Australian Government
Department of Industry, Science and Resources

Offshore Greenhouse Gas Guideline for Declaration of Identified Greenhouse Gas Storage Formation (including under a Cross-boundary Greenhouse Gas Assessment Permit) and Notification of an Eligible Greenhouse Gas Storage Formation

In relation to the *Offshore Petroleum and Greenhouse Gas Storage Act 2006*

Effective 11 August 2021

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This document is available online at www.nopta.gov.au.

Contents

1. Overview

1.1. The purpose of this guideline is to assist titleholders in lodging applications for the declaration of identified greenhouse gas (GHG) storage formations and related matters under the *Offshore Petroleum and Greenhouse Gas Storage Act 2006* (the OPGGS Act) and the Offshore Petroleum and Greenhouse Gas Storage (Greenhouse Gas Injection and Storage) Regulations 2011 (the Regulations).

1.2. The declaration of an identified GHG storage formation provides the mechanism for transition from a GHG assessment permit (including a cross-boundary GHG assessment permit) to a GHG holding lease or GHG injection licence following the identification of an eligible storage formation.

1.3. This guideline outlines the expectations and policies of the responsible Commonwealth Minister (RCM) in respect to the following applications and notifications under the OPGGS Act:

- notification of eligible GHG storage formation: subsections 451, 451A (cross-boundary) and 451B (consolidation of two Commonwealth GHG assessment permits)
- declaration of identified GHG storage formation: section 312 and 312A (cross-boundary)
- variation of declaration of identified GHG storage formation: section 313
- revocation of declaration of identified GHG storage formation: section 314

1.4. Potential applicants or persons who are required to provide a notification to the RCM should engage with the National Offshore Petroleum Titles Administration (NOPTA) early in the process if they are unsure of their responsibilities under the OPGGS Act or requirements for making an application (see Schedule 1 of the Regulations).

2. The storage formation

2.1. A storage formation must be deemed capable of permanently storing an injected GHG substance. In this context, permanent storage is considered as storage over geological timeframes. As well as geological factors the size or spatial extent of a storage formation also depends on factors under the control of a GHG titleholder including, in particular, the amount of GHG substance to be injected, the rate of injection, the period over which injection is to take place and the location of injection points. Section 21 of the OPGGS Act terms these factors as 'fundamental suitability determinants' (see section 3 of this guideline). A single geological formation may contain multiple storage formations, spatially separate from each other.

2.2. The OPGGS Act establishes three categories of GHG storage formation (potential, eligible and identified) reflecting a titleholder's and the RCM's degree of technical understanding of the formation. The following expands on these categories in more detail.

2.3. The declaration of a storage formation as an 'identified GHG formation' is a critical step in establishing the technical viability of a potential storage site for GHG injection and storage operations. Before an application can be made for a GHG holding lease or GHG injection licence one or more identified GHG storage formations must be declared to be wholly situated within the relevant title area: subsections 324, 330, 343, 361, 369 of the OPGGS Act; or a cross-boundary GHG holding lease or cross-boundary GHG injection licence: subsections 329A, 335A, 368A of the OPGGS Act.

2.4. A declaration of an identified GHG storage formation retains its significance over the whole life of the GHG storage project. This is because the injection and storage activities to be

carried out under an injection licence need to be consistent with certain parameters specified in the declaration, such as the fundamental suitability determinants, integrity of the storage formation and plume migration modelling.

Potential GHG storage formation

2.5. A 'potential GHG storage formation' is a part of a geological formation, where that part is suitable, with or without engineering enhancements, for the permanent storage of a GHG substance: subsection 20(1) of the OPGGS Act. This may reflect a titleholder's understanding of the formation based on existing field data, new or reprocessed seismic interpretation, and foreseeable technological developments. Further detailed analysis of the 'potential' formation is necessary before the titleholder can notify the RCM (sections 451 and 451A of the OPGGS Act) that they have a reasonable suspicion that part of a geological formation within a relevant title area could be an eligible GHG storage formation (see Appendix A of this guideline).

Eligible GHG storage formation

2.6. An 'eligible GHG storage formation' is a part of a geological formation that is suitable, with or without engineering enhancements, for the permanent storage of a particular amount (at least 100,000 tonnes) of a GHG substance, injected at a particular point(s) over a particular period of time: subsections 21(1) - (2) of the OPGGS Act.

Notification of an eligible GHG storage formation (general and cross-boundary)

2.7. Section 451 of the OPGGS Act requires a GHG titleholder to inform the RCM (through NOPTA) within 30 days of developing reasonable grounds to suspect that a part of a geological formation that is wholly situated within a GHG title area[1] could be an 'eligible GHG storage formation'. The notification is not required to set out the fundamental suitability determinants, but must be accompanied by a written statement that the titleholder has reasonable grounds to suspect that the part of the geological formation is suitable for the permanent storage of a specified amount of a specified GHG substance: subsection 451(5) of the OPGGS Act.

2.8. If the GHG titleholder has reasonable grounds to suspect that the part of the geological formation could be an eligible GHG storage formation with engineering enhancements, the notification must be accompanied by a written statement describing the engineering enhancements: subsection 451(6) of the OPGGS Act.

2.9. Notification to the RCM (as described in paragraph 2.5) is not required where a former titleholder of the permit, lease or licence has previously complied with subsections 451(2), (5) - (6) of the OPGGS Act in relation to that part of the formation: subsection 451(7) of the OPGGS Act.

2.10. Under section 451A of the OPGGS Act, the holder of a GHG assessment permit[2] who is also the holder of a State/Territory GHG assessment title may write to inform the RCM (through NOPTA) that:

- at least one block of the GHG assessment permit area has a side in common with at least one block of the State/Territory GHG assessment title; and

1 - A GHG title area includes references to a GHG assessment permit, a GHG holding lease and/or a GHG injection licence

2 - The following guideline will assist applicants to lodge applications to unify adjacent greenhouse gas assessment permits – Offshore Greenhouse Gas Guideline for Unified (Consolidated and Cross-boundary) Greenhouse Gas Assessment Permits.

- a part of a geological formation is wholly situated within the area that consists of the combination of both the GHG assessment permit area and the State/Territory GHG assessment title area; and

- the part of the geological formation extends to the permit area of the GHG assessment permit and to the relevant area of the State/Territory GHG assessment title; and

- the GHG permittee has reasonable grounds to suspect that the part could be an 'eligible GHG storage formation'.

2.11. The notification under section 451A of the OPGGS Act is not required to set out the fundamental suitability determinants (section 451A(3) of the OPGGS Act), but must be accompanied by a written statement that the permittee has reasonable grounds to suspect that the part of the geological formation is suitable for the permanent storage of a specified amount of a specified GHG substance: subsection 451A(5) of the OPGGS Act.
The notification is a prerequisite to an application for the grant of a cross-boundary GHG assessment permit (subsection 307A(1)(d) of the OPGGS Act).

2.12. However, if the permittee has reasonable grounds to suspect that the part of the geological formation could be an eligible GHG storage formation with engineering enhancements, the notification must be accompanied by a written statement describing the engineering enhancements: subsection 451A(6) of the OPGGS Act.

2.13. Under subsection 451B(2) of the OPGGS Act, the holder of two work-bid GHG assessment permits may write to inform the RCM (through NOPTA) that:

- at least one block of the area of one of the GHG assessment permits has a side in common with at least one block of the other GHG assessment permit; and

- a part of a geological formation is wholly situated within the area that consists of the combination of both of the GHG assessment permits; and

- the part of the geological formation extends to the permit area of each of the GHG assessment permits; and

- the GHG permittee has reasonable grounds to suspect that the part could be an 'eligible GHG storage formation'.

The notification is a prerequisite to an application for the grant of a consolidated work-bid GHG assessment permit. The notification under section 451B of the OPGGS Act is not required to set out the fundamental suitability determinants (subsection 451B(3) of the OPGGS Act), but must be accompanied by a written statement that the permittee has reasonable grounds to suspect that the part of the geological formation is suitable for the permanent storage of a specified amount of a specified GHG substance: subsection 451B(5) of the OPGGS Act.

2.14. However, if the permittee has reasonable grounds to suspect that the part of the geological formation could be an eligible GHG storage formation with engineering enhancements, the notification must be accompanied by a written statement describing the engineering enhancements: subsection 451B(6) of the OPGGS Act.

Identified GHG storage formation

2.15. An 'identified GHG storage formation' is an eligible GHG formation that is declared by the RCM as an identified GHG storage formation under subsection 312(11) of the OPGGS Act or subsection 312A(11) of the OPGGS Act (cross-boundary).

2.16. If a GHG titleholder, or the holder of a petroleum retention lease or petroleum production licence, has reasonable grounds to believe that a part of a geological formation wholly situated in the title area is an eligible GHG storage formation, the titleholder may apply to the RCM to declare the part of the storage formation as an 'identified GHG storage formation': subsections 312(1) and (2) of the OPGGS Act.

2.17. If a cross-boundary GHG assessment permit holder has reasonable grounds to believe that:

- a part of a geological formation is an eligible GHG storage formation; and
- the part is wholly situated in the permit area; and
- the part of the geological formation extends to the permit area of the precursor GHG assessment permit and the relevant area of the precursor State/Territory GHG assessment title,

and there is no identified GHG storage formation wholly situated within the permit area of the precursor GHG assessment permit or precursor State/Territory GHG assessment title then the assessment permit holder may apply to the RCM to declare the part of the storage formation as an 'identified GHG storage formation': subsections 312A(1) and (2) of the OPGGS Act.

2.18. The application requirements are the same for all GHG titles, including cross-boundary (see section 4 of this guideline).

2.19. It is possible to have a second or subsequent identified GHG storage formation declared in the area of a GHG assessment permit (including a cross-boundary GHG assessment permit), a GHG holding lease (including a cross-boundary GHG holding lease, a GHG injection licence (including a cross-boundary GHG injection licence), a petroleum retention lease or a petroleum production licence, provided each part of the eligible geological formation is wholly situated within the title area. The RCM's declaration will be in accordance with the requirements set out in section 312 of the OPGGS Act.

3. Fundamental suitability determinants

3.1. In applying for a declaration of identified GHG storage formation the titleholder must set out the fundamental suitability determinants (subsections 312(3)(b)(i) and 312A(3)(b)(i) of the OPGGS Act). For an eligible storage formation, fundamental suitability determinants have the meaning given by subsection 21(8) of the OPGGS Act. The following are the fundamental suitability determinants of an eligible GHG storage formation:

- the amount of GHG substance that may be stored, noting that it must be at least 100,000 tonnes: subsections 21(1) - (2) of the OPGGS Act
- the particular GHG substance for which the storage formation is suitable to store
- the proposed injection point or points
- the proposed injection period
- the engineering enhancements (if any) required
- the effective sealing feature, attribute or mechanism of the storage formation that enables permanent storage.

3.2. It is expected that the titleholder will have analysed and described the geological features of the storage formation in sufficient detail to allow accurate definition of the fundamental suitability determinants.

4. Applying for a declaration of an identified GHG storage formation (including cross-boundary)

4.1. A titleholder may apply to the RCM for the declaration of a part of a geological formation as an identified GHG storage formation if they have reasonable grounds to believe that a part of a geological formation is an eligible GHG storage formation and that part is wholly situated in the title area: subsections 312(1) and 312A(1) of the OPGGS Act.

4.2. The information contained in the application must satisfy the RCM that the applicant's understanding of the geological environment is sufficient to allow the applicant to identify all risks relating to the integrity of the identified storage formation. The applicant's understanding is expected to be based on relevant, high-quality data.

4.3. Detail on the information that needs to be included in an application is set out in Schedule 1 of the Regulations, and summarised in Appendix A of this guideline. See Appendix B of this guideline for suggested further information to support an application for a declaration of identified storage formation.

4.4. In summary, and in accordance with subsections 312(3)(a)-(c) and 312A(3)(a)-(c) of the OPGGS Act, the application must detail, with supporting information, the following:

- the reasons for believing that a part of a geological formation is an eligible GHG storage formation
- the fundamental suitability determinants of the proposed 'eligible GHG storage formation' (see section 3 of this guideline)
- an estimate of the spatial extent of the proposed 'eligible GHG storage formation' (an estimate of spatial extent must comply with the requirements specified in Schedule 1, Part 4 of the Regulations)
- such other information (if any) as is specified in the Regulations.

4.5. The RCM can require the applicant to give further information, or to carry out further analysis of information contained in the application: subsections 312(5) and 312A(5) of the OPGGS Act. If the applicant fails to provide the further information or analysis, the RCM may refuse to progress the application: subsections 312(6) and 312A(6) of the OPGGS Act.

4.6. If the RCM is satisfied that using the fundamental suitability determinants set out in the application:

- a part of a geological formation is an eligible GHG storage formation; and
- the estimate of the spatial extent set out in the application is a reasonable estimate of the spatial extent of the eligible GHG storage formation

the RCM must, by writing:

- declare that part of a geological formation to be an identified GHG storage formation
- declare the spatial extent of the identified GHG storage formation is the spatial extent estimated in the application

- declare that the fundamental suitability determinants specified in the application are the fundamental suitability determinants of the identified GHG storage formation.

4.7. If an application has been lodged, the RCM must, by writing, advise of refusal to declare an identified GHG storage information if the RCM is not satisfied that:

- a part of a geological formation is an eligible GHG storage formation; and/or
- the estimate of the spatial extent set out in the application is a reasonable estimate of the spatial extent of the eligible GHG storage formation.

Timing

4.8. Under regulation 2.2, Part 2 of the Regulations, the RCM is required, within 20 days after receiving an application for a declaration of an identified GHG storage formation, to give the applicant a notice setting out a proposed timetable for the consideration of the application. The timetable is not binding on the RCM and may be changed, depending on the circumstances, to ensure that the application will be considered fairly.

4.9. Given the detailed level of analysis that is required by both NOPTA and the RCM in assessing an application of this type, it is recommended that the titleholder allow for at least six months for a decision to be made, noting any requests for further information are likely to extend this process.

5. Variation of an 'application' for a declaration of identified GHG storage formation

5.1. Subsections 312(7) or 312A(7) of the OPGGS Act provide that at any time before the RCM makes a decision on an application for a declaration of identified GHG storage formation, the applicant may, by written notice given to the RCM, vary:

- any or all of the fundamental suitability determinants specified in the application; or
- the spatial extent estimated in the application.

5.2. An application must set out the proposed variation and specify the reasons and provide supporting evidence.

6. Variation of a declaration of identified GHG storage formation

6.1. At any time after a declaration is in force under sections 312 or 312A of the OPGGS Act, the RCM may vary the declaration either on application by the titleholder or on the RCM's own initiative. Before varying a declaration on the RCM's own initiative, the RCM must consult with the relevant titleholder: section 313 of the OPGGS Act.

6.2. The titleholder of any of the following titles may apply to the RCM for a variation of a declaration, if the part of the geological formation in relation to which the declaration is in force is wholly situated in:

- the permit area of a GHG assessment permit (including a cross-boundary GHG assessment permit); or
- the lease area of a GHG holding lease (including a cross-boundary GHG holding lease); or
- the licence area of a GHG injection licence (including a cross-boundary GHG injection licence); or

- the lease area of a petroleum retention lease; or
- the licence area of a petroleum production licence.

6.3. An application must set out the proposed variation and specify the reasons and provide supporting evidence. In deciding to vary the declaration the RCM must have regard to any new information, analysis, relevant scientific or technological developments and other matters as the RCM considers relevant.

6.4. A copy of a variation must be published in the Australian Government Gazette.

6.5. The RCM may also, by writing, vary the declaration: section 313 of the OPGGS Act.

7. Revocation of declaration of identified GHG storage formation

7.1. At any time after a declaration is in force under section 312 or 312A of the OPGGS Act, the RCM may revoke the declaration if the RCM is satisfied that the part of the formation is not suitable (consistent with the fundamental suitability determinants) for the permanent storage of a GHG substance, for example, as a result of new information about the integrity of the storage formation: section 314 of the OPGGS Act.

7.2. The RCM must consult with the titleholder before revoking the declaration.

7.3. Before revoking the declaration the RCM must consider whether the declaration should instead be varied.

8. Other matters

8.1. The matters specified in a GHG injection licence or a cross-boundary GHG injection licence must not be inconsistent with the fundamental suitability determinants of the identified GHG storage formation concerned: subsections 358(4) (general) and 358A(4) (cross-boundary) of the OPGGS Act.

8.2. More specifically, once approved, the declaration of GHG storage formation will form the basis of the information for Parts 3 and 4 of Part B of the Site Plan, relating to the integrity of the storage formation and plume migration modelling respectively (refer to Schedule 2 of the Regulations). The information needs to be altered for the purposes of a Site Plan if, for example, it is necessary to vary the Declaration (see section 5 of this guideline).

Appendix A: Summary of contents for an application for a declaration of identified GHG storage formation (applicants must refer to Schedule 1 of the Regulations and sections 21 and 312 or 312A of the OPGGS Act)

Fundamental suitability determinants of storage formation	Description of the geology of storage formation	Plume migration and predictions	Engineering Enhancements	Spatial extent of the storage formation
Must provide adequate information on the following fundamental suitability determinants: • the amount of GHG substance for which the storage formation is suitable to store • the chemical composition of the particular GHG substance that the formation is suitable to store • the proposed injection point or points • the proposed injection rate and period over which injection will take place • the proposed engineering enhancements, if any, for the permanent storage of GHG substance in the storage formation • the effective sealing features that make the storage formation suitable for permanent GHG storage. This must include identification of all relevant risks to the integrity of the storage formation. Must provide sufficient information to demonstrate that the confining zones of the storage formation constitute an effective and sound sealing mechanism.	Must provide a detailed analysis of the geological features of the storage formation, including the effective sealing mechanism associated with the formation, discussing as a minimum: • stratigraphy, structure, rock types, and depositional model of the storage formation (both reservoir & seal rocks) • identification of any faults in either the reservoir or seal rocks • porosity and permeability of reservoir and seal rocks • reactivity of rock types with the proposed GHG storage substance in both the reservoir and seal rocks • local stress regime, fracture gradients, fault stability and the geomechanical response of the storage formation to injection • reservoir fluid parameters, including chemical composition, pressure and temperature • seismicity, including the history of earthquake activity in the area • well data (well performance and well testing) in the area • conduct of any previous exploration (petroleum and GHG) activities, if any, in the area, in particular abandoned wells and any available relevant information on their nature (well locations, well plugging, type of cement used, etc.) and a map. Must also include any information relevant to the long-term (geological timeframes) safe and secure storage of the GHG substance. This may require data relating to areas outside the title area.	Must provide sufficient information on the expected migration pathway(s) of the injected GHG substance to inform the expected behaviour over the life of the GHG storage project and in the longer term. All migration pathways of which the probability of occurrence is greater than 10% must be considered. The predictions must be based on the fundamental suitability determinants of the storage formation. This information must include: • details of all data used to generate the models • details of the modelling including methodology, spatial resolution, types of models and assumptions to predict plume migration pathways • predictions of the migration pathways and probability distributions associated with these predictions. These predictions should be provided at intervals over the life of the project and in the longer term, and must include at least: • five years after injection is expected to cease • the time when the GHG substance has effectively stabilised in the subsurface.	Must provide sufficient detail about any proposed engineering enhancements including: • a description of the proposed engineering enhancements to the storage formation • demonstration that any risks to the integrity of the storage formation are likely to be acceptable. Details of the risk assessment analysis (including description of the methodology used), covering the following for each risk factor: • a description of the risk • the possible consequences of the risk • assessment of the probabilities of occurrence and possible consequences • an explanation of how the risk has been or will be eliminated or reduced to as low as practicable.	Must provide an evidence-based estimate of the spatial extent of the eligible GHG storage formation, which is the vertical and horizontal extent of the expected migration pathway(s) of the injected GHG substance over the period from the commencement of injection operations to the notional site closing time. The estimate of the spatial extent must be based on relevant parameters, including the expected plume migration pathways (all those which have a 10% or greater probability of occurring up until the notional site closing certificate time (see section 21 of the OPGGS Act), and fundamental suitability determinants. The graticular blocks constituting the spatial extent must include all blocks in the migration pathways referred to above.

Appendix B: Information to support an application for a declaration of identified GHG storage formation

The applicant should provide details of all data used in assessing the formation, including a justification of the suitability of the datasets for the identification of all risks to the integrity of the storage formation.

Figures should be submitted both within the text and as separate high resolution files in a ‘Figures’ appendix. At a minimum, the following must be included:

- regional map showing the location of the title and storage formation
- detailed map of the eligible storage formation, showing all wells, relevant infrastructure and petroleum fields (including depleted fields)
- map of all known geological faults
- relevant stratigraphic column
- well logs and stratigraphic correlations
- TWT and depth structure maps of all key reservoir and seal horizons, including wells and faults. Location of any seismic lines and cross sections used must be annotated.
- Map of the extent of the eligible storage formation, incorporating all scenarios where the expected plume migration pathway has been estimated to have a greater than 10 per cent probability of occurring.
- Maps and/or cross sections in an appropriate format that provide an accurate representation of the distribution of porosity, permeability (including fault permeability), water saturation, salinity and any other relevant parameters used in plume migration modelling.