

OFFSHORE GREENHOUSE GAS GUIDELINE

DECLARATION OF STORAGE FORMATION

**A guideline in relation to the
*Offshore Petroleum and Greenhouse Gas Storage Act 2006***

Prepared by the
Australian Government Department of Industry, Innovation and Science

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This document has been developed as a general guide only. It is subject to, and does not replace or amend the requirements of the *Offshore Petroleum and Greenhouse Gas Storage Act 2006* and associated Regulations, which should be read in conjunction with the guideline.

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It is anticipated that the guideline will be amended from time to time. The most recent version of the guideline is available online at: www.nopta.gov.au.

1. OVERVIEW

- 1.1. The purpose of this guideline is to assist titleholders in lodging applications for the declaration of greenhouse gas (GHG) storage formations and related matters under the *Offshore Petroleum and Greenhouse Gas Storage Act 2006* (the OPGGSA) 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 an assessment permit to a holding lease or injection licence (which includes a site plan) following the identification of an eligible storage formation. In general, the matters specified in the injection licence must not be inconsistent with the fundamental suitability determinants set out in the declaration of storage formation (section 358(4)) of the OPGGSA.
- 1.3. More specifically, once approved the declaration of 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 may only need 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).
- 1.4. This guideline outlines the expectations and policies of the responsible Commonwealth Minister (RCM) in respect to the following applications and notification under the OPGGSA:
 - notification of eligible GHG storage formation: s 451
 - declaration of identified GHG storage formation: s 312
 - variation of declaration of identified GHG storage formation: s 313
 - revocation of declaration of identified GHG storage formation: s 314.

- 1.5. Potential applicants should engage with the National Offshore Petroleum Titles Administration (NOPTA) early in the process if they are unsure of their responsibilities under the OPGGSA or requirements for making an application.

2. CATEGORIES OF STORAGE FORMATION

- 2.1. As a first principle, 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. The size of a storage formation, however, 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) as well as geological factors. Section 21 of the OPGGSA terms these factors as ‘fundamental suitability determinants’ (see section 3 below for further discussion). A single geological formation may contain multiple storage formations, spatially separate from each other.
- 2.2. The OPGGSA establishes three categories of GHG storage formation (potential, eligible and identified) reflecting a titleholder’s and RCM degree of technical understanding of the formation. The following expands on these categories in more detail.

Potential GHG storage formation

- 2.3. A potential GHG storage formation is a part of a geological formation that is suitable, with or without engineering enhancements, for the permanent storage of a GHG substance. See section 21(1) of the OPGGSA. 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 (with confidence) declare a GHG storage formation site as ‘eligible’ (see Appendix A).

Eligible GHG storage formation

- 2.4. 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. See section 21(1) and (2) of the OPGGSA.
- 2.5. Section 451 of the OPGGSA requires a GHG titleholder to inform the RCM (through NOPTA), within 30 days of developing a reasonable suspicion that a part of a geological formation is wholly situated within a GHG title area, and the titleholder has reasonable grounds to suspect that the part 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 describing any necessary engineering enhancements to the suspected eligible formation (s.451(6)).
- 2.6. Notification to the RCM (as described in paragraph 2.5) is not required where a former titleholder of the permit, lease or licence area, has previously complied with section 451 (2), (5) and (6) in relation to that part of the formation. See section 451(7) of the OPGGSA.

Identified GHG formation

- 2.7. An ‘identified’ GHG storage formation is an eligible GHG formation that is declared by the RCM under section 312 of the OPGGSA.

- 2.8. The definition of an identified GHG storage formation is closely linked to the requirements as stipulated under Schedule 1 of the Regulations and the ‘fundamental suitability determinants’ (see section 3 below).
- 2.9. Once a GHG title holder, or existing holder of a petroleum retention lease or petroleum production license, has reasonable grounds to believe that a part of a geological formation in a permit area is an eligible GHG storage formation, the applicant can apply to the RCM to declare the storage formation an ‘identified GHG storage formation’. See section 4 for an overview of application requirements.
- 2.10. 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. A declaration must be in force before an application can be made for a GHG holding lease or GHG injection licence.
- 2.11. 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 (see section 1.2 and 1.3 of this guideline).
- 2.12. A holder of a petroleum retention lease or petroleum production license can also apply for a Declaration over a storage formation within the lease area or licence area.
- 2.13. It is possible to have a second or subsequent identified GHG storage formation declared provided each part of the eligible geological formation is wholly situated within the titleholder’s assessment permit area, or within a GHG holding lease, petroleum retention lease, GHG injection licence, or petroleum production licence area. The RCM’s declaration will be in accordance with the requirements set out in section 312 of the OPGGSA.

3. FUNDAMENTAL SUITABILITY DETERMINANTS

- 3.1. In applying for a declaration of identified storage formation the titleholder must clearly define the ‘fundamental suitability determinants’ for the eligible storage formation in accordance with subsection 21(8) of the OPGGSA. This includes detail on the following criteria:
 - the amount of GHG substance that may be stored, noting that it must be at least 100,000 tonnes (s.21(1) and s.21(2))
 - the particular GHG substance for which the the storage formation is suitable to store
 - the proposed injection point or points
 - the proposed injection period
 - any proposed 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 STORAGE FORMATION – section 312 of the OPGGSA

- 4.1. An applicant may apply to the RCM for the declaration of a part of a geological formation as an identified GHG storage formation if the applicant has 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 permit, lease or licence area.
- 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 relevant 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 to this Guideline. See Appendix B for suggested further information to support a declaration of identified storage formation application.
- 4.4. In summary, the application must detail, with supporting information, the following:
 - the reasons for believing that a part of a geological formation is an eligible greenhouse gas formation
 - the fundamental suitability determinants of the proposed 'eligible greenhouse gas storage formation' (see section 3 above)
 - an estimate of the spatial extent of the proposed 'eligible greenhouse gas storage formation' (an estimate of spatial extent must comply with the requirements specified in the Regulations Schedule 1, Part 4)
 - 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, see section 312(5). If the applicant fails to provide the further information or analysis, the RCM may refuse to progress the application.
- 4.6. If the RCM is satisfied that:
 - a part of a geological formation is an eligible greenhouse gas 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 greenhouse gas storage formation

the RCM must, by writing:

- declare that part of a geological formation to be an identified greenhouse gas storage formation
- declare the spatial extent of the identified greenhouse gas 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 greenhouse gas storage formation.

- 4.7. If an application has been lodged and the RCM is not satisfied that:
- a part of a geological formation is an eligible greenhouse gas 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 greenhouse gas storage formation, the RCM must, by written notice, advise the applicant of the refusal.

Timing

- 4.8. Under regulation 2.2 the RCM is required, within 20 days after receiving an application for a declaration of identified 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 GREENHOUSE GAS STORAGE FORMATION – subsection 312(7) of the OPGGSA

- 5.1. At any time before the RCM makes a decision on an application for an declaration of identified GHG storage formation, the applicant may apply to the RCM to 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 GREENHOUSE GAS STORAGE FORMATION – section 313 of the OPGGSA

- 6.1. At any time after a declaration is in force under section 312 of the OPGGSA, the RCM may vary the declaration either on application by the titleholder or by the Minister’s own initiative. Before varying a declaration on the RCM’s own initiative, the RCM must consult with the appropriate titleholder.
- 6.2. The titleholder of any of the following titles may apply to the RCM for a variation of declaration, if the part is wholly situated in:
- the permit area of a GHG assessment permit; or
 - lease area of a GHG holding lease; or
 - the licence area of a 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.

7. REVOCATION OF DECLARATION OF IDENTIFIED GREENHOUSE GAS STORAGE FORMATION – section 314 of the OPGGSA

7.1. At any time after a declaration is in force under section 312 of the OPGGSA, the RCM may revoke the declaration if it becomes apparent that 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.

7.2. The RCM must consult with the appropriate title holder before revoking the declaration.

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

APPENDIX A: SUMMARY OF APPLICATION CONTENTS FOR A DECLARATION (APPLICANTS MUST REFER TO SCHEDULE 1 OF THE REGULATIONS AND SECTIONS 21 AND 312 OF THE OPGGSA)

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
<p>Must provide adequate information on the following fundamental suitability determinants:</p> <ul style="list-style-type: none"> 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. <p>This must include identification of all relevant risks to the integrity of the storage formation.</p> <p>Must provide sufficient information to demonstrate that the confining zones of the storage formation constitute an effective and sound sealing mechanism.</p>	<p>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:</p> <ul style="list-style-type: none"> 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. <p>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.</p>	<p>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.</p> <p>All migration pathways of which the probability of occurrence is greater than 10% must be considered.</p> <p>The predictions must be based on the fundamental suitability determinants of the storage formation.</p> <p>This information must include:</p> <ul style="list-style-type: none"> 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. <p>These predictions should be provided at intervals over the life of the project and in the longer term, and must include at least:</p> <p>five years after injection is expected to cease</p> <p>the time when the GHG substance has effectively stabilised in the subsurface.</p>	<p>Must provide sufficient detail about any proposed engineering enhancements including:</p> <ul style="list-style-type: none"> 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. <p>Details of the risk assessment analysis (including description of the methodology used), covering the following for each risk factor:</p> <ul style="list-style-type: none"> a description of the risk the possible consequences of the risk assessment of the probabilities of occurrence and possible consequencesAn explanation of how the risk has been or will be eliminated or reduced to as low as practicable. 	<p>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.</p> <p>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 s21 of the Act)), and fundamental suitability determinants.</p> <p>The graticular blocks constituting the spatial extent must include all blocks in the migration pathways referred to above, together with any blocks required for the on-going management of the site (for example, pressure management wells). Such blocks must lie within the original assessment permit area and contiguous with other blocks constituting the spatial extent. Thus, the RCM has the discretion to allow 'buffer' areas to be included if considered necessary.</p>

APPENDIX B: INFORMATION TO SUPPORT A DECLARATION OF IDENTIFIED STORAGE FORMATION APPLICATION

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 files in a 'Figures' appendix (at least 300 dpi eps and jpg formats)

- regional map showing the location of the assessment permit and storage formation
- detailed map of the eligible storage formation, showing all wells, relevant infrastructure and any petroleum fields (including depleted fields)
- fault map
- relevant stratigraphic column
- well log and stratigraphic correlations
- TWT and depth structure maps of all key reservoir and seal horizons, including wells and faults. Location of any seismic 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 represent of the distribution of porosity, permeability, water saturation, salinity and any other relevant parameters used in plume migration modelling.