
- b) Seismic acquisition
- c) Seismic reprocessing

Where a work programme data acquisition requirement is a contingent commitment, and the Licensee decides not to carry out the work, the NSTA will review in detail the Licensee's justification before making a decision on whether to waive any work programme commitment.

Engagement Schedule

76. The Engagement Schedule is a schedule of regular meetings agreed with the NSTA that are intended to assist the Licensee in demonstrating to the NSTA that appropriate progress is being achieved in the project. The typical frequency of engagements will be quarterly, but this will be dependent on the progress being made by the Licensee and is therefore subject to change. The proposed Engagement Schedule will be submitted on or before the date the Early Risk Assessment report is required. An agenda prior to each engagement will be agreed in advance with the NSTA.

Stakeholder Engagement Plan

77. The Licensee shall demonstrate to the NSTA's satisfaction its Stakeholder Engagement Plan to demonstrate to the NSTA that the Licensee will consult and, as applicable, has consulted with other interested parties that might be affected by the proposed appraisal activities and any subsequent development activities under any storage permit (if granted) and that such parties will not be unduly compromised by any appraisal and storage development plans.

78. The Licensee should demonstrate to the NSTA that stakeholder analysis has been carried out to assist in prioritising and planning the engagement strategy. Consideration should be given to the level of influence each stakeholder has along with their level of interest to allow for prioritisation ranking and mapping of stakeholder importance.
79. The engagement plan should outline the engagement strategy detailing how and when the Licensee will communicate with each stakeholder based on the stakeholder analysis, ranking and prioritisation. The Stakeholder Engagement Plan should be updated regularly throughout the Appraisal Term of the licence and communicated to the NSTA.

Commercial and other conditionality

80. The Licensee shall update the NSTA on the status of any commercial or other conditionality that may have a material impact on the timely delivery of a Storage Permit Application and operational storage scheme.
81. A list of commercial stakeholders including prospective sources of CO₂ should be provided to the NSTA at this stage. An associated timeline including key milestones associated with the progression of the commercial agreements with each stakeholder up to first injection should also be provided. This will assist the NSTA in understanding the commercial progress and risks to the project.
82. Commercial risks should be captured in a project risk register and provided to the NSTA. This should include any contingency plans for prospective sources, should commercial arrangements with initial planned prospective sources providing CO₂ to the Transport and Storage ('T&S') Network change.

Project governance and organisation

83. The Licensee shall demonstrate to the NSTA's satisfaction that appropriate project governance and organisation is in place, including but not limited to:
- a) A project governance and management structure that defines the decision makers, project owners, joint venture partners and regulators
 - b) The capability and competence of key roles including project managers and project leadership
 - c) Defined, documented and distributed project goals, roles and responsibilities, delegation of authority, and a management of change process
 - d) A defined organisational structure to support an integrated approach including subsurface, well operations, facilities, injection operations, logistics, supply chain, commercial and finance, and joint venture partners

Project management

84. The Licensee shall demonstrate to the NSTA's satisfaction:
- a) The use of a project management process to deliver the project objectives and milestones, including the decision-making process, stage-specific progression criteria and decision hold points
 - b) How quality and assurance is being applied, appropriate to the size/complexity of the project
 - c) Employment of a project-specific risk management process, including technical and non-technical risks
 - d) That internal and external lessons learned are incorporated to ensure continuous improvement to the business process

Assess Phase Plan

85. Before progressing into the Assess Phase of the project the Licensee must submit to the NSTA an Assess Phase activity plan and schedule.

Assess Phase Requirements

86. Any further data gathering, studies and appraisal activities agreed in the Appraise Phase should be either completed or integrated into the Work Programme and executed. The Assess Phase requirements build on the Early Risk Assessment and Site Characterisation requirements of the Appraise Phase while informing the preliminary MP and CMP, and assessing the PPCP. The Assess Phase report should include an outline concept-select assessment of the Carbon Storage Development Plan and should provide the NSTA with sufficient information to gain an understanding of the conceptual development and the associated engineering considerations. An Assess Phase review will take place for the Licensee to demonstrate to the NSTA that the Site Characterisation is complete, and the CO₂ transportation and facilities concept has been assessed and selected, as outlined in the report, before progressing into the Define Phase.
- (a) of the Storage Regulations in a form and of a quality suitable for inclusion in an application for a storage permit and as outlined in Annex I of the Directive and according to best practices at the time of the assessment.
89. The Licensee should demonstrate that the static and dynamic modelling, which must fulfil the requirements of Annex I to the Directive, contains a representative range of scenarios that cover all possible outcomes of CO₂ injection based on the existing data. This should include any impact the proposed composition of the CO₂ stream has on containment, storage capacity, and injection rates.
90. A storage permit will allow the approved Storage Operator to inject CO₂ up to maximum volumes and rates set out in the storage permit based on a prospective source's ability to supply those CO₂ volumes. Risks to injectivity must therefore be thoroughly understood and presented in technical detail.

Assess Phase Report

87. The Assess Phase Report should be provided to the NSTA by an agreed date and should comprise the following three key requirements:

i. Site Characterisation

88. The Site Characterisation should demonstrate that subsurface characterisation of the proposed storage site and complex and surrounding area is complete as set out in regulation 7(1)

ii. Preliminary Containment Risk Assessment

91. A Preliminary Containment Risk Assessment building on the requirements of the Early Risk Assessment in the Appraise Phase and detailing risks to containment, storage capacity and injectivity should be provided that integrates any further risk reduction measures agreed at the Early Risk Assessment Workshop or by the end of the Appraise Phase and

should seek to demonstrate that under the proposed condition of use of the storage site, there is no significant risk of leakage. The Licensee should at this stage have considered all possible leakage and migration mechanisms from the storage site and complex and should now identify risk management measures, mitigating actions, monitoring requirements and safeguards or contingency actions for each potential risk event, including the appropriate monitoring and corrective measures.

92. The Licensee should rank the identified risks using appropriate risk analysis techniques. The risk assessment methodology should again be clearly outlined and include all risk analysis and management techniques (see paragraph 59), including but not limited to, bow tie analysis which have been used to better assess and analyse the risks and assist in identifying the appropriate controls and mitigation measures to manage the risks. The risk assessment methodology should be clear on where and why certain risk analysis techniques have been used.
93. Sensitivities to the composition of the CO₂ stream and excursions and how these may impact the integrity of the storage site or the relevant transport infrastructure should be addressed in the preliminary Containment Risk Assessment.
94. The Licensee should also detail the remaining work required for a Containment Risk Assessment which will be submitted as part of the Storage Permit Application. This includes any remaining work to be carried out to remediate decommissioned legacy wells required before a storage permit can be granted.

iii. Concept-select assessment

95. The concept-select assessment should outline the proposed CO₂ transportation and injection facilities, well types, and layout that can support the proposed forecast range of injection volumes and rates throughout the operational term, and the associated CO₂ phase management engineering considerations.
96. The Licensee should demonstrate the CO₂ integrity of any potential infrastructure, equipment, and materials to be used along with documenting the critical matters associated with well management, maintenance, and decommissioning procedures in a CO₂ storage development.
97. The development concept should be consistent with the prospective CO₂ volumes, timing, and duration.
98. The NSTA must be consulted on development options early on so that matters requiring detailed consideration by the NSTA can be identified. Such considerations may include technical and net zero evaluation of the options considered. Net zero evaluation should include a like-for-like comparison of emissions from all development options. A reasoned analysis must be provided to the NSTA if the selected option does not have the lowest GHG emissions.

Preliminary Monitoring Plan (MP)

99. The Licensee is required to monitor the injection facilities, storage complex and the applicable surrounding areas to confirm CO₂ containment, plume behaviour and identify any significant irregularities or leakage from the storage complex. In addition, any potential leakage risks throughout the operational phase and for a period after closure

of the store (post-closure), until the licence is terminated, and liabilities are transferred back to government should now have been identified. The legal framework for the MP is outlined in schedule 2, paragraph 2 of the Storage Regulations and Annex II to the Directive and includes post-closure measurement and monitoring requirements.

100. The preliminary MP should consider and assess the pre-injection baseline measurement, the operational monitoring of the injection facilities and the monitoring activities of the storage complex and relevant surrounding areas. This should be informed and directly linked to the identified risks in the Risk Assessment and the subsurface characterisation of the storage site and complex. Multiple monitoring methods should be considered to cover operational monitoring, plume behaviour, pathways for potential leakage, monitoring for surface leakage to the biosphere, and monitoring for any aquifer water discharge at surface where applicable. Consideration should be given to both surface leak detection and leakage measurement techniques to quantify the CO₂.

101. The methods considered will be risk based and storage site and complex specific and should be reassessed and adapted throughout the operational phase and into the post-closure period. Any methods considered should be reviewed for any experience gained from operational storage projects elsewhere and use the best available techniques and technologies at the time of the assessment. The Licensee should demonstrate to the NSTA the monitoring methods considered and the justification for any methods that are deemed not suitable for the proposed selected storage site and complex.

102. The Licensee may consider including a plan for a baseline 3D seismic survey and subsequent repeat 4D seismic surveys including a permitting plan identifying any constraints on the ability to obtain permits and execute the survey.

Corrective Measures feasibility study

103. The preliminary MP should inform the Corrective Measures ('**CM**') feasibility study. Any potential significant irregularities, leakage, or near risk of leakage identified in the preliminary Containment Risk Assessment should be detectable through the MP and will indicate any corrective measures required; including detailing the appropriate steps and how they might be taken. Regulation 10 and paragraph 6 of schedule 2 of the Storage Regulations outlines the legal framework for implementing any corrective measures.

104. The CM feasibility study will be storage site and complex specific and will inform the CMP to be submitted as part of the Storage Permit Application. The study should outline a range of potential corrective measures and techniques which could be utilised in the event a significant irregularity, CO₂ leakage event, or aquifer water discharge at surface is detected through the MP data, analysis, and results. The study should consider the range of leak rates, how long the CM method or remediation will take, and the likelihood of success.

Provisional Post-Closure assessment study

105. A PPCP is required under regulation 13 of the Storage Regulations and must be in accordance with Annex II to the Directive. This will be submitted as part of a Storage Permit Application. The Provisional Post-Closure ('PPC') assessment study is in place at this phase of the licence for the Licensee to consider and demonstrate to the NSTA:
- a) The initial plans and timing for storage site closure including the post-closure removal of injection facilities and how all wells utilised in the injection phase will be cost effectively decommissioned
 - b) That the equipment and infrastructure necessary for post-closure monitoring in line with the obligations set out in schedule 1, paragraph 4 of the Storage Regulations will remain in place until they are no longer required
 - c) The Licensee has assessed storage site and complex specific post-closure monitoring methods to demonstrate continued containment and conformance of CO₂ within the storage site

End Assess Phase Review

106. An End Assess Phase Review will be required to provide the Licensee the opportunity to demonstrate to the NSTA, among other things:
- a) That the storage site and complex are fully assessed and characterised; and
 - b) The CO₂ transportation and facilities concept selected by the Licensee is the most appropriate
107. The End Assess Phase Review will determine if and when the Licensee can progress into the Define Phase of the project by providing assurance to the NSTA that the technical work is at a sufficient stage, and appropriate progress is being made to demonstrate that the requirements of the Storage Regulations are understood and being addressed. If the NSTA has any further comments/concerns to be addressed, it may seek to agree with the Licensee a programme of work or further review, intended to lead to its resolution within an agreed timeframe before the project can progress into the Define Phase.
108. As set out above, progression from the End Assess Phase to the Define Phase does not give the Licensee any expectations that a storage permit will be granted.

Consultation on Supply Chain Action Plan (SCAP)

109. In 2021, the NSTA introduced the Supply Chain Collaboration and Cooperation Stewardship Expectation SE12¹² to ensure oil and gas Field Operators work appropriately with the supply chain and derive maximum value from project activity and in 2022 updated the SCAP guidance taking into account net zero and the North Sea Transition Deal¹³. Should any of the provisions in SE12 not directly apply to carbon storage then the NSTA expects the Licensee to follow the sentiment of any such provision. The purpose of an SCAP in the context of carbon storage is to assist operators in demonstrating their contract strategies and concepts are comprehensive and well-positioned to deliver 'best value' in accordance with their Storage Permit Application.
110. The NSTA expects all Licensees submitting a Storage Permit Application to develop an SCAP. In the Assess Phase, the Licensee should prepare a draft SCAP and share it with the NSTA for informal review and discussion. This should be at an early stage of the project, in advance of any project specific contract award.
111. Following the NSTA's initial review, any incomplete or unsatisfactory SCAPs will be returned with comments/clarifications to be addressed. The Licensee can amend the SCAP during the Define Phase following feedback from the NSTA or the Licensee's internal review. The above referenced SCAP guidance also contains a template which may be modified, with the NSTA's prior agreement, as necessary.

112. It is anticipated that SCAPs will be developed as an ongoing process in tandem with the Storage Permit Application.

Consultation on Project Execution Plan (PEP)

113. The Licensee should prepare a PEP for all stages of the project. In the Assess Phase, the PEP should be developed in parallel to the Assess Phase Report and other requirements and should be recompiled and updated at each stage of the project.
114. The PEP should integrate and continue to develop the following Appraise Phase requirements:
- a) Commercial and other conditionality
 - b) Project governance and organisation
 - c) Project management
- while also including sections comprising such things as:
- d) Contracting strategy (reference the SCAP)
 - e) Cost planning, control, and management
115. Stewardship Expectation SE05¹⁴ outlines the expected behaviours and good practices to achieve robust project delivery for oil and gas projects. Section 3 of SE05, although not directly aimed at carbon storage projects, provides a useful framework for the Licensee to follow and assist in delivering a carbon storage project.

¹² [Supply Chain Collaboration and Cooperation Stewardship Expectation 12 \(nstauthority.co.uk\)](https://www.nstauthority.co.uk/guidance-on-applications-for-a-carbon-storage-permit/consultation-on-supply-chain-collaboration-and-cooperation-stewardship-expectation-12)

¹³ [Supply Chain Action Plan Guidance August 2022 \(nstauthority.co.uk\)](https://www.nstauthority.co.uk/guidance-on-applications-for-a-carbon-storage-permit/consultation-on-supply-chain-collaboration-and-cooperation-stewardship-expectation-12)

¹⁴ [Robust Project Delivery Stewardship Expectation 5 \(nstauthority.co.uk\)](https://www.nstauthority.co.uk/guidance-on-applications-for-a-carbon-storage-permit/consultation-on-supply-chain-collaboration-and-cooperation-stewardship-expectation-12)

Technology screening

116. Licensees should be aware of existing, new, or emerging technology and should review existing operational carbon storage projects for lessons learned and current best available techniques and technologies. This applies to technology for the safe transport and injection of CO₂ as well as all monitoring and measurement technology that can detect and measure any significant irregularity or leakage from the storage complex.
117. In accordance with schedule 2, paragraph 2(5) of the Storage Regulations, the MP must be updated in any case every five years to take account of a number of changes including improvements in best available technology.

Environmental Statement (ES) preparation

118. Under the 2020 EIA Regulations the Licensee is required to submit an ES to BEIS OPRED. The Licensee should normally engage with BEIS OPRED in the Assess Phase, before Concept Select, and the choice of development concept must be made giving full weight to any environmental concerns.
119. See BEIS OPRED Regulations¹⁵ for further information on the preparation and submission of an ES. The timescale for the EIA process may vary from project to project.

Marine Licence preparation

120. A Marine Licence may be required for electrification of carbon storage development infrastructure. The Licensee should engage early with the NSTA and the relevant regulator once the CO₂ transportation and facilities concept has been selected. The marine licensing authority for England is the Marine Management Organisation ('**MMO**'), in Scotland it is Marine Scotland ('**MS**'), and for Wales it is Natural Resources Wales ('**NRW**').

Define Phase Plan

121. Before progressing to the Define Phase of the project, the Licensee must provide the NSTA with an activity plan and schedule for the Define Phase.

¹⁵ [Oil and gas: offshore environmental legislation – GOV.UK \(www.gov.uk\)](https://www.gov.uk)

Define Phase Requirements

122. The Define Phase of the project should continue to build on the requirements and documents of the Appraise and Assess Phases of the licence while undertaking further activities. The aim will be the submission of a Storage Permit Application which on approval, will allow the Storage Operator to install facilities and inject CO₂ into a specified storage site.
123. The Define Phase requires the development concept to be matured to a stage where the Licensee will take FID and work to secure all relevant Licensee and regulatory approvals. The Define Phase should deliver all the information necessary to ensure a robust project is developed with clear scope, cost estimate, and schedule; along with both a PEP and SCAP.
124. A storage permit may only be granted if, among other things, the Licensee has demonstrated to the NSTA's satisfaction that under the proposed conditions of use of the storage site, there is no significant risk of leakage or of harm to the environment or human health. In particular, the NSTA would require the appropriate and necessary evidence and analysis to be provided in a Storage Permit Application to enable it to reach a determination that there is no significant risk of leakage from all abandoned legacy wells at the time of permitting. If this can't be demonstrated to the NSTA's satisfaction, then dependent on the well risks identified in the risk

assessment, such abandoned legacy wells may be required to be remediated and a revised Storage Permit Application made. To avoid delay, it is suggested that the evidence and analysis on abandoned wells is discussed with the NSTA early in the preparation of an application. The abandonment of currently active or inactive wells may be undertaken after the permit is given if the Storage Permit Application contains satisfactory data and analysis of the anticipated effectiveness of such post permit operations.

Content of the Storage Permit Application

125. The eight documents that make up a Storage Permit Application are discussed in this section:
 - a) Carbon Storage Project Overview
 - b) Storage Site and Complex Characterisation
 - c) Carbon Storage Development Plan
 - d) Containment Risk Assessment
 - e) Monitoring Plan
 - f) Corrective Measures Plan
 - g) Provisional Post-Closure Plan
 - h) Proposal for Financial Security

126. These documents must provide detail on the Licensee's understanding of the Storage Site and Complex throughout the operational, closure and post-closure periods of the development up to transfer of responsibility. A suggested structure and guidance on the preparation and content of the Storage Permit Application documents can be found in the supplementary guidance on the content of Offshore Carbon Storage Permit Applications.
127. The content of the Storage Permit Application should be agreed with the NSTA and will be specific to the storage site and complex and informed by the deliverables and issues identified throughout the Appraise and Assess Phases including site characterisation, uncertainties and risks to containment, capacity and injectivity.
128. The Storage Permit Application will provide a clear explanation of the commitments that the Licensees are making (in terms of minimising emissions, facilities, number of wells, MP, and CMP etc.) and must fulfil the legal requirements of regulation 6 of the Storage Regulations including evidence demonstrating that under the proposed conditions of use of the storage site there is no significant risk of leakage or of harm to the environment or human health.
129. The actual form of the development and basis for storage site management including all monitoring and measurement of CO₂, should be described in sufficient detail to enable the NSTA to consider properly whether to grant a storage permit.

Define Phase Review

130. The Define Phase Review will take place prior to the Licensee submitting the draft Storage Permit Application documents. This will provide the opportunity to demonstrate to the NSTA that the storage site and storage complex is integrated into a feasible project concept; including but not limited to a review of the Carbon Storage Development Plan, including the CO₂ pipeline/transportation and injection facilities; Containment Risk Assessment measures; MP; CMP; PPCP; and proposal for Financial Security.

Storage permit draft application documents

i. Carbon storage project overview

131. The carbon storage project overview should provide a summary of the essential features of the proposed storage site development including a clear definition of the storage site and complex, the containment analysis, and include a summary of the points outlined in regulation 6(3)(c) of the Storage Regulations to assist in the review of the Storage Permit Application documents. Further details on the content of this summary can be found in the supplementary guidance.

ii. Storage Site and Complex Characterisation

132. The Storage Site and Complex Characterisation completed as part of the Assess Phase requirements should be updated and finalised as appropriate and submitted as a document to support the Storage Permit Application. This should form the basis of the Carbon Storage Development Plan and the Containment Risk Assessment.

iii. Carbon Storage Development Plan

133. The Carbon Storage Development Plan should be developed from the results and outputs of the Storage Site and Complex Characterisation and the CO₂ transportation and facilities concept selected by the Licensee in the Assess Phase. A select number of appropriate three-dimensional static and dynamic models should be developed as part of the site characterisation. These should capture sufficiently the range of subsurface uncertainties and therefore forecast the plume behaviour, CO₂ injection rates, pressure volume and saturation behaviour and storage capacity to demonstrate the viability of the proposed development plan; including that under the proposed conditions of use of the storage site, there is no significant risk of leakage. It should therefore clearly outline the safe operating parameters, that will minimise the risk of leakage and/or prevent any leakage occurring.
134. The surface and subsurface facilities and transportation concept to support the forecast range of injection volumes and rates, should be described in sufficient technical detail; including a clear timeline for drilling activities, installation, and commissioning. All proposed surface and subsurface infrastructure, equipment, and materials to be used in the development, whether new or re-purposed should be proven to be compliant for CO₂ injection and rated to the full potential range of pressures and temperatures that could be expected from injecting CO₂ into the store in different operating scenarios. The Licensee should be aware of, and plan to deploy the most appropriate, existing, new, or emerging technologies and should review existing operational carbon storage projects for lessons learned and industry good practice.
135. The Licensee should provide details on the prospective CO₂ sources that will meet the proposed injection volumes and rates as well as the timing of the source availability.
136. The composition and bulk fluid quantities of the CO₂ stream from all prospective sources should be confirmed and meet the legal requirements of schedule 2, paragraph 1 of the Storage Regulations and be accounted for in the development plan. Further information on this can be found in the supplementary contents guidance.
137. Information on any plans for future carbon store build outs may be described in the Carbon Storage Development Plan. However, a permit will not be granted for build out stores under the initial Storage Permit Application and the Licensee will need to make subsequent additional applications for build out store developments.

iv. Containment Risk Assessment

138. The Early Risk Assessment documented in the Appraise Phase and the Preliminary Containment Risk Assessment documented in the Assess Phase should conclude in the Containment Risk Assessment document required as part of the Storage Permit Application. Any remaining work and analysis should now be complete and integrated into the Risk Assessment to demonstrate that under the proposed conditions of use of the storage site there is no significant risk of leakage or of harm to the environment or human health. Further information on the format and content of the Containment Risk Assessment can be found in the supplementary contents guidance.

139. The Containment Risk Assessment should be directly informed by the detailed Storage Site and Complex Characterisation and will in turn inform the requirements of the MP and CMP and is therefore critical and central to the safe and permanent storage of CO₂. Throughout the full life cycle of the carbon storage development the Containment Risk Assessment should be periodically updated to reflect the updated geological understanding and therefore the risks relating to containment, capacity, injectivity and leakage gained from drilling new wells and the monitoring and measurement activities carried out throughout the operational and post-closure phases.
140. The Licensee should have identified and characterised all risks relating to potential CO₂ leakage from the proposed storage complex. This should include an assessment of hazard identification, the likelihood of occurrence, and the potential impacts and magnitude of leakage for each identified leakage pathway (flux rates) as outlined in Annex I, section 3.3.1 to the Directive. This will form the basis of the NSTA's assessment of the viability of the storage site and complex for the safe injection of CO₂ for the purposes of permanent storage.

v. Monitoring Plan

141. The preliminary MP submitted in the Assess Phase should be developed further to reflect the conclusions of the Containment Risk Assessment and the Carbon Storage Development Plan. This should be drawn up in accordance with schedule 2, paragraph 2 of the Storage Regulations and Annex II to the Directive and should be interlinked to mitigations and planned corrective measures should a significant irregularity or leak be detected. Further information on the format and content of the Containment Risk Assessment can be found in the supplementary contents guidance.
142. The MP should outline all baseline monitoring data of the injection facilities and storage complex that will be collected prior to injection start-up (this may include monitoring for aquifer water discharge at surface) and which will be used as a reference for monitoring data throughout the injection and post-injection phases. This should include baseline monitoring for any contingency monitoring techniques that may be utilised in the case of a significant irregularity or leak or in the case any monitoring method failures.
143. Multiple monitoring methods and technologies should be selected based on the most appropriate, existing, new, or emerging technologies and where possible use existing operational carbon storage projects for lessons learned and best available techniques and technology.
144. The MP should utilise the dynamic modelling and forecasts from the Carbon Storage Development Plan as a reference and guide for monitoring data where applicable.
145. Requirements for the measurement and compositional analysis of the CO₂ stream are outlined in schedule 2, paragraph 1 of the Storage Regulations and are described earlier in this guidance (paragraphs 40 to 44). The methods and techniques to be used should be clearly outlined in the MP.
146. In the scenario where a leak from the storage complex is detected, the Licensee should demonstrate how the deployed monitoring technologies will be used to measure and quantify the leakage event and therefore assess the level of leakage. This may in cases require a combination of techniques and methods but is essential to inform the CMP and for quantification and accounting purposes.

147. The NSTA must approve the MP before a storage permit can be granted.

vi. Corrective Measures Plan

148. The CMP should build on the Corrective Measures feasibility study carried out in the Assess Phase and be informed by the risks identified in the Containment Risk Assessment and closely interlinked to the MP. It should outline clearly the necessary actions and measures that will be taken in the event of a significant irregularity or if a leakage event is detected to prevent or stop any leakage of CO₂ from the storage site or complex. Further information on the format and content of the CMP can be found in the supplementary content guidance.

149. Any monitoring which detects a significant irregularity (as defined in the Directive), CO₂ leakage event, or where aquifer water discharge is detected at surface, will trigger any corrective measures to be deployed. These should be based on the specific event. It is therefore essential that the MP and CMP are integrated.

150. Under the Storage Regulations, the NSTA must be informed on the corrective measures options considered, so that matters requiring detailed review by the NSTA can be identified.

151. The legal framework for corrective measures is outlined in the Storage Regulations, including at regulation 10. The Storage Operator is required to notify the NSTA immediately in the event a significant irregularity or leak is detected. Therefore, the Licensee should identify and demonstrate from the monitoring technologies chosen that the source and location of any leakage event or significant irregularity can be identified, and that it can quantify the level of leakage. Where leakage cannot be quantified and where it is appropriate

to do so, the Licensee should outline in the MP and CMP how it will deploy additional or contingent monitoring techniques in an effective timeframe.

152. The CMP will be storage site and complex specific. It should clearly outline the Licensee's analysis and decision-making methodology on the corrective measures to be deployed should a risk event scenario described in the Containment Risk Assessment occur. Further information can be found in the supplementary content guidance.

153. The Licensee should demonstrate in the CMP how it will use the 3D dynamic models or any other modelling software to assess and forecast the duration and magnitude of a significant irregularity or detected leakage event over time and how this may have an impact on any chosen corrective measures techniques. The Licensee should outline where any additional data may be required through monitoring to assist in the evaluation.

154. In scenarios where a significant irregularity or leakage event is detected that was not expected or described in the risk events of the Containment Risk Assessment, the Licensee should outline in the CMP the resources it will have available to respond both operationally (including for potential data gathering) and analytically. In these circumstances, the response to significant irregularities or leakage events may be additional to or different from those set out in the Corrective Measures Plan.

155. The costs associated with the corrective measures techniques should be provided and indicate how they have been derived. These will vary depending on the type and nature of the risk event and any costs associated with corrective measures should also consider the costs of having to stop or reduce CO₂ injection.

156. The NSTA must approve the CMP before a storage permit can be granted.

vii. Provisional Post-Closure Plan

157. The PPC assessment study completed in the Assess Phase should be updated and developed further as appropriate and based on the final Carbon Storage Development Plan including the facilities, injection wells and the duration of the development as well as the Containment Risk Assessment, MP, and CMP. Further information on the format and content of the PPCP can be found in the supplementary guidance to this document.

158. The conditions for the closure of the storage site are required under regulation 8(1)(k) of the Storage Regulations and will be set out in the storage permit. The Licensee should therefore be clear as to the total quantity of CO₂ to be stored and the corresponding reservoir pressure at the time of closure of the storage site.

159. The Licensee should provide a broad outline of the proposed steps for the post-closure period of the storage site including the safe removal of injection facilities and decommissioning of any operational wells that will not be used for post-closure monitoring and submit them to the NSTA as part of the Storage Permit Application. Expected timings in relation to the cessation of injection should be provided while demonstrating how the work will be carried out in a cost-effective way.

160. The planning for well decommissioning should outline the use of appropriate materials in a CO₂ injection environment and use industry good practices at the time which should be updated as experience and knowledge in the safe operation of carbon storage sites matures. The Licensee should

give consideration and justification to any facilities and wells required for monitoring purposes during the post-closure period to assist in demonstrating conformance and containment of CO₂ within the storage site and complex.

161. The proposed Provisional Post-Closure Plan is required under regulation 13 of the Storage Regulations and should outline the monitoring and associated corrective measures required following the closure of the storage site. The Licensee should be aware that, under the Termination Regulations, it will not be able to terminate the CS Licence and hand it over to government unless and until it can demonstrate that (among other things) all available evidence indicates that the stored CO₂ will be completely and permanently contained.

162. The Licensee should base the monitoring and corrective measures requirements in the post-closure period around the expected modelled behaviour of CO₂ throughout the injection phase and the evolution of potential risks and whether the likelihood of the risk events increase or decrease with time. The post-closure MP and CMP will be updated throughout the operational period to reflect any changes to the operational MP and CMP and any deployed corrective measures.

163. The Post-Closure Monitoring Plan should be for a duration of at least 20 years as outlined in regulation 7 of the Termination Regulations, unless the Storage Operator can demonstrate to the NSTA that data-based evidence gathered through monitoring indicates that the stored CO₂ will be completely and permanently stored.

164. The NSTA must approve the proposed provisional post-closure plan before a storage permit can be granted.

viii. Proposal for financial security

165. Before the NSTA can grant a carbon storage permit, the NSTA must be satisfied that sufficient financial security will be in place prior to first injection as set out in the Storage Regulations, to cover (amongst other things) all obligations under the storage permit.
166. The full list of obligations are set out in the Storage Regulations and broadly fall under four categories:
- i. **Obligations under the permit:** including but not limited to monitoring, updating Corrective Measures Plan, decommissioning
 - ii. **Closure and post-closure:** including but not limited to post-closure monitoring, final financial contribution
 - iii. **Paying the NSTA's costs:** including but not limited to funds being available if the NSTA must take corrective measures on behalf of the operator and where NSTA is deemed the Storage Operator
 - iv. **UK ETS:** any obligations under UK ETS, specifically the offset of any emissions due to leakage from the store complex
167. The Licensee must maintain financial security that is of an amount sufficient to ensure that all the obligations can be met and must remain in force until the licence is terminated. The NSTA will assess whether the secured amount of financial security is appropriate in the light of:
- a) The assessed risk of leakage; and
 - b) The estimated costs of meeting the obligations
168. If, following the assessment, the NSTA decides that the secured amount is to be adjusted:
- a) The NSTA will notify the operator of the new amount that is required; and
 - b) Where the secured amount is less than that new amount, the operator must ensure that it is increased to the new amount within three months of receiving that notification
169. If the storage permit is revoked the security must remain in force:
- a) Until a new storage permit is granted; or
 - b) If the storage site is closed following such revocation, until the licence is terminated
170. The amount of financial security maintained in accordance with the provisions of the storage permit for each storage site will be published on the Carbon Storage Public Register in accordance with section 29 of the Energy Act 2008.
171. The NSTA expects Licensees to approach and engage at an early stage to allow the amounts of financial security required to be estimated and to put forward their proposed mechanism(s) for taking security.

Draft Storage Permit Application Review

172. The NSTA will undertake a review of the Licensee's Storage Permit Application documents to determine if the following, amongst other matters, have been demonstrated and evidenced to the NSTA's satisfaction in line with the requirements of the Storage Regulations:

- a) That subsurface characterisation of the proposed storage site and complex and surrounding area is complete and directly informs the Carbon Storage Development Plan, Containment Risk Assessment, MP, and CMP
- b) The viability of the Carbon Storage Development Plan and the necessary justification of such plans
- c) The emissions basis for the development
- d) Under the proposed conditions of use of the storage site, that there is no significant risk of leakage or of harm to the environment or human health
- e) That the methods and technologies to be deployed as outlined in the MP are appropriate for the conclusions of the Containment Risk Assessment and are fit for purpose to confirm:
 - i. Containment of CO₂
 - ii. Identify and quantify significant irregularities or leakage
 - iii. Verify the CO₂ plume behaviour; and
 - iv. Alert where there is an increased risk of leakage
- f) The CMP methods and technologies to be deployed are fit for purpose in preventing or stopping any significant irregularities or leakage events and cover all eventualities identified in the Containment Risk Assessment including contingency plans in the event any deployed corrective measures are not successful
- g) The PPCP is adequately described and acceptable; and
- h) Proposal for financial security

The NSTA may seek independent verification on review of the Storage Permit Application documents. Where the NSTA is not in agreement with the information, analysis, plans, or justifications provided, the NSTA, where appropriate, will advise on any necessary changes which should be implemented by the Licensee before resubmitting. Should the NSTA conclude from its review based on the information and analysis provided, that the Licensee has not demonstrated that there is no significant risk of leakage or of harm to the environment or human health, it will be expected to provide necessary justification and any supporting data and analysis, or a storage permit will not be granted.

Economic assessment

173. The Licensee will be required to submit relevant data for economic assessment to Ofgem for the purposes of an Economic Licence. This data should also be submitted to the NSTA for review at the same time for the purposes of benchmarking.

Net zero evaluation

174. The NSTA considers the emissions contributions of carbon storage developments in the assessment of granting a storage permit. The Licensee must demonstrate, for example among other things, that the following have been considered and evaluated in a proportionate manner from a net zero, technical and/or economic perspective:
- a) What has been considered, incorporated, or rejected to minimise emissions
 - b) Emissions from power, compression, and heating, if required, for the life of operations including any post-closure monitoring operations

- c) Data should be provided on: yearly injection forecasts and emissions intensity; and life of store emissions intensity
- d) Synergies with the offshore renewable sector
- e) A like-for-like comparison of emissions from all development options when determining the solution with the lowest carbon emissions; and
- f) Where projects are not powered from the grid or a local renewable source, a brief description of any provision made to allow future connection to a low carbon power source
- b) Trust – demonstration of trust and empowerment throughout the project lifecycle – clearly identifying functional requirements and subsequently supporting the supply chain to deliver to their contractual commitments without bespoke, restrictive, or client-specific requirements
- c) Innovation – encouragement and fair evaluation for the proposed use of alternative/new products, processes and/or contracting methodologies
- d) Quality – demonstration that historical performance, quality, employment practice and supplier culture is appropriately valued

The Supply Chain Action Plan (SCAP)

175. In the Define Phase, the Licensee should submit its final SCAP. The SCAP should be submitted to the NSTA at the same time as the Draft Storage Permit Application documents. The NSTA updated the SCAP guidance in 2022 taking into account net zero and the North Sea Transition Deal and also contains a template.
176. The SCAP submission should focus on the following criteria as per the NSTA Supply Chain Action Plans Guidance¹⁶ and SE12 – Supply Chain Collaboration and Cooperation. These include:
- a) Engagement – early and sustained engagement with the Licensee's supply chain regarding the specifics of the project, aimed at improving project performance. This may extend to evidence of adoption of any current industry tool kits such as the NSTA Project Pathfinder Portal. GHG emission efficiency objectives should also be included as part of the Licensee's initial engagement with the supply chain
177. Once the final SCAP is submitted, an assessment process will be undertaken by the NSTA. Where the NSTA considers that all four of the above criteria have been addressed satisfactorily, the SCAP will usually be endorsed with no further action.
178. In cases where one or more of the elements are considered not to meet expectations, the NSTA will seek improvement. In cases where improvements cannot be achieved, final endorsement will be withheld pending discussion between the Licensee and the NSTA.
179. There is no prescriptive format for a SCAP document or on how to prepare the required supporting evidence. However, it is preferred that the SCAP should be submitted as a single document where possible and, to aid consistent assessment, SCAPs should normally include as a minimum the following sections:

¹⁶ <https://www.nstauthority.co.uk/media/8359/scap-guidance-august-2022.pdf>

- a) Executive summary
- b) Company overview and contracting policy
- c) Project overview
- d) Evidence of engagement, trust, innovation, and quality

Project Execution Plan (PEP)

180. The Licensee should provide the NSTA with an updated PEP covering the Define Phase and prepare a PEP for the Execute Phase of the project.

Environmental Statement consultation

181. The NSTA cannot grant a storage permit to authorise the use of a place as a storage site until BEIS OPRED (acting on behalf of the Secretary of State) has agreed to the grant of such consent¹⁷.
182. The Licensee should submit a Storage Permit Application to the NSTA and confirm that it will submit, or has submitted, a supporting ES to BEIS OPRED. Relevant parts of the Storage Permit Application should be copied to BEIS OPRED at the same time. Under the 2020 EIA Regulations, all ESs are subject to a period of public consultation during which time any person may submit representations in relation to the proposed project to the Secretary of State. Licensees should bear in mind that the consideration of an ES generally takes several months and can take much longer than this if significant representations are made by any person, or if insufficient information is presented within the ES.

183. Once BEIS OPRED reaches a conclusion on the significant effects of the project on the environment, BEIS OPRED will notify the Licensee (the ‘developer’ in the 2020 EIA Regulations) of the Secretary of State’s decision whether to agree to the grant of consent. If the Secretary of State agrees to the grant of a consent, BEIS OPRED will inform the Licensee of any environmental conditions attached to such agreement. BEIS OPRED will also inform the NSTA of the Secretary of State’s decision.

Marine Licence application

184. If the transportation and facilities development plan includes electrification of carbon storage development infrastructure and a Marine Licence is required, then the Licensee should at this stage be prepared to submit a Marine Licence application which, depending on the location of the proposed carbon storage site, will be to either the MMO, MS, or NRW.

Operator approval

185. Prior to submitting the finalised Storage Permit Application, Licensees are required to appoint a Storage Operator who is technically competent and able to carry on or control the activities at the storage site and requires approval by the NSTA.

¹⁷ [Oil and gas: offshore environmental legislation – GOV.UK \(www.gov.uk\)](https://www.gov.uk/guidance/oil-and-gas-offshore-environmental-legislation), reg 4

Decommissioning security arrangements

186. BEIS OPRED needs to be satisfied that appropriate Financial Security arrangements for decommissioning are in place. The Licensee should engage with BEIS OPRED on this matter and keep the NSTA informed and ensure that the Storage Permit Application contains sufficient detail of post-closure operations and an estimate of the total cost of the post-closure period and the post-transfer costs.

Submit Storage Permit Application

187. Once the process set out in this guidance is complete and the Licensee has formally taken FID, the Licensee may submit the finalised Storage Permit Application. This should be submitted formally by electronic means.

Granting a storage permit

188. A storage permit, if granted, will authorise the use of a place as a storage site for CO₂. This will grant authorisation for the approved Storage Operator to proceed with both the construction of facilities and other infrastructure, and the injection of a CO₂ stream consisting overwhelmingly of carbon dioxide into the Storage Site, subject to the terms and conditions set out in the storage permit, which may be updated and amended from time to time.

189. The storage permit will be granted for the development plan as outlined in the Storage Permit Application; however, the Storage Operator must continue to engage with the NSTA as the project is executed.

190. For all storage sites, the limits for injection rates and pressures will be set out in the storage permit. These will usually be based on the proposed maximum and minimum cases as stated in the Storage Permit Application. Licensees should, however, note that the NSTA cannot issue a storage permit with maximum injection and pressure limits that exceed those set out in the Secretary of State's agreement to the grant of a storage permit.

191. It is the Licensee's responsibility to ensure it has obtained all other required regulatory approvals.

Execute Phase requirements

192. The agreed Storage Permit Application and PEP will be implemented during the Execute Phase of the project. At this stage, the Licensees have committed to proceed with the development and the NSTA has granted a storage permit. The purpose of this phase is for the approved Storage Operator to execute all required activities (e.g., well construction, engineering, procurement, construction, commissioning/start-up etc.) and to deliver the project objectives.
193. The NSTA's expectations during this phase are set out below. The end of Execute Phase will be regarded as first injection of CO₂.

Monitor project execution

194. The agreed Storage Permit Application and PEP will include a project schedule including major decision points and milestones. As part of the PEP the Storage Operator should also discuss and agree an engagement plan with the NSTA. During the Execute Phase, progress against the project schedule should be monitored and deviations from the planned schedule should be reported to the NSTA.

Pipeline Works Authorisation

195. Pipeline Works Authorisation¹⁸ ('PWA') apply to carbon storage development and will not usually be issued until after the storage permit has been granted. The NSTA has published separate guidance on the PWA process¹⁹.
196. A PWA or variation should be in place before any pipeline or pipeline system construction or modification works begins. Before submitting a PWA application, the NSTA recommends that the pipeline owner (or prospective owner) contacts the NSTA, BEIS OPRED and the HSE at the earliest possible opportunity, to discuss the proposed scheme and the applicable regulatory requirements.
197. Where there are no objections, it normally takes approximately four to six months from receipt of a satisfactory application to issuing a PWA. In the case of pipelines in respect of which an ES is required under the 2020 EIA Regulations, the process may take longer. Storage Operators must, therefore, submit PWA applications at least four to six months before construction begins.

¹⁸ [North Sea Transition Authority \(NSTA\): Pipeline Works Authorisations – Consents – Licensing](#)

¹⁹ [North Sea Transition Authority \(NSTA\): Guidance – Regulatory](#)

Compliance with the approved storage permit

198. Once a storage permit has been granted, the Licensee must comply with the conditions set out in it, including but not limited to compliance with the actions set out in the MP and CMP, total quantity of CO₂ to be stored, maximum injection rates and pressures. Should the Licensee wish to propose any amendments to the storage permit then it must promptly inform the NSTA of such proposals. Any amendments to the storage permit require NSTA approval.
199. If proposing any amendment to the storage permit, the Storage Operator should contact BEIS OPRED for further information to understand what may be required under the 2020 EIA Regulations.
200. The Licensee should be aware of the enforcement powers in connection with CS Licences, including those set out under Chapter 3 of the Energy Act 2008 which include certain offences relating to CS Licences.

Reporting

201. Reporting obligations are outlined in paragraph 3, schedule 2 of the Storage Regulations. The NSTA may request additional data to that stated in the Storage Regulations and at a more frequent reporting period, particularly early on in the carbon storage development but will notify the Storage Operator of these requirements.

Financial Security (come into effect)

202. Prior to the commencement of injection, the NSTA must be satisfied that the financial security will in fact be in place at the point of first injection and that it will cover all the applicable obligations as set out under the Storage Regulations.

Extraction of stored CO₂

203. As outlined in schedule 1, paragraph 5 of the Storage Regulations the Storage Operator must not (and must not permit any other person to) extract stored CO₂ from the storage site except with the prior written consent of the NSTA and in accordance with any conditions subject to which any such consent is given.

Definition of terms

1. In this guidance the following expressions have the meanings as given by the Storage Regulations:

CO₂	Carbon dioxide
Injection	Injection of CO ₂ into a storage site
Legislation	Legislation in force in the United Kingdom (whether passed, or made, before or after the commencement of these Regulations).
the Directive	Directive 2009/31/EC of the European Parliament and of the Council of 23 April 2009 on the geological storage of carbon dioxide.
Storage permit	A consent granted under a licence, authorising the use of a place as a storage site.
Licensed area	The area within which activities are authorised under the licence.

2. The following expressions are as provided by the Storage Regulations and have the meanings given by Article 3 of the Directive (and cognate expressions are to be construed accordingly):

Closure	Definitive cessation of CO ₂ injection into that storage site.
Corrective measures	Any measures taken to correct significant irregularities or to close leakages in order to prevent or stop the release of CO ₂ from the storage complex.
CO₂ plume	Dispersing volume of CO ₂ in the geological formation.
CO₂ stream	A flow of substances that results from CO ₂ capture processes.
Exploration	Assessment of potential storage complexes for the purposes of geologically storing CO ₂ by means of activities intruding into the subsurface such as drilling to obtain geological information about strata in the potential storage complex and, as appropriate, carrying out injection tests in order to characterise the storage site.
Hydraulic unit	A hydraulically connected pore space where pressure communication can be measured by technical means and which is bordered by flow barriers, such as faults, salt domes, lithological boundaries, or by the wedging out or outcropping of the formation.
Leakage	Any release of CO ₂ from the storage complex.
Migration	Movement of CO ₂ within the storage complex.
Significant irregularity	Any irregularity in the injection or storage operations or in the condition of the storage complex itself, which implies the risk of a leakage or risk to the environment or human health.
Significant risk	A combination of a probability of occurrence of damage and a magnitude of damage that cannot be disregarded.
Storage complex	Storage site and surrounding geological domain which can have an effect on overall storage integrity and security; that is, secondary containment formations.
Storage site	A defined volume area within a geological formation used for the geological storage of CO ₂ and associated surface and injection facilities.
Substantial change	Any change not provided for in the storage permit, which may have significant effects on the environment or human health.

Annex A – Carbon Storage Permit Operator Guidelines

Purpose of these guidelines

These guidelines are provided to assist companies who wish to become a carbon storage permit operator (**'Storage Permit Operator'**) under a Carbon Dioxide Appraisal and Storage Licence (**'CS Storage Licence'**). A Storage Permit Operator is defined in The Storage of Carbon Dioxide (Licensing etc.) Regulations 2010¹ (the **'CS Licensing Regs'**) as follows: *'in relation to a storage permit, means the person who carries on or (where different) controls activities at the storage site'*. This role is separate to the Exploration Operator under the CS Storage Licence, guidance on which is set out in the NSTA's *Guidance on the application for a Carbon Dioxide Appraisal and Storage Licence*.²

These guidelines are designed to help companies understand the information that the NSTA will require to consider a Storage Permit Operatorship Application. The NSTA will consider whether an entity satisfies the requirements of Storage Permit Operator on a case-by-case basis. However, prospective Storage Permit Operators should be aware of the following significant responsibilities, and differences with the petroleum regime, attached to the Storage Permit Operator:

- Storage Permit Operatorship carries a significant number of financial, operational, and legal obligations under the storage permit³
- The obligations and requirements placed on a Storage Permit Operator, and the prevailing regime, are different to those of a Petroleum Field Operator
- In light of the requirements of the related economic licence required under the regulatory regime for carbon dioxide transport and storage networks (the **'Economic Licence'**) – in particular, the ring-fencing conditions of that licence – the Storage Permit Operator may be a separate, newly established Incorporated Joint Venture or other Special Purpose Vehicle (**'IJV/SPV'**) rather than part of an established company
- Under the UK offshore oil and gas regime, typically there are multiple entities with a participating interest in a field but only one is the Petroleum Field Operator. Whereas in the emerging UK offshore carbon storage regime, it is expected that the Storage Permit Operator may be the IJV/SPV itself rather than one of the established shareholders

¹ See s. 1(3) definition of "operator" – [The Storage of Carbon Dioxide \(Licensing etc.\) Regulations 2010 \(legislation.gov.uk\)](https://www.legislation.gov.uk)

² [Guidance on the application for a Carbon Dioxide Appraisal and Storage Licence \(nstaauthority.co.uk\)](https://www.nsta.co.uk)

³ See s. 1(3) definition of "storage permit" – [The Storage of Carbon Dioxide \(Licensing etc.\) Regulations 2010 \(legislation.gov.uk\)](https://www.legislation.gov.uk)

Application of these guidelines

The guidelines are applicable to those who wish to apply to the NSTA to become a Storage Permit Operator under a CS Storage Licence selected as a Track-1 cluster under the Government's Carbon Capture, Usage and Storage ('**CCUS**') cluster sequencing process⁴. They do not, and should not be taken to, indicate how the NSTA will evaluate Storage Permit Operatorship in the future.

General guidance

The prospective Storage Permit Operator must be a Licensee under the CS Storage Licence.⁵ To be approved by the NSTA as a Storage Permit Operator, a company must demonstrate that the prospective Storage Permit Operator understands and can satisfactorily fulfil their obligations under the storage permit, specifically as set out in the CS Licensing Regs. These include, but are not limited to, the prospective Storage Permit Operator being able to:

- Demonstrate technical competence (including in the operation of an environmental management system)
- Have an appropriate programme of training and development for staff
- Reliably carry out the functions of a Storage Permit Operator
- Fulfil responsibilities set out in the storage permit with respect to monitoring of the injection facilities and storage complex (and, where appropriate, the surrounding environment), reporting of leakages and significant irregularities and the carrying out of corrective measures

- Manage the development of ongoing storage site operations, as well as complying with the obligations and provisions of the storage permit
- Demonstrate financial soundness
- Maintain the financial security as required under the CS Licensing Regs (such security must remain in place until the CS Storage Licence is terminated)

Senior staff at the entity applying to be the Storage Permit Operator must demonstrate their ability to give leadership to their teams and be supported in this by an effective management structure and system, and an established group of experienced, skilled staff. The Storage Permit Operator would normally be expected to demonstrate the skills and experience gained from comparable projects and developments elsewhere, either carbon storage and/or hydrocarbon production. A substantial use of contracted staff, including those covered by a Service Level Agreement with an affiliate of the Storage Permit Operator, would need to be justified, and the Storage Permit Operator would need to demonstrate the specialist knowledge and skills to manage and lead these successfully.

It should be noted that approval is on a permit-by-permit basis, i.e., it should not be assumed that where an entity is approved to be the Storage Permit Operator under one storage permit that it will be automatically approved under any additional storage permits.

⁴ <https://www.gov.uk/government/publications/cluster-sequencing-for-carbon-capture-usage-and-storage-ccus-deployment-phase-1-expressions-of-interest/october-2021-update-track-1-clusters-confirmed>

⁵ See Reg 8 of the CS Licensing Regs

Technical competence

The operatorship of a storage site requires a very high level of technical competence given the emerging nature of the industry in the UK and the associated challenges of developing an industry of this kind. The proposed technical staff structure should be described carefully, specifically the role of any contractors in the decision-making process. It is crucial that Storage Permit Operators maintain sufficient in-house staff to clearly understand and supervise key storage site and associated infrastructure issues, and to direct overall storage site activities. The NSTA will need to understand the rationale for choosing external expertise over in-house competence, with operators being able to demonstrate the relationship they have with external companies.

The NSTA is aware that given the nature of a carbon store's lifecycle, the company ownership structure of the entity holding the CS Storage Licence and/or the proposed Storage Permit Operator might look different at the time of any storage permit award compared to commencement of injection and site closure, particularly given the expected length of time between such licence events. Therefore, the Storage Permit Operator should engage with the NSTA to understand what the technical competency requirements are at key CS Storage Licence milestones. UKCS operatorship experience of key technical staff should be described, as should any staff's carbon storage experience elsewhere in the world.

Storage Permit Operators are required to have in place an appropriate programme of professional and technical development and training for their staff. The NSTA considers that this should extend to any seconded or contractor staff. The details of this programme and its objectives should be presented as part of the Storage Permit Operatorship Application.

Governance

The prospective Storage Permit Operator will need to demonstrate its independence in carrying out or controlling the activities at the storage site, including acting promptly to meet the requirements of the storage permit and the applicable law and regulations, as well as cooperating with the NSTA on such regulatory matters in a timely fashion. The Storage Permit Operator should identify which corporate governance code they intend to comply with. The NSTA's current guidance on corporate governance for offshore oil and gas licensees should be referred to⁶ as the principles are equally applicable to carbon storage.

Good corporate governance is essential to a company's success, and to that end the NSTA would expect an appropriate balance of non-executive and independent non-executive directors ('**NEDs**') to be on the IJV/SPV board to ensure that no one individual or small group of individuals dominates the board's decision making. Independent NEDs can provide constructive challenge, foster independent decision making and mitigate potential conflicts of interest. This is expected to be equally important where the prospective Storage Permit Operator is structured as an IJV/SPV; understanding the Shareholder Agreement and/or other governance documents will be important in this regard.

The 'fitness' of Licensees and other persons connected with Licensees is critical to the NSTA's statutory duties and objectives. Directors of the CS Storage Licensee and Storage Permit Operator and individuals involved in the management of the CS Storage Licensee and Storage Permit Operator, as well as those who control such Licensee and Storage Permit Operator, must have knowledge of, and comply with, the NSTA's requirements as to 'fitness'.

⁶ [OGA Governance Guidance \(nstaauthority.co.uk\)](https://www.nsta.gov.uk/governance-guidance)

Prospective Storage Permit Operators should refer to the *NSTA's general approach to assessing the 'fitness' of Licensees, Directors of Licensees, and individuals involved in the management of Licensees; and of those who control Licensees*⁷.

Shareholder disputes can sometimes act as an obstacle to timely compliance with regulatory and legal obligations, or the smooth running of operations. Therefore, the proposals for storage permit management by the Storage Permit Operator should be outlined with specific reference to how this is dealt with (e.g., in a Shareholder's Agreement). This information is particularly important given the developing nature of the carbon storage industry, and in this case the management arrangements (including, but not limited to, the proposed regularity of Operating Committees ('**OPCOMS**') and Management Committees ('**MANCOMS**')) should be explicitly set out.

Financial soundness and financial security

The NSTA will undertake a financial review as part of the Storage Permit Application. For more information relating to Storage Permit Operator financial soundness and financial security requirements, please contact licensee.finance@nstauthority.co.uk.

Environmental management

The technical competence of the Storage Permit Operator includes the development, maintenance, and operation of an environmental management system suitable for the operations to be undertaken throughout the lifecycle of the store.

Other regulators

The NSTA is not the only regulator who has an interest in offshore carbon storage. It will be the Storage Permit Operator's responsibility to ensure that all necessary licences and approvals are sought from the relevant regulators and other bodies. This includes, but is not limited to, Ofgem, the Health and Safety Executive, The Crown Estate, Crown Estate Scotland, the Department for Energy Security and Net Zero, and the Offshore Petroleum Regulator for Environment and Decommissioning.

The NSTA is aware that the Economic Licence will place obligations on the transport and storage company ('**T&SCo**', i.e., the entity which we expect to apply as Storage Permit Operator) to act in a certain way, and appoint individuals into roles; these obligations could have an impact on any storage permit granted by the NSTA. The NSTA will require the Storage Permit Operator to set out how this will work in relation to the storage permit obligations on the T&SCo and the requirements set out above and under applicable law. In the unlikely event that the T&SCo considers that the obligations under the Economic Licence might potentially conflict with its obligations under the CS Storage Licence or Storage Permit, it should inform the NSTA as part of the application for a storage permit.

⁷ [OGA's general approach to assessing the 'fitness', Directors and individuals involved in the management of Licensees; and of those who control Licensees \(nstauthority.co.uk\)](#)

Detailed information requirements

There is no specific format in which the information for a Storage Permit Operator Application should be provided, and in some cases, only a subset of the information listed below will be required depending on the specific circumstances of each case. It is recommended that companies discuss the NSTA's specific requirements before starting the process. An application to become a Storage Permit Operator should be sent to approvals@nstauthority.co.uk and will generally form part of the Storage Permit Application. An application should include contact details for the person responsible for the application from the prospective Storage Permit Operator.

1. Charts showing the proposed management structure of the company submitting the application, to include the organisation, responsibilities, reporting lines and current post-holders of the proposed operating team for carrying out all the responsibilities of the Storage Permit Operator, including their office location. The location of the registered office with telephone and contact email addresses should be provided. For multinational companies, the hierarchy of decision-making responsibility between the UK affiliate and head-office should be clearly explained. If an IJV/SPV will be the prospective Storage Permit Operator, the hierarchy of decision-making responsibility between the IJV/SPV and the individual shareholders should be clearly explained including with reference to the Shareholder's Agreement, the Company's Articles of Association, the corporate governance code which it will apply, and any other relevant documents.
2. The charts should identify which individuals are responsible for facilities engineering, store management, drilling, supply services, maintenance, monitoring (including any reporting, updating or other requirements in connection with the Monitoring Plan as defined in the CS Licensing Regs), corrective measures (including any reporting, updating or other requirements in connection with the Corrective Measures Plan as defined in the CS Licensing Regs), closure and post-closure (including any reporting, updating or other requirements in connection with the Provisional and/or final Closure and Post-Closure Plan as defined in the CS Licensing Regs), the Project Execution Plan, maintenance of Financial Security, ongoing net zero considerations, data, reporting to the NSTA. If there will be different persons responsible for reporting to other Regulators this should be included too, for example on matters of health and safety, emergencies and environmental matters. As set out above, the NSTA is aware that the company structure of the prospective Storage Permit Operator might potentially look different at any permit award compared to commencement of injection of CO₂, therefore, the prospective Storage Permit Operator should clearly set out a timeline of how the organisation will grow to cover the different responsibilities and notify the NSTA promptly of any such changes to what has been set out.

3. Details of the numbers and disciplines of the personnel employed by the prospective Storage Permit Operator in each of the key areas of management and operating responsibility, and the basis on which they are employed (e.g., permanent staff or contract) is required. This should include, but is not limited to, those with responsibility for managing:
 - a) The Monitoring Plan
 - b) The Corrective Measures Plan
 - c) The Storage Site Management Plan
 - d) Reporting and notification of leakages and significant irregularities
 - e) General reporting and notification obligations under the CS Regs
 - f) The acceptance and injection of CO₂
 - g) The Carbon Storage Development Plan
 - h) Project Execution Plan
 - i) Onshore and offshore metering
 - j) Ongoing net zero considerations of storage permit activities
 - k) Financial security
 - l) The Supply Chain Action Plan
 - m) Community engagement
 - n) All data reporting requirements
 - o) Decommissioning
4. Curricula vitae of executive directors and all key management of the prospective Storage Permit Operator, giving full details of their technical background, skills (including leadership and management), and previous experience and, where appropriate, their experience to date on the current storage site.
5. If there are any current vacancies in key posts in the management structure and operating team, a statement of what action is in hand to fill them and what arrangements are being made to provide the necessary expertise pending recruitment of suitable personnel.
6. The process by which the company will manage all of their ongoing legal and regulatory obligations in relation to reporting and keeping the NSTA updated on store activities should be described.
7. An explanation of the quality management standards the company will apply in all aspects of operating the development of the store and how contractors undertaking construction, maintenance and operations activities will be audited. The allocation of duties between in-house and external providers of store management services should be clearly explained, including the chain of responsibility and decision-making matrix.
8. The environmental management system the company will use for its store operations and how this is suitable in meeting the storage permit obligations should be described, as well as any staff experience of managing such systems in the hydrocarbon or other sectors.

9. The proposed business process (e.g., regularity of OPCOMS and MANCOMS, and the procedures for dealing with partner or shareholder disputes) should be described.
10. A detailed statement of the financial resources available to the prospective Storage Permit Operator (and where appropriate its parent company or owners) to ensure the storage site will be appropriately managed; this will usually be provided as a separate document in accordance with the NSTA's carbon storage financial guidance.
11. A list of current UKCS carbon storage licence interests should be provided. If the prospective Storage Permit Operator will be an IJV/SPV, this should be the licence interests of all shareholders in the IJV/SPV.
12. For companies already operating carbon stores outside the UKCS: a list of carbon stores worldwide (onshore and offshore) which have been or are currently being operated; and for each of the stores a brief explanation of how these stores have performed against original expectations. If the prospective Storage Permit Operator will be an IJV/SPV, this should include carbon stores associated with all shareholders in the IJV/SPV.
13. Companies with no previous carbon storage permit operator experience should provide details of any UKCS or worldwide hydrocarbon operating experience their staff have that they consider is relevant to becoming a carbon storage permit operator on the UKCS.
14. A description of the company's in-house capabilities in store and facilities management, and, if these are not self-sufficient, what external resources are available/utilised to supplement these capabilities. A statement of the company's policy towards the professional and technical development and training of its staff, secondees and contractors, including formal internal or outside training programmes and other ways of ensuring that staff are kept up to date in their specialist subject(s).
15. The Storage Permit Operator should indicate how they will keep abreast of the latest technology developments and where appropriate how they will deploy these across their operations throughout the lifecycle of the project.
16. A statement of the company's store management philosophy. What internal audits (i.e., Competent Person's Report) will be carried out on the store development programme(s) and their frequency, and the store's capacity and efficiency in line with the SRMS framework.
17. A statement of the facilities operations and maintenance strategy that the company would expect to adopt.
18. A list of the extent of the company's current engagement with industry trade associations, such as Offshore Energies UK, Carbon Capture and Storage Association, etc., and involvement in industry and government CCS working groups.

Notes

Items 1-5: Company structure

We consider a management structure showing clear lines of responsibility and clear processes for store management to be essential. The NSTA will normally look for a strong store management team with key operations based in the UK and the minimum of vacancies in key positions.

Item 6-7: Management system

The responses to these items on the checklist should describe how the prospective Storage Permit Operator will manage the store in practice, clearly describing the division of responsibility between the company's own staff, those covered under a Service Level Agreement with an affiliate of the Storage Permit Operator, and contractors if the latter are employed. The NSTA generally supports the growth of alliancing on the UKCS as a way of reducing the burden on operators and placing responsibility where the best expertise lies provided the essential responsibilities of the operator are maintained, although this will need to be considered given the nascent nature of the industry. Prospective Storage Permit Operators will need to demonstrate how they will ensure that any contractors employed have and will maintain appropriate levels of competence and standards and how the operator will manage communications, leadership, and delegation of responsibility. These procedures should look to recognise management and auditing standards. The arrangements for handling emergency situations should be clearly explained. The NSTA's experience under the petroleum regime shows that lack of partner/shareholder alignment can seriously hinder project development. The Storage Permit Operator is responsible for managing the development and ongoing store site operations and complying with the obligations and provisions of their storage permit and other applicable

UK legislation. The Storage Permit Operator should demonstrate how they will continue to involve all shareholders or other parties with an interest in the store in the continuing store development.

Item 8: Environmental management system

Inclusion of an appropriate ISO standard (ISO 14001). The Storage Permit Operator should explain its staff's experience in managing such systems.

Item 12-13: Worldwide carbon storage and UKCS hydrocarbon operating experience

Companies should draw on any carbon storage operating experience overseas and UKCS operating experience of their staff to demonstrate a track record of effective store management. For an IJV/SPV this should be experience associated with all shareholders in the IJV/SPV.

Item 14: Training and technical competence

Well-trained staff are essential for effective operatorship of a UKCS store. Any formal training standards that the prospective Storage Permit Operator has adopted (e.g., "Investors in People" standard) should be noted here as well as the way in which the prospective Storage Permit Operator will establish such standards in contractors. The CS Licensing Regs place certain obligations on the Storage Permit Operator regarding technical competence and development, and the prospective Storage Permit Operator should clearly state how their training of staff and contractors will meet these obligations.

Item 15: Store management resources

This item seeks more detail on the technical resources available to the prospective Storage Permit Operator. The prospective Storage Permit Operator's own analysis of the potential of the store, as per the Storage Permit Application, should also be explained.



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