

**GUIDELINES FOR INJECTION AND STORAGE  
OF GREENHOUSE GAS SUBSTANCES IN  
OFFSHORE AREAS**

**Clean Energy Division**

**Department of Resources, Energy and Tourism**

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# 1. Objectives

1.1 The objective of these guidelines is to:

- assist greenhouse gas titleholders/operators<sup>1</sup> of greenhouse gas (GHG) storage projects to better understand the procedures and requirements for injection and storage of a 'greenhouse gas (GHG) substance'<sup>2</sup> in an offshore area, under the Offshore Petroleum and Greenhouse Gas Storage Act 2006 (the Act) and the Offshore Petroleum and Greenhouse Gas Storage (Greenhouse Gas Injection and Storage) Regulations 2011 (the Regulations);
- provide guidance to titleholders/GHG project operators in the preparation and submission of relevant documentation (eg, application for declaration of a storage formation and a site plan for GHG storage operations), under the Act and the Regulations.

**Note.** The administrative arrangements for offshore petroleum and GHG activities will change on 1 January 2012, with the formation of two new bodies. These are:

- The National Offshore Safety and Environmental Management Authority (NOPSEMA), which be an expanded version of the existing National Offshore Safety Authority (NOPSA);
- The National Offshore Petroleum Titles Administrator (NOPTA).

These, however, will have no immediate impact on administrative arrangements for GHG operations.

In relation to occupational health and safety for GHG operations, NOPSEMA will fulfil the role previously filled by NOPSA. In relation to the environment for GHG operations, the responsible Commonwealth Minister (RCM) will remain the regulator under the Environmental Regulations. The RCM, however, will be able call upon NOPSEMA to provide advice with respect to GHG operations. It is expected that as regulatory practice develops, the RCM will devolve at least some regulatory power in relation to the environment to NOPSEMA

Similarly, in the case of NOPTA, the responsible Commonwealth Minister (RCM) will remain the regulator in relation to GHG operations. Again, it is expected that as regulatory practice develops, the RCM will devolve at least some regulatory power in relation to GHG operations to NOPTA.

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<sup>1</sup> A greenhouse gas project operator is a person appointed by the holder of the greenhouse gas title; or if no operator is appointed by the titleholder — the titleholder.

<sup>2</sup> The Act refers to 'greenhouse gas substance' and specifies that it applies only to carbon dioxide and prescribed greenhouse gases. It is not intended at this time to prescribe any other greenhouse gases and hence the term 'greenhouse gas' can be taken to be synonymous with 'carbon dioxide' for the purpose of these Guidelines.

## 2. Background

- 2.1 In 2005, the Intergovernmental Panel on Climate Change (IPCC) released the *IPCC Special Report: Carbon Dioxide Capture and Storage*, which provided a scientific consensus of the utility of carbon dioxide capture and storage (CCS). A key finding of this report was that:

“With appropriate site selection based on available subsurface information, a monitoring program to detect problems, a regulatory system and the appropriate use of remediation technologies to stop or control CO<sub>2</sub> releases if they arise, the local health, safety and environmental risks of geological storage would be comparable to the risks of current activities such as natural gas storage, EOR [enhanced oil recovery], and deep underground disposal of acid gas.

Observations from engineered and natural analogues as well as models suggest that the fraction retained in appropriately selected and managed geological reservoirs is very likely to exceed 99% over 100 years and likely to exceed 99% over 1000 years.”

- 2.2 The Ministerial Council for Minerals and Petroleum Resources (MCMPR) report of 2005, *Carbon Dioxide Capture and Geological Storage – Australian Regulatory Guiding Principles*, provided guiding principles to facilitate a nationally consistent approach to the application of CCS in Australia.
- 2.3 The IPCC Report and the MCMPR Guiding Principles highlight the need for an effective regulatory regime that provides for proper management of CCS operations. In November 2008 the Australian Government enacted legislation, *Offshore Petroleum and Greenhouse Gas Storage Act 2006*, to enable CCS activities in Commonwealth offshore waters. This legislation establishes access and property rights to allow industry to explore for and develop GHG storage sites in offshore areas.
- 2.4 The GHG storage provisions of the Act are underpinned by the *Offshore Petroleum and Greenhouse Gas Storage (Greenhouse Gas Injection and Storage) Regulations 2011*. The Act and the Regulations, which are administered by the Commonwealth Minister responsible for Resources (the responsible Commonwealth Minister - RCM), provide an integrated framework for the regulation of GHG activities.

### 3. Legislative Context

- 3.1 The offshore CCS legislation provides for a range of offshore GHG titles that authorise exploration for offshore GHG storage sites, and the transportation, injection and storage of a GHG substance. A brief description of these GHG titles is given in **Table 1**.
- 3.2 Upon discovery of a geological formation in a GHG title area, the titleholder can apply to the RCM to declare a part of the geological formation as ‘an identified storage formation’. The RCM will make a declaration if the RCM is satisfied that the relevant part of the geological formation referred to in the application is an eligible GHG storage formation and the estimate of its spatial extent is a reasonable estimate (s312(11) of the Act).
- 3.3 Once a declaration is in force, an assessment permittee can proceed to apply for a GHG injection licence over the declared storage formation, if there will be a source of a GHG substance available to commence injection within 5 years of the grant of the injection licence (s362(1) of the Act). The permittee can apply for a GHG holding lease instead, if the permittee is not in a position to inject and store a greenhouse gas substance in the declared storage formation at the time of the application, but is likely to be in a position to do so within 15 years (s325(1)).
- 3.4 It is possible to have a second or subsequent identified GHG storage formation declared, provided each of them is wholly situated within the current assessment permit area, or within a holding lease or injection licence area that is derived from that original assessment permit area.
- 3.5 An application for an injection licence must be accompanied by a draft site plan, which is the core regulatory document for the management of GHG injection and storage operations (s361 (10) of the Act). The Act and the Regulations prohibit the carrying out of any activity under the authority of the injection licence unless a site plan is in force and unless the activity is carried out in accordance with the site plan.
- 3.6 When deciding whether to grant an injection licence, the RCM must be satisfied that the site plan contains adequate information to ensure that the GHG injection and storage operations will be managed in a safe and secure manner (see section 6 of these guidelines and Attachment 1). The RCM must also be satisfied that there is no significant risk that operations under the injection licence will have a significant adverse impact on petroleum operations that are being, or could be, carried on under a pre-commencement petroleum title (see s28-29 and s362 of the Act). In some circumstances, determining whether there is a ‘significant risk of a significant adverse impact’ (SROSAI) may be a complex task. The Regulations, therefore, set out a procedure to be followed by the RCM in this situation. Further details of the SROSAI test are provided in section 7 of these guidelines.
- 3.7 It is also a requirement under the Act (s460) that GHG injection and storage operations be carried out in a manner that does not interfere unduly with: navigation; fishing; the conservation of the resources of the sea and seabed; native title rights and interests; or any activities of another person being lawfully carried on.
- 3.8 The Act (s358 (11)) provides that the RCM may require a holder of a GHG injection licence, at any time during the term of the title, to provide a security or an additional security for compliance with the applicable statutory obligations. Once a security is in force, it will remain in force even though the title may change hands one or more times after the security is lodged.
- 3.10 The Act (s379) provides that a serious situation arises in relation to a storage formation in a GHG injection licence, if a GHG substance injected into the storage formation (a) has

- 3.11 Behaving as predicted is a key principle in the Act and the Regulations. Thus the Act requires predictions of behaviour to be presented in part A of the site plan. In assessing the site plan the RCM will consider whether the predictions are soundly based and whether the predictions themselves are acceptable. Once accepted, the predictions form one of the criteria for deciding whether a serious situation has arisen. If operational experience shows that the predictions need to be revised, then the site plan will need to be revised accordingly, subject to the same scrutiny as originally applied by the RCM.
- 3.12 The Act (s380) has given the RCM wide powers to deal with serious situations where injection and storage operations do not go as planned. If the RCM is satisfied that a serious situation exists, the RCM can direct the injection licensee to:
- carry on operations in a manner specified in the direction;
  - cease or suspend injection; or
  - undertake such activities as are specified in the direction for the purpose of eliminating, mitigating, managing or remediating the serious situation.
- 3.13 During the operational phase of a GHG project, the RCM, in accordance with s465(2) of Act and r3.5(5) of the Regulations, will release the results of monitoring of the behaviour of the stored GHG substance and any leakages the GHG substance during transportation and injection activities. This information will be made available on the Department of Resources, Energy and Tourism (RET) website.
- 3.14 When injection and storage operations cease in an injection licence area, the injection licensee must apply for a site closing certificate within 30 days (s386 of the Act). This triggers the commencement of the site closing period, during which the licensee is required to: decommission structures, equipment and other items or property that have been brought into the site in connection with GHG injection and storage operations (s782(1), Item 15); and plug or close off all wells made in the licence area (s442(3)). The RCM may allow certain wells that can be used for monitoring the behaviour of the GHG substance in storage formation after the site is closed to remain unplugged.
- 3.15 The RCM must make a decision on whether a closing certificate should be granted within five years after the lodgement of the application for site closure. When offering the site closing certificate, the RCM will notify the licensee of the program of post site closure monitoring that the Commonwealth proposes to carry out in future years; an estimate of the cost of the proposed program; and the form and amount of security to be lodged to carry out the program (see section 9 of these guidelines). The RCM will issue site closing certificate, if the licensee has lodged the specified security within 60 days of the notice. The licensee can then surrender the licence in good standing.
- 3.16 Once the closing certificate is issued the title holder's statutory obligations cease but common law liabilities will continue. At least 15 years after the closing certificate is issued, and subject to the behaviour of the stored substance being as predicted and posing no significant risks, the Commonwealth will take over common law liabilities. This creates an effective minimum limit of 15 years post-injection (to which the time taken to obtain a closing certificate must be added – a process that, realistically, will take some years) during which the GHG licensee will be liable for any damages under common law, before the Commonwealth could assume liability.

**Table 1: Offshore Greenhouse Gas Titles**

Title	Title Term	Application Type	Application Requirements	Other Relevant Information
<b>GHG Assessment Permit</b>	6 years + poss 3 year extension	Application for Greenhouse Gas assessment permit ( <i>s296 of the Act</i> ). <u>Application Fee: Nil</u>	Applications should provide details including a work program ( <i>s296(3)</i> ) showing timing of operations and address any matters affecting others rights eg Environment; Navigation; Fishing; Defence; Submarine cables; Native title and existing petroleum titles.	Corresponds to petroleum exploration permit. Minimum guaranteed work program bid required as outlined in Guidance Notes for applicants in the greenhouse gas (GHG) Acreage Release Publication. Applications to be submitted by published closing date. <b>Note:-</b> preference will be given to an applicant who can demonstrate the availability of GHG. If an exploration well results in the discovery of petroleum, the titleholder, with approval from the responsible Commonwealth Minister (RCM) ( <i>s357(1)(i)</i> ), is authorised to recover petroleum for the sole purposes of appraising the petroleum discovery (any petroleum recovered does not become the property of the licensee). The titleholder is not compelled to carry out this appraisal work, but without such data it would be difficult for the RCM to make a decision about the potential impacts of future GHG activities on the petroleum discovery.
<b>Declaration of a Storage Formation</b>	Indefinite	Application for Declaration ( <i>s312 of the Act</i> ). <u>Application Fee: Nil</u>	Must provide detailed analysis of the geological features, suitability determinants and spatial extent of the storage formation plus analysis and predictions of plume migration to satisfy the RCM that the formation is suitable for permanent storage of a GHG substance- see section 5 of these guidelines.	Corresponds to a petroleum declaration of location. Pre application consultation with RET advisable. An applicant may be required to provide further information or to carry out further analysis of information already provided, failure to do so may result in the application being refused ( <i>s312(5) &amp; (6)</i> ). A Declaration can be varied ( <i>s313</i> ). A Declaration provides the basis for an application for an injection licence or holding lease.
<b>GHG Injection Licence</b>	Indefinite - or if no injection for a period of 5 years	Application for Greenhouse Gas injection licence ( <i>s361 of the Act</i> ). <u>Application Fee: \$1,835</u>	A draft site plan must accompany the application ( <i>s361(10)</i> ). Part A of the site plan must provide the predictions of behaviours of GHG substance to be stored in the formation over the life of the project; and Part B must outline all matters relating to the management of the site, including the proposed monitoring program ( <i>s24(c)</i> ).The application must address each of the matters which may be specified in the licence (see <i>s358(3)(d) to (k)</i> ); provide details on technical qualification & work and expenditure proposals. Once injection operations cease permanently the licensee must apply for a site closing certificate ( <i>s386</i> ) - <u>Application Fee \$4,590.</u>	Corresponds to petroleum production licence. Early consultation with RET while in the process of preparing the draft site plan advisable. A summary of the site plan will be released for public comment. Granting an injection licence will also require the RCM to be satisfied that there will be no significant risk of a significant adverse impact on petroleum operations under a pre-commencement petroleum title.

Title	Title Term	Application Type	Application Requirements	Other Relevant Information
<b>GHG Holding Lease</b>	5 years + one renewal for a further 5 years	Application for Greenhouse Gas holding lease ( <i>s324 of the Act</i> ). <u>Application Fee: \$1,835</u>	An applicant with a declared GHG storage formation who is currently not in a position to inject or permanently store a GHG substance into the GHG storage formation, but is likely to do so within 15 years may apply for a holding lease ( <i>s325(1)(b)</i> ). The application should include details of work proposals and expenditure relating to any further exploration in the title.	Corresponds to petroleum retention lease. <b>Note:-</b> if an application for a GHG injection licence would have been granted except for possible adverse impacts, then an application can be made for a special holding lease for an indefinite term ( <i>s336 of the Act</i> ).
<b>Greenhouse Gas Search Authority</b>	In force for a specified period which must not exceed 180 days	Application for Greenhouse Gas search authority ( <i>s407 of the Act</i> ). <u>Application Fee: Nil</u>	Applications should provide details and timing of operations and also cover off on matters affecting others rights eg environment; navigation; fishing; defence; submarine cables; native title and existing petroleum titles.	Corresponds to petroleum special prospecting authority. It enables the exploration for potential greenhouse gas storage formations and injection sites in the authority area, but does not permit the drilling of wells.
<b>Greenhouse Gas Special Authority</b>	In force for a specified period which can be extended	Application for a Greenhouse Gas special authority ( <i>s415 of the Act</i> ). <u>Application Fee: Nil</u>	An application for a GHG special authority would be required if an existing GHG titleholder wishes to obtain geoscientific information about a block/blocks adjacent to their title.	Corresponds to petroleum access authority. Similar to above it allows for exploration but not the drilling of a well in the adjacent block/blocks.
<b>Greenhouse Gas Research Consents</b>	In force for a specified period	Application for Greenhouse Gas research consent ( <i>s425 of the Act</i> ). <u>Application Fee: Nil</u>	An organisation undertaking scientific investigations relating to GHG storage and injection sites under a GHG research consent must openly publish the details and results of the completed investigation in accordance with paragraph 3 to article 246 of UNCLOS.	Corresponds to a petroleum scientific investigation.
<b>Infrastructure &amp; Pipeline Licences</b>	Indefinite	Applications for licences ( <i>s198 &amp; s217 of the Act</i> ) respectively. <u>Application Fees: \$1,835 &amp; \$4,590 respectively.</u>	Application must be accompanied by a plan showing the proposed route, siting of terminal points, pumping and valve stations or proposed infrastructure facilities. For pipelines it must also provide information regarding the type of greenhouse gas substance that is to be stored ( <i>s213</i> ).	Same as for petroleum infrastructure and pipeline licences. Rights conferred by pipeline licence and conditions outlined under <i>s211 and s212</i> respectively. Rights conferred by infrastructure licence and conditions outlined under <i>s194 and s195</i> respectively.

**Note:-** GHG assessment permit, holding lease and injection licence titles are subject to *s454* of the Act whereby a condition can be imposed requiring the lodgement of a security - *s 291(4), 320(4) and 358(11) respectively.*



## 4. Preliminary Information and Consultation

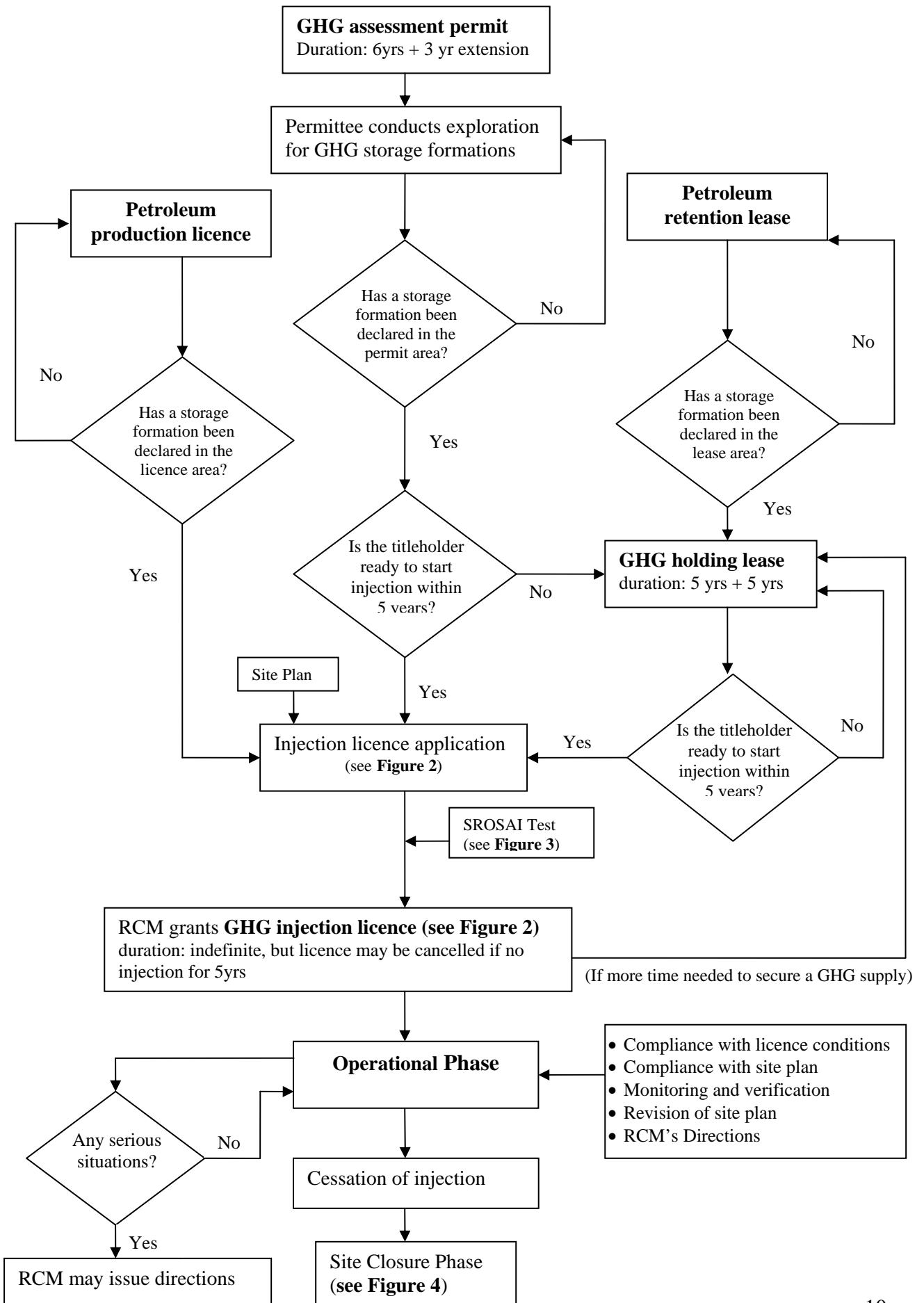
- 4.1 A titleholder/operator who intends to undertake a GHG storage project is encouraged to initiate consultation with RET at a very early stage of the project (**Figure 1** outlines the key stages of a GHG storage project). For instance, it may be useful for the titleholder to communicate with RET prior to applying for a declaration of a suitable storage formation or in the process of preparing a draft site plan for an injection licence application. Adequate preliminary consultation is of particular importance for those GHG storage projects which are in sensitive areas (for example, areas where overlapping GHG and petroleum titles exist).
- 4.2 During the initial consultation process, the titleholder may also provide RET with analyses, reports and preliminary modelling relating to the project proposal to enable RET to gain a clear understanding of the titleholder's plans for project development. Meetings with departmental officials may also be desirable to facilitate this process. This will enable RET to commence whole of government approval processes to assist in streamlining other approval processes as outlined in paragraph 4.4 below.
- 4.3 If the GHG title, where the proposed GHG injection and storage operations are to be carried out, overlaps with petroleum title(s), or is located in the vicinity of petroleum project(s), the GHG titleholder is expected to consult with relevant petroleum titleholders regarding the proposed GHG operations, with the aim of reaching commercial agreement(s) at an early stage of project development. Early consultation, especially if it results in a commercial agreement between petroleum and GHG titleholders, will significantly simplify the approval process.
- 4.4 An offshore GHG storage project, prior to commencement of injection and storage operations, may also require:
- Environmental approvals:
    - an Environment Impact Assessment under the *Environment Protection and Biodiversity Conservation Act 1999*, which is administered by the Department of Sustainability, Environment, Water, Population and Communities – SEWPAC)
    - a permit for storage activity under the *Environment Protection (Sea Dumping) Act 1981* (administered by SEWPAC); and
    - an Environment Plan under the *Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009* (administered by the RCM).
  - Safety approvals:
    - a Safety Case under the *Offshore Petroleum and Greenhouse Gas Storage (Safety) Regulations 2009* (administered by the National Offshore Petroleum and Safety and Environment Management Authority - NOPSEMA<sup>3</sup>).

Therefore, the titleholder is encouraged to initiate consultation with SEWPAC, RET and NOPSEMA regarding environmental and safety aspects of the project (further information on environmental and safety approvals are in **Attachment 4**).

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<sup>3</sup> NOPSEMA will come into operation on 1 January 2012.

**Figure 1: Key Stages of an Offshore GHG Storage Project**



## 5. Declaration of Storage Formation

- 5.1 A storage formation forms part of a geological formation or formations. As a first principle, a storage formation must be deemed capable of permanently storing the 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. The Act terms these factors as ‘fundamental suitability determinants’<sup>4</sup>. A single geological formation may contain multiple storage formations, separated from one another by the expected extent of their individual migration plumes.
- 5.2 The concept of a storage formation underpins many important parts of the Act.
- 5.3 Once a GHG assessment permittee has reasonable grounds to believe that a part of a geological formation in a permit area is an ‘eligible GHG storage formation’<sup>5</sup>, the permittee can apply to the RCM to declare the storage formation as an ‘identified greenhouse gas storage formation’. A holder of a GHG holding lease, GHG injection licence, petroleum retention lease or petroleum production licence can also apply for a Declaration over a storage formation within the lease area or licence area, if the lessee or the licensee has reasonable grounds to believe that the part of the geological formation is an eligible greenhouse gas storage formation (see **Figure 1**).
- 5.4 The declaration of a storage formation is the first 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.
- 5.5 Consistent with the Act and the Regulations, an application for a declaration must provide information relating to geology, spatial extent of the storage formation, fundamental suitability determinants and modelling of plume migration pathways (see **Table 2**). The information must be sufficient to satisfy the RCM that the formation is suitable for the permanent storage of the GHG substance (this requirement flows from s21 of the Act). Part 2 and Schedule 1 of the Regulations set out the information that needs to be supplied in an application.
- 5.6 The basis for establishing the spatial extent of a declared storage formation (which would provide the basis for a future holding lease or injection licence) is set out in s21 of the Act and Part 4 of Schedule 1 of the Regulations. These are summarised in Table 2 of these guidelines.
- 5.7 The RCM will declare that part of the geological formation set out in the application to be an ‘identified greenhouse gas storage formation’, if the RCM is satisfied that the application has met the conditions specified in s312 (11) of the Act. The RCM can require the applicant to give further information or to carry out further analysis of information already provided in the application. If the applicant fails to provide the required information or analysis, the RCM may refuse to progress the application further.

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<sup>4</sup> Section 21 of the Act defines spatial extent and fundamental suitability determinants.

<sup>5</sup> 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 (see sections 21 (1) & (2) of the Act).

- 5.8 Unlike the declaration of a petroleum location, the 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 and spatial extent of the identified storage formation.
- 5.9 The application must include an estimate of the spatial extent of the Declaration. The Regulations (Schedule 1, Part 4) set out the procedure for establishing the spatial extent. This information is summarised in **Table 2**.
- 5.10 A Declaration can be varied, either at the request of a title-holder or at the RCM's own instigation. This allows for variation of one or more fundamental suitability determinants as new information about the storage formation becomes available. For example:
- The titleholder may seek a variation to increase the amount of GHG substance to be injected because new information indicates that the injectivity/storage capacity of the storage formation is better than previously thought; or
  - The RCM might vary the declaration if new information indicates that the storage formation is not suitable for the permanent storage of the amount of GHG substance specified in the original declaration but would be suitable for the storage of a lesser amount.
- 5.11 An application for variation of declaration must set out the proposed variation and specify the reason for the proposed variation.

**Table 2: Contents of an Application for a Declaration (refer also to the Regulations - Schedule 1)**

Description of the geology of storage formation	Fundamental suitability determinants of storage formation	Plume migration and predictions	Estimate of spatial extent of the storage formation
<p>Must provide a detailed analysis of the geological features of the storage formation, including the effective sealing mechanism associated with the formation. Factors that must be addressed include:</p> <ul style="list-style-type: none"> <li>• stratigraphy, faults, structures, rock types, depositional model of the storage formation (both reservoir &amp; seal rocks);</li> <li>• porosity and permeability of reservoir and cap rocks;</li> <li>• reactivity of rock types with the proposed GHG storage substance;</li> <li>• fracture gradients;</li> <li>• reservoir fluid parameters, including chemical composition, pressure and temperature;</li> <li>• seismicity, including the history of earthquake activity in the area;</li> <li>• well data (well performance and well testing) in the area; and</li> <li>• previous exploration (petroleum and GHG) activities, if any, in the area, in particular abandoned wells and any available information on their nature (well locations, well plugging, type of cement used, etc) and a map.</li> </ul> <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 adequate information on the following fundamental suitability determinants:</p> <ul style="list-style-type: none"> <li>• the amount of GHG substance that it is suitable to store;</li> <li>• the chemical composition of GHG substance that it is suitable to store;</li> <li>• the proposed injection point or points;</li> <li>• the proposed injection rate &amp; period over which injection will take place;</li> <li>• the proposed engineering enhancements, if any, for the permanent storage of GHG substance in the storage formation;</li> <li>• the effective sealing features that make the storage formation suitable for permanent GHG storage</li> </ul> <p>This must include a risk assessment analysis, identifying the relevant risks, the probability of occurrence and the possible impacts that could arise from each risk, and details of any proposed strategies to reduce each identified risk.</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 sufficient information on the expected migration pathway(s) of the injected GHG substance to inform the RCM of expected behaviour over the life of the GHG storage project and in the longer term. This information must include:</p> <ul style="list-style-type: none"> <li>• details of any modelling undertaken, including methodology, types of models and assumptions to predict plume migration path ways;</li> <li>• predictions of the migration pathways and probability distributions associated with these projections (all migration pathways of which the probability of occurrence is greater than 10% must be considered).</li> </ul> <p>(detailed modelling may not be required in all situations; for example, injection within depleted petroleum fields)</p> <p>The predictions must be based on the fundamental suitability determinants of the storage formation. These predictions must be provided at intervals over the life of the project and in the longer term, and must include at least:</p> <ul style="list-style-type: none"> <li>• five years after injection is expected to cease;</li> <li>• the time when the GHG substance has effectively stabilised in the subsurface.</li> </ul>	<p>Must provide a reasonable 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 five years after injection is expected to cease (s21(3) of the Act).</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>

## 6. Site Plan

6.1 Once a declaration is in place over a storage formation within a GHG assessment permit, GHG holding lease or petroleum production licence, the permittee, lessee or licensee can apply to the RCM for a GHG injection licence. At the time of applying for an injection licence, the applicant must also submit a draft site plan (two hard copies and one electronic copy) and a summary of the draft site plan (one hard copy and one electronic copy). This summary will be made publicly available (see below).

Note: As illustrated in **Figure 1**, a petroleum retention lessee with a declaration in their lease would initially apply for a GHG holding lease, and then for a GHG injection licence if injection was expected to commence within 5 years.

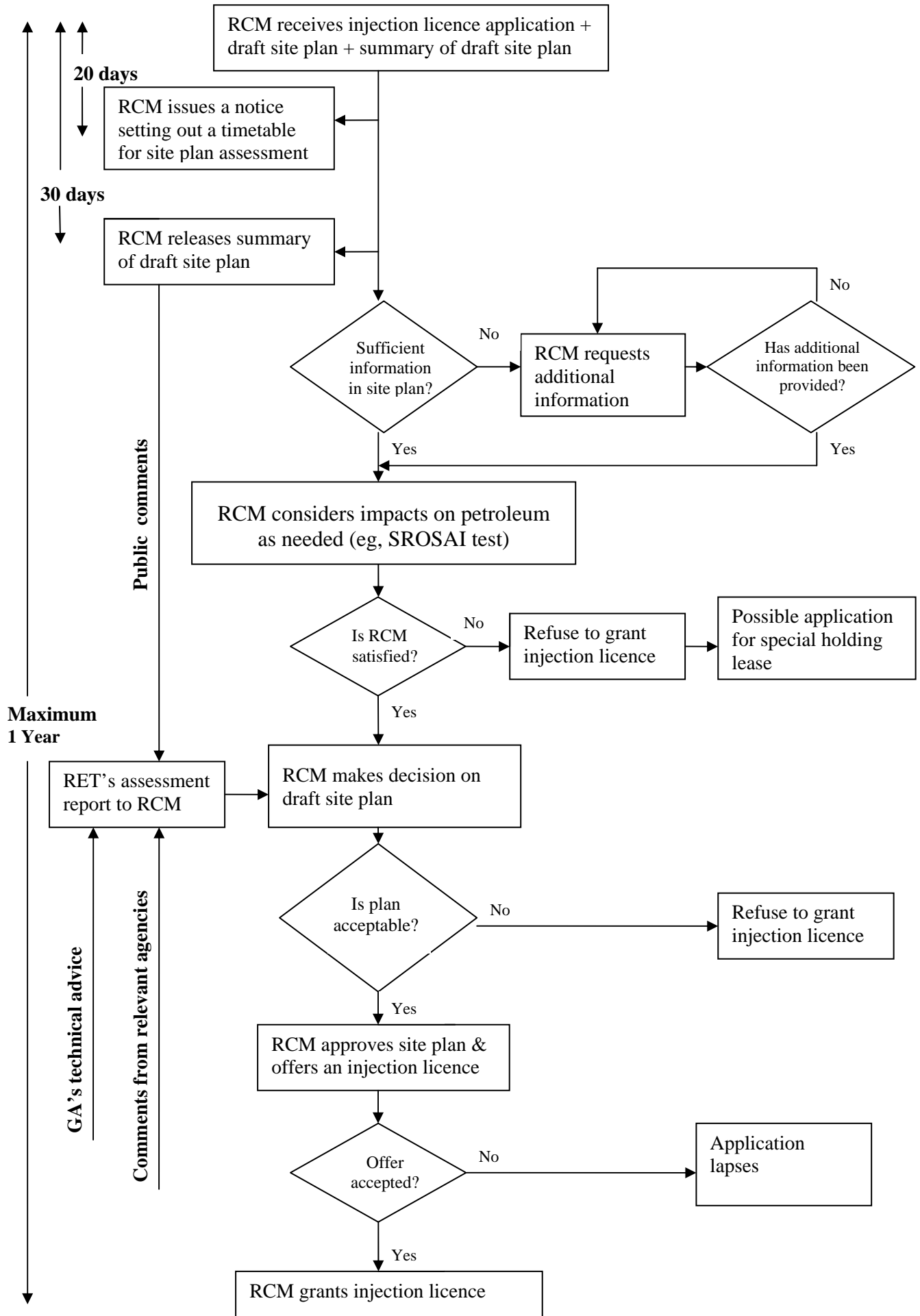
- 6.2 The draft site plan must provide sufficient information, including modelling of plume migration and a proposed monitoring plan and risk assessment, to satisfy the RCM that the proposed operations management system will ensure safe and secure permanent storage of the GHG substance (**Attachment 1** provides an overview of the information that should be included in the site plan). Information provided in the site plan must be consistent with that set out in the declaration (see **Table 2**). The relevant information from the declaration may be attached to the draft site plan.
- 6.3 Since the Act and the Regulations require the RCM to be satisfied that the site is suitable for the permanent storage of the GHG substance, the applicant should provide all relevant additional information in support of the analyses and conclusions of the site plan (possibly as an attachment). Such information should include: details of modelling undertaken, including methodology, types of models and assumptions; and any detailed geological, geophysical, geochemical or other geotechnical information.
- 6.4 Within **20 days** of receiving all relevant information on the licence application and the draft site plan, the RCM will give a written notice to the applicant setting out a timetable for assessing the site plan. The timetable must allow sufficient time for the titleholder to make any changes to the draft site plan that are needed to enable the RCM to make a decision under s362(1) and 370(i) of the Act. This timetable may be modified as circumstances require. Within **one year** of receiving an application for an injection licence, the RCM will either accept or reject the site plan that accompanied the application.
- 6.5 If the RCM considers that the draft site plan does not contain adequate information, the RCM will seek further information from the applicant to address the deficiencies in the draft plan. The RCM may repeat this process as many times as the RCM considers necessary to result in a satisfactory site plan. The RCM may reject the application, if the RCM consider the applicant is not in a position to provide the required information.
- 6.6 RET will work closely with Geoscience Australia (GA) in the assessment of the draft site plan. GA will also provide technical advice to the RCM and RET, whenever necessary, on matters relating to GHG injection and storage. RET will also consult with relevant agencies in the process of assessing the draft site plan to ensure that the proposed GHG operations will not interfere with other users. These agencies include:
- Department of Sustainability, Environment, Water, Population and Communities
  - Australian Maritime Safety Authority
  - Australian Fisheries Management Authority
  - Department of Defence
  - National Offshore Petroleum Safety Authority

- Telstra
  - Australian Communications and Media Authority
  - National Native Title Tribunal
- 6.7 Once the RCM is satisfied that the applicant has provided adequate information relating to the draft site plan, RET will prepare an assessment report on the basis of GA's technical advice to assist the RCM's decision making process. This report will provide a detailed assessment of the contents of the draft site plan against the criteria set out in the Regulations (see r3.3) and make recommendations to the RCM regarding the approval/rejection of the draft site plan. The RCM may also establish an Expert Advisory Committee under s749(2)(g) of the Act to seek advice on matters relating to the site plan.
- 6.8 Before granting an injection licence the RCM must be satisfied that the proposed operations does not pose a significant risk of a significant adverse impact on petroleum operations undertaken under a pre-commencement petroleum title or an existing petroleum production licence (see section 7 of these guidelines).
- 6.9 The summary of the draft site plan referred to in paragraph 6.1 will be made available, within **30 days** of receiving it, on the RET website, for public comment. It will provide the community with a basis for comments on the proposed operations as well as having the important role of assuring the public that the project will not pose any significant health, safety and environmental risks. The summary should not include any information that is commercial in confidence or reveals intellectual property. In the decision making process, the RCM will also have regard to any public comments. **Attachment 2** provides an outline of what should be included in the summary of the site plan.
- 6.10 The site plan will interact with the environment plan and safety case. Section 11 of these guidelines provides information on how possible interactions with these other regulatory requirements should be addressed.
- 6.11 **Figure 2** gives an overview of the site plan assessment process.

### **Consultation**

- 6.12 The Regulations (part 13 of Schedule 2) require that Part B of the site plan include a description of any consultations that have taken place, the outcome of those consultations and a strategy for consultation over the life of the operation. As mentioned in paragraph 4.3 of these guidelines, applicants are encouraged to initiate early consultations with key stakeholders (that is, before a draft site plan is submitted) as these have the potential to greatly simplify the approvals process, especially in relation to the SROSAI test (see section 7 of these guidelines).
- 6.13 Part 10 of Schedule 2 to the regulations requires the site plan to include information on any designated agreement with petroleum titleholders. The RCM will need to be satisfied that the agreement is in the public interest and whether or not it has significant implications for the operations that might be carried out under either title, as these may have implications for operational matters which could impact on matters such as occupational health and safety, the environment or safe and secure storage.

**Figure 2: Approval of Site Plan and Grant of Injection Licence**





## **7. Significant Risk of a Significant Adverse Impact Test**

- 7.1 The Act provides for petroleum titles and GHG titles to co-exist (s458). To manage possible interactions between petroleum and GHG operations, the Act requires the RCM to be satisfied that in certain circumstances (see paragraphs 7.5 and 7.6 below and s25-29 of the Act) activities under one title do not pose a significant risk of a significant adverse impact (SROSAI) on activities under another title. The SROSAI test, therefore, is applied by the RCM and will draw on information from multiple sources. In this context, the Act provides the RCM with wide information gathering powers (s725 of the Act). The Regulations on the SROSAI test, therefore, are Regulations binding the RCM to a particular set of procedures when applying the test.
- 7.2 This transparency provides petroleum and GHG titleholders with certainty about the decision making process associated with the application of the SROSAI test..
- 7.3 The Act also provides other methods which may resolve resource conflict issues. Where petroleum and GHG projects are proposed in the same area, the Act provides for commercial agreements between petroleum and GHG proponents. It is only in the absence of any such commercial agreements, that the RCM will have to decide whether an activity under one title would pose a significant risk of a significant adverse impact on operations that could be carried on under the other title. It is important to note that this applies to all key GHG activities as defined in the Act (s(7)), including seismic surveys.
- 7.4 GHG titleholders are encouraged to consider seeking early agreement with overlapping petroleum titleholders for key GHG operations that form part of their proposed exploration work program, as a first step, to avoid unnecessary delays. The development of a commercial agreement relating to any proposed injection and storage operations can form a second stage.
- 7.5 A key application of the SROSAI test is to protect the pre-existing rights of the petroleum industry. It provides protection to all petroleum titles that existed when the GHG provisions of the Act came into force – 21 November 2008 – including titles in the same series (for example, a petroleum production licence derived from a pre-commencement exploration permit). The test will also assist GHG titleholders to determine whether their proposed operations might impact on petroleum operations.
- 7.6 The SROSAI test is also used in the event that a post-commencement petroleum production or GHG injection licence has already been granted in the area. In this case the purpose of the test is to protect the investment already made in the other operation.
- 7.7 The SROSAI test can be viewed as a “last resort” to protect pre-existing rights. In many cases it is likely that relatively simple studies will satisfy the RCM that there is no significant risk of a significant adverse impact (for example, no known petroleum in the vicinity meaning that probability of such an impact is essentially zero). In this case there would be no need to work through the detailed mathematical procedures set out in the test for the RCM to be satisfied. Even in cases where there was known petroleum in the vicinity, all the detailed procedures still might not be required. This is demonstrated by existing CCS projects. For example, in the Sleipner project the CO<sub>2</sub> being injected into a shallower horizon; in the In Salah project the CO<sub>2</sub> is being injected down dip from the petroleum accumulation; and in the Gorgon project it is proposed that the GHG will be injected into a horizon below an existing oil field; in all these cases the probability of any

impacts is extremely low. As already noted, even in the case where there is a higher potential for adverse impacts, the issue may well be addressed by means of a commercial agreement between the parties, removing the need for the RCM to apply the test.

7.8 Thus the detailed procedures of the SROSAI test set out in the Regulations would only be invoked when needed to satisfy the RCM that there was no SROSAI.

7.9 In the event that these procedures are required, the major parameters are:

- the probability of the occurrence of an adverse impact;
- the cost of the adverse impact on the project; and
- the total resource value of the project.

7.10 In estimating the cost of an adverse impact, the RCM will take into consideration whether the adverse impact will result in:

- any increase in the capital costs of the relevant petroleum operations or the relevant greenhouse gas operations;
- any increase in the operating costs of the relevant petroleum operations or the relevant greenhouse gas operations;
- any reduction in the rate of recovery of the petroleum or the rate of injection of the greenhouse gas substance; or
- any reduction in the quantity of the petroleum that will be able to be recovered or the greenhouse gas substance that will be able to be stored.

7.11 Safety and environment impacts would be considered in estimating costs, only if those impacts would contribute to increase in capital/operating costs or reduction in petroleum recovery/injection of GHG substance. In addition, certain precautionary costs would be considered if those costs relate to an activity (for example, well drilling) that has been undertaken by an affected titleholder to mitigate a potential adverse impact.

7.12 The Act (s25(6)) provides that: ‘risk is not to be treated as significant and adverse impact is not to be treated as significant, if the amount that, under the regulations, is taken to be the probability-weighted impact cost of petroleum/GHG operations is less than the amount that, under regulations, is taken to be the threshold amount’. This means a particular event would pose a ‘significant risk of a significant adverse impact’, only if the probability weighted costs of adverse impacts (that is, the probability of the occurrence of an event which causes an adverse impact multiplied by the cost that would be incurred if the event were to occur) exceed a threshold amount.

7.13 To deal with the question of ‘threshold amount’, the Regulations provide for two thresholds: one relates to a probability weighted absolute impact cost; and the other relates to a probability weighted relative impact cost (ie, the size of the impact compared with the size of the resource value of the project being impacted on), where:

Probability weighted absolute impact cost = event probability x event absolute value

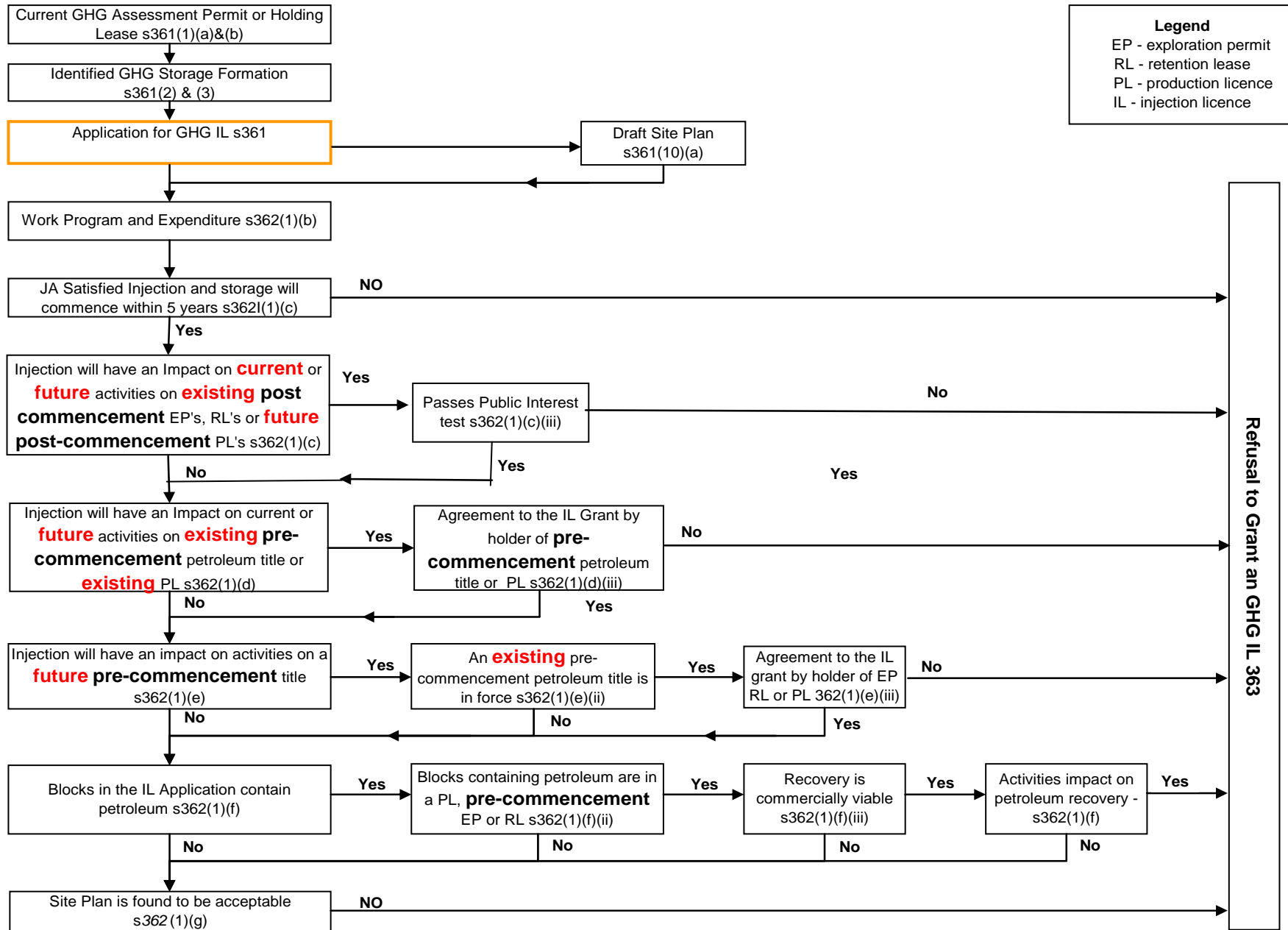
$$\text{Probability weighted relative impact cost} = \frac{\text{event probability} \times \text{event absolute value}}{\text{total resource value}}$$

7.14 The Regulations also establish absolute and relative threshold amounts at \$5 million (2010 dollars) and 0.0015 respectively. The thresholds need to be quantifiable to ensure surety and consistency in these determinations and provide an objective basis for the test. If either

impact cost exceeds its relevant threshold amount, then a significant risk of a significant adverse impact would be deemed to exist. **Attachment 3** provides a number of examples of threshold assessment using the SROSAI test.

- 7.15 The RCM may also establish an Expert Advisory Committee under s748(1) of the Act to seek advice on matters relating to the SROSAI test.
- 7.16 Accordingly, a GHG titleholder must give the RCM **sufficient information** to enable the RCM to determine whether any of the operations would pose a significant risk of a significant adverse impact on relevant petroleum operations. The RCM may request the applicant to provide additional information, if the RCM considers that the information is inadequate.
- 7.17 The RCM may also request the petroleum titleholder to provide information in relation to determining whether there is a SROSAI.
- 7.18 If the holder of the overlapping petroleum title has provided the RCM with relevant information, the RCM must take this information into account in the application of the SROSAI test.
- 7.19 After having considered whether there is a significant adverse impact, the RCM must inform the both parties of the determination. Both parties have 60 days to lodge an objection to the determination (r1.7 and r1.8) and to provide whatever information they consider relevant. In such cases, there is potential for significant delays due to the timeframes laid out in r1.7 and r1.8. Further delays could arise if the RCM needs to request the holder(s) of the relevant titles to provide additional information that may be relevant to the SROSAI test.

**Figure 3: GHG Injection Licence - Significant Risk of Significant Adverse Impact Test**



## **8. Public Interest Test**

- 8.1 The public interest test is applied by the RCM when GHG and post-commencement petroleum operations cannot coexist to determine which of the two activities should proceed. Titleholders are encouraged to work together to determine whether there are any acceptable ways in which the two activities might be modified to allow coexistence before the RCM must make a decision. This test, unlike the SROSAI test which provides protection for pre-existing rights, serves the purpose of allowing the RCM to make a decision on which activity should proceed in the event that petroleum and GHG operations cannot coexist in the case where there are no pre-existing rights. Therefore, the public interest test is a 'last resort'.
- 8.2 The Act lays out a system for establishing precedence between GHG titles and post-commencement petroleum titles, and defines when the RCM should apply the public interest test.
- 8.3 In summary, this test can apply when:
- operations under a post-commencement petroleum exploration or retention title conflict with those of a GHG assessment or holding title;
  - operations under a GHG assessment or holding title conflict with those of a post-commencement petroleum exploration or retention title.
- 8.4 The considerations to be taken into account by the RCM in determining what is in the public interest are not closely confined. The RCM will be able to take into account a wide range of consideration, including environmental and economic factors in determining what is in the 'public interest'.
- 8.5 The public interest includes any goal that the community aspires to and that is relevant to the GHG transport, injection and storage industry. Criteria include:
- the environment;
  - economic impacts;
  - employment;
  - social welfare;
  - regional development;
  - consumer interests;
  - business competitiveness;
  - economic efficiency.

However this list is not prescriptive and other goals may also be relevant. Each criterion will have differing relevance and importance in each particular case and the relative importance of different criteria is likely to vary over time.

- 8.6 Thus, for example, the RCM will be able to take into account the importance of the industry producing the GHG proposed for storage (such as the power generation industry) compared with the importance of petroleum activities that might be impacted by the storage proposal. Similarly the RCM could consider the relative importance of GHG storage activities (and the climate change implications) that might be impacted by a petroleum proposal.

## 9. Site Closure

- 9.1 The site plan must include a provisional plan for the activities to be carried out at the site closing stage and the monitoring activities to be undertaken after the injection ceases (see Schedule 2, part 12 of the Regulations and paragraphs 10.3 to 10.5 below). The titleholder will need to revise this provisional plan in the light of industry best practice and operational experience, in the process of reviewing the site plan, consistent with the Act (s457(7)) and the Regulations (r3.10).
- 9.2 Within 30 days of all injection operations ceasing, the injection licensee must lodge an application for a site closing certificate accompanied by a site closing report (see **Figure 4**), setting out:
- the modelling conducted by the applicant of the behaviour of the GHG substance injected into the storage formation and relevant information and analysis, including: methodology; types of models; and assumptions;
  - the applicant's assessment of the expected migration pathway(s) and short and long term consequences of the migration;
  - the applicant's assessment of the short-term and long-term consequences of the migration of the GHG substance; and
  - the applicant's suggestions for a post site closing monitoring program of the stored GHG substance to be undertaken by the Commonwealth, after the issue of a site closing certificate, to monitor the behaviour of the stored GHG substance.
  - Details of monitoring, measurement and verification of the behaviour of the injected GHG in the storage formation to enable the RCM to achieve sufficient confidence about the likely fate of the injected GHG after the site closure.
- 9.3 The RCM must make a decision on the site closing certificate within five years of the lodgement of the application. In deciding whether to grant a site closing certificate, the RCM must have regard to whether:
- the GHG substance injected into the storage formation is behaving as predicted in Part A of the site plan;
  - any significant risk to navigation, fishing, pipeline operations or enjoyment of native title rights;
  - there is a significant risk that the stored GHG substance will have a significant adverse impact on:
    - the conservation or exploitation of natural resources;
    - the geotechnical integrity of the whole or part of the geological formation; and
    - the environment, human health or safety.
  - the decommissioning process has been completed (see section 10 of these guidelines);
  - the relevant statutory requirements (eg, conditions imposed in the injection licence) have been complied with.
- 9.4 If the RCM is satisfied that all the above requirements have been met, the RCM will give the injection licensee a pre-certificate notice, specifying:
- a program of operations that the Commonwealth proposes to carry out for the purpose of monitoring the behaviour of the stored GHG substance after the post site closure, including an estimate of the costs of the program; and
  - the form and amount of security to be lodged by the applicant in relation to the estimated costs of carrying out the monitoring program.

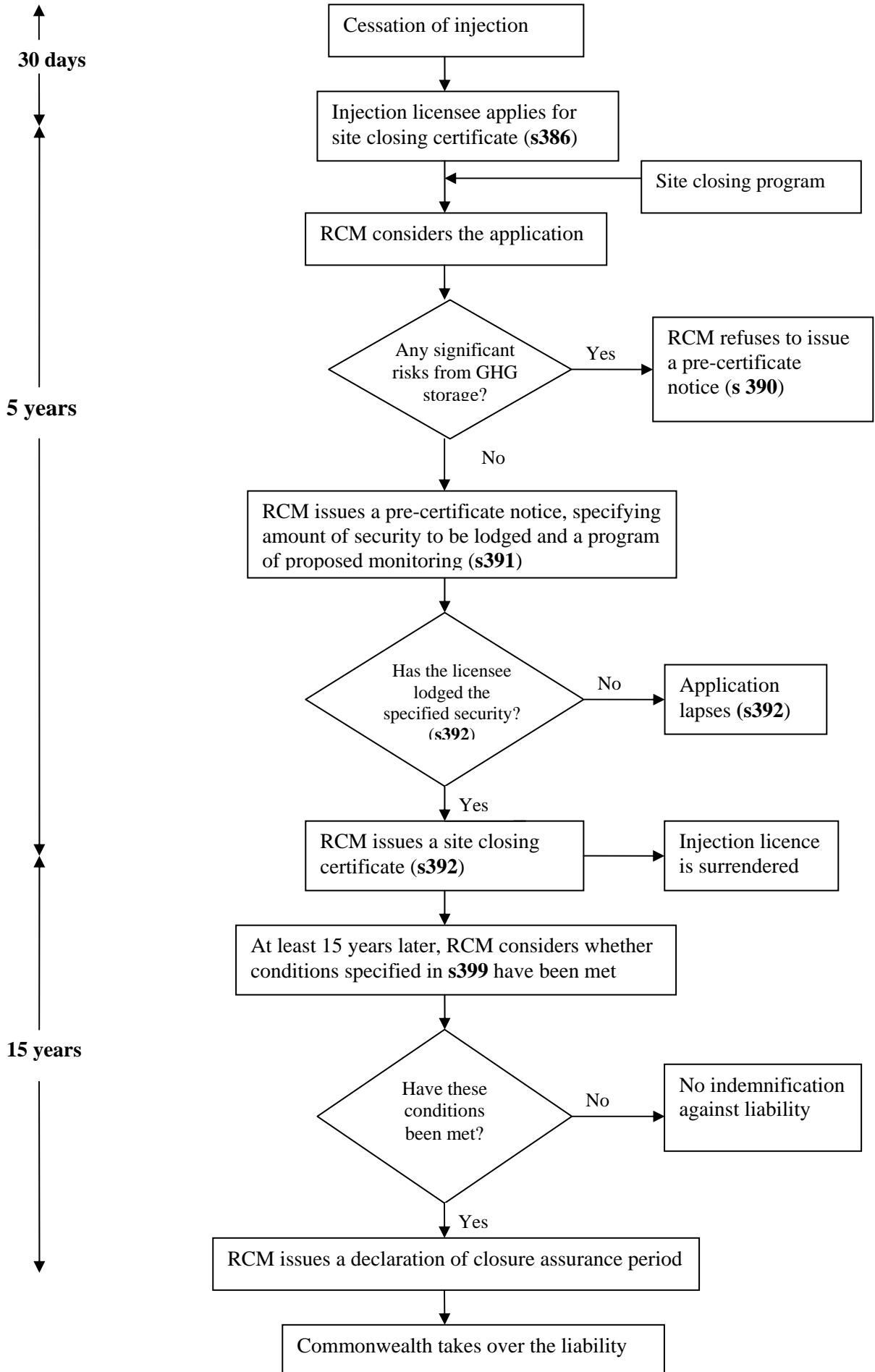
- 9.5 If the licensee has lodged the specified security within 60 days after the pre-certificate notice was given, the RCM will issue to a site closing certificate. Once the site-closing certificate is issued, the licensee can surrender the title and leave the site. At this point the title holder's statutory obligations will cease, but common law liabilities will continue.
- 9.6 The 'Closure Assurance Period' (CAP) commences on the issue of a site closing certificate. At the end of the CAP (a minimum of 15 years) the Commonwealth will take over common law liabilities, if the RCM is satisfied that: the stored GHG substance is behaving as predicted; and there is no significant risk that the stored substance will have a significant adverse impact on the integrity of the whole or part of a geological formation, the environment and human health/safety.

## 10. Decommissioning

- 10.1 A GHG titleholder is required to decommission structures, equipment and other items of property that have been brought into an offshore area for the exploration, injection, or the storage of a GHG substance in a storage formation, prior to surrendering the title (see s782 (1), item 15 of the Act). The Act also requires (s442(3)) the titleholder, to the satisfaction of the RCM, to plug or close off all wells made in the surrender area.
- 10.2 Accordingly, the titleholder of a GHG storage project must undertake decommissioning of structures and equipment and site remediation, including plugging and closing off all wells, after injection operations have ceased. All decommissioning activities must be completed to the satisfaction of the RCM, before the site closing certificate is issued. The RCM may allow certain structures to remain, if the RCM considers them to be useful for long-term stewardship of the site or the removal of them would pose significant safety risks. The RCM may also allow some wells to remain unplugged, if those wells are to be used for site monitoring after the site closure.
- 10.3 The titleholder must submit a provisional decommissioning plan at the same time as the draft site plan, outlining the proposed approach and activities to be undertaken in decommissioning of the site after injection ceases (the provisional decommissioning plan may be provided separately or as an attachment to the site plan).
- 10.4 This provisional decommissioning plan must be reviewed at least every ten years during the injection phase of the project to demonstrate whether or not this provisional plan needs to be revised in the light of evolution of industry best practice and operational experience gained since the previous review. One such review must be undertaken five years before injection is due to cease. The plan should be up-dated if the site plan is revised to include significant new structures during the injection phase of the project.
- 10.5 A final decommissioning plan must be submitted for approval no sooner than 12 months before injection is expected to cease. The decommissioning of GHG structures and equipment will be similar to that of petroleum facilities. The relevant guidelines for petroleum decommissioning, is available at: [http://www.ret.gov.au/resources/Documents/upstream-petroleum/Guidelines for the Decommissioning Australia%27s Offshore Oil and Gas Facilities.pdf](http://www.ret.gov.au/resources/Documents/upstream-petroleum/Guidelines%20for%20the%20Decommissioning%20Australia%27s%20Offshore%20Oil%20and%20Gas%20Facilities.pdf) .



**Figure 4: Site Closure and Decommissioning**



## 11. Interaction with Environment and Safety Requirements

- 11.1 In addition to the site plan, an Environment Plan under the Environment Regulations and a Safety Case under the Safety Regulations will be required prior to the commencement of the injection and storage operations. The project may also require environmental approvals from the Commonwealth Environment Minister: an Environment Impact Assessment under the *Environment Protection and Biodiversity Conservation Act 1999*; and a Permit under the *Environment Protection (Sea Dumping Act) 1981* (see **Attachment 4**).
- 11.2 The Environment Plan and the Safety Case for a GHG storage project are likely to be submitted later than the site plan and, quite possibly, significantly after a site plan has been approved. Given all these three plans deal with management of different operational aspects of the project, there is a need to manage their interaction in an effective and efficient way, both as part of the approvals process and during the operational phase of a project. It is particularly important to avoid duplication and at the same time to ensure that there are no ‘gaps’ between the plans which might allow activities to proceed without appropriate approvals.
- 11.3 Accordingly, the site plan must provide a short description of how the site plan will interact with the proposed Environment Plan and Safety Case to clearly identify what matters will be addressed in these other plans, with the objectives of:
- ensuring that when submitted the Environment Plan and Safety Case will be consistent with the site plan;
  - avoiding overlaps or duplication with the requirements of the site plan (except for incident reporting – see below); and
  - ensuring that all matters relevant to the regulation of an injection and storage activity that should be the subject of these plans are covered.
- 11.4 If the development of the Safety Case or the Environment Plan subsequent to the approval of a site plan requires changes to the site plan, the titleholder must seek a revision of the site plan.
- 11.5 During the operational phase, incidents could occur that trigger responses in two or more of the plans. Such situations could, for example, include a leakage of a GHG substance that triggers responses under the Safety Regulations; and/or the Environment Regulations; and/or trigger the RCM’s serious situations powers under the Act.
- 11.6 If an incident requires a response under the Environment Regulations or the Safety Regulations, but does not trigger a reporting requirement under the GHG Regulations, then the incident is to be dealt with in accordance with the Environment and Safety Regulations. In this case the RCM must be notified at the same time (noting that the RCM is the regulator in regard to environmental matters, while NOPSEMA is the regulator in regard to safety matters).
- 11.7 If such an incident also triggers the RCM’s serious situations powers under the Act or other powers under the GHG Regulations, then the RCM will consult with any other relevant regulator before taking action. Mechanisms that enable effective coordination between regulators will be analogous to those already in place for managing potential incidents relating to petroleum activities where there is potential for incidents to require action by multiple regulators.

## **Attachment 1: Contents of Site Plan**

The following provides guidance on information to be included in a site plan. If this information is not provided there is a very real risk that the draft site plan will not be approved. Proponents are encouraged to liaise closely with RET during the development of the site plan.

The Act (s24) provides for the site plan to comprise Part A, which sets out predictions for the behaviour of a GHG substance stored in the storage formation, and Part B which deals with other matters.

### **Part A of Site Plan**

The purpose of Part A of the site plan is to establish a trigger for the RCM's serious situation powers under s380 of the Act. If the stored GHG is not behaving in accordance with the predictions in Part A, a serious situation will have arisen.

Part A of the site plan must provide only the predictions of behaviours of the GHG substance to be stored in the storage formation over the life of the project, on the basis of plume migration modelling (details of the modelling used for these predictions must be provided in Part B).

Specifically, R3.4 requires that:

- The predictions of plume migration paths must include expected migration pathways of the GHG substance; and probabilities associated with each of the migration paths, and their migration rates. This information may be provided in the form of a table or a map.
- These predictions must be provided for specific times over the life of the project which, subject to approval by the RCM, must include at least:
  - every five years during the injection phase of the project;
  - the time when the injection of approximately 50% of the total estimated quantity of the GHG substance has taken place, provided this is expected to occur in a period less than five years after injection has commenced;
  - the time when injection is expected to cease; and
  - five years after injection is expected to cease.
- In assessing the contents of Part A, the RCM must be satisfied that the predictions of plume migration paths are soundly based. In this regard, the RCM will:
  - ascertain whether the predictions in Part A of plume migration paths are soundly based on detailed modelling provided in Part B of the site plan; and
  - consider whether there is reasonable grounds for each individual predicted behaviour to occur at each specific time, and whether the combined outcome is acceptable.

In the assessment, the RCM will also have regard to the proposed monitoring plan in Part B with the aim of ensuring that each individual prediction at a given specific time can be satisfactorily verified.

Note: The level of detail required in the modelling will vary from site to site. For example, where long migration paths are involved, very detailed modelling will likely be required. In the case of injection into a depleted petroleum reservoir, the amount of modelling required may be quite limited.

## **Part B of Site Plan**

Part B of the site plan should present the detailed information that will enable the RCM fulfil his statutory requirements to be satisfied that the overall injection and storage project will result in the permanent storage of the GHG substance and that the proposed monitoring program will detect any incidents in a timely manner.

Thus the plan needs to include the following (noting that many of these are required specifically required under R3.4).

- a. Project planning and operations overview
- b. Integrity of the storage formation
- c. plume migration modelling
- d. Proposed injection and storage operations
- e. Monitoring and verification
- f. Risk assessment
- g. Interactions with the petroleum industry
- h. Impact on other users
- i. Preliminary plan for site closure
- j. Consultation

More detail on these requirements is given in the following paragraphs.

Much of the information required can be taken directly from the declaration, which, for simplicity, may be annexed to the site plan.

### **a. Project planning and operations overview**

This section of the site plan should include:

- A brief overview of the proposed GHG storage project, including:
  - a project schedule, giving the indicative timing proposed for major milestones and information on significant works/upgrades that are planned over the life of the project;
  - maps indicating the title area and graticular blocks to be included in the injection licence (consistent with the declaration); and
  - the geographical location(s) of the project.
- Details of:
  - any joint venture arrangements and commercial agreements titleholder has reached with titleholders of the adjacent petroleum fields (if not covered elsewhere), including maps indicating the locations of the relevant petroleum fields.
- A description of:
  - the facilities to be used in injection and storage operations;
  - proposed amount of the GHG substance to be stored;
  - proposed rates of injection and injection pressures;
  - proposed period of injection operations;
  - number and location of injection wells; and
  - source, composition and other relevant physical and chemical properties of the GHG substance proposed for storage.

- Adequate information to demonstrate that the titleholder has access to resources to manage the financial and technical aspects of the project.
- Other relevant information, including:
  - the name and contact details of a person nominated by the titleholder as a single point of contact on matters relating to the project (this person may or may not be the 'facility operator' registered with NOPSEMA under the Safety Regulations); and
  - chain(s) of command for different parts of the project to ensure that there are integrated chain-of-command arrangements in place.

**b. Integrity of the storage formation**

- As previously indicated (see section 5 of these guidelines), in applying to the RCM for a declaration of a storage formation within a GHG title area, the titleholder must provide sufficient information (see Table 2) to satisfy the RCM that the storage formation is suitable for permanent storage of a GHG substance. This means the integrity of the storage formation, including its storage capacity, has been adequately established at the stage of granting the declaration with the supporting information being provided in the application for the declaration. Therefore, any further information in this regard may not be needed in the site plan. However, for completeness, information identical (or substantially identical) to that in the application for declaration, which has been approved by the RCM, must be included in or attached to the site plan.

**c. Plume migration modelling**

The site plan should include:

- Details of the modelling used for those predictions presented in Part A of the site plan in relation to the behaviour of the GHG substance to be stored in the storage formation.
- This may be the same modelling presented in the application for the declaration of a storage formation (Table 2), but the results of the modelling presented in Part B of the site plan must cover a greater number of time intervals than required by either the declaration or Part A and must include at least:
  - Every five years during the injection phase of the project;
  - the time when the injection of approximately 50% of the total estimated quantity of the GHG substance has taken place, provided this is expected to occur in a period less than five years after injection has commenced;
  - the time when injection is expected to cease;
  - five years after injection is expected to cease;
  - twenty years after injection is expected to cease; and
  - the time when the GHG substance has effectively stabilised in the subsurface.
- Information provided should include:
  - details of modelling undertaken, including methodology, types of models and assumptions;
  - sensitivity analysis covering a range of likely injection rates and pressures, including the highest values of the injection rate and the pressure proposed in the application; and
  - outcomes of modelling should include the predicted spatial extent of the plume and reservoir pressure.

Note: The level of detail required will be site dependent. In some cases, such as injection into a depleted petroleum field, only very limited modelling may be needed to support the required predictions.

#### **d. Proposed injection and storage operations**

The site plan should include:

- Details of preparatory work the titleholder has undertaken for commercial scale injection and storage operations, including:
  - interpretations of seismic data and well testing data accumulated during the exploration and appraisal stages of the project; and
  - the results of injection tests.
- A description of the primary activities involved in the injection and storage phase, including:
  - facility construction;
  - well drilling and logging;
  - operational data collection; and
  - injection planning and execution.
- Details of operational planning undertaken by the titleholder, including:
  - a framework for well and facility design, well drilling, injection operations;
  - timing and staging of injection, and operational data collection, with sufficient flexibility to adapt to unexpected subsurface environments; and
  - planning undertaken by the titleholder for major activities of the project such as GHG injection and storage, monitoring and verification of plume modelling and risk assessment;
- Sufficient information on equipment integrity, other than purely health & safety aspects that will be covered in the Safety Case, to satisfy the RCM that:
  - all equipment, such as pipelines, compressors, injection wells and their casings have been designed taking into account the composition of the proposed GHG substance and are fit for purpose;
  - in designing wells, the titleholder has taken into account their operational safety, performance and effectiveness, and the possible environmental impacts;
  - well integrity, including casing cement and well performance, will be tested after well construction is completed, and routinely while wells are operational; and
  - arrangements are in place to implement corrosion management, such as regular facility checks, wells and meters to detect corrosion immediately, and that corrosion inhibition/component replacement will be implemented as needed.
- In relation to the above, the information provided should not duplicate information required under other regulations (for example, the Consolidated Resource Management and Administration Regulations under the Act). However, as set out in section 11 of these guidelines, the information provided should clearly indicate where the boundaries between the different areas fall.

#### **e. Monitoring and verification**

- The site plan must include a monitoring plan that will satisfy the RCM that significant events in the reservoir will be detected in a timely manner to enable any necessary mitigation and remediation activities to be initiated. This must include a plan for monitoring the behaviour of plume migration in the storage formation and possible leakages of the stored GHG substance. This monitoring plan, therefore, should:
  - describe the techniques proposed for monitoring; and how these monitoring techniques will effectively assess the behaviour of the stored GHG substance;
  - include a monitoring program to detect possible leakage of the stored GHG substance to the seabed, including leakage from any well bores, and any leakages from transport and injection and activities or due to maintenance operations, pressure surges or equipment failure; and
  - include proposed reporting procedures for any venting.
  
- The monitoring plan should clearly identify targets to be monitored:
  - at sub-seabed, monitoring targets may be plume migration pathway(s) or a specific wellbore or a fault zone; and geochemical changes that may indicate unacceptable movement of the GHG substance or formation fluids;
  - seabed venting of gases; freshwater aquifers with onshore connections (if applicable); and seabed biomarkers near any potential leakage points;
  - it is important that the chosen monitoring targets involve measurable physical properties that are expected to alter in the presence of leakage from the storage site.
  
- The monitoring plan must be designed so that it can determine whether the behaviour of the stored GHG substance is consistent with the predictions provided in Part A of the site plan. The timing of the monitoring designed to verify the predictions in Part A, therefore, has to be aligned with the following specific times over which the predictions in Part A have been made:
  - every five years during the injection phase of the project, or in the case where over 50% of the total quantity to be injected is expected to occur in a period less than five years after injection commences, at a time when approximately 50 per cent of planned injection has taken place;
  - the time when injection is expected to cease;
  - five years after injection is expected to cease;
  
- In addition, the monitoring should be planned to determine the behaviour of the stored GHG substance twenty years after injection is expected to cease.
  
- The monitoring plan should be designed having regard to the time that may be required to obtain and analyse data (particularly important for seismic surveys), noting that in some cases data analysis may take time and hence have implications for the reporting timeframe. Thus, for example, a seismic survey might be included to confirm that predictions of plume migration five years after injection commenced were accurate, but the plan should show that the results would not be available until the following year.
  
- The monitoring plan should also nominate any threshold events in addition to those arising from Part A of the site plan that will constitute reportable incidents (see S379 of the Act) in relation to the behaviour of the GHG substance in the reservoir.

- For completeness, detailed information on modelling, including simulation methodology, assumptions and results, should be also provided (this information must be substantially identical to that included in the application for the declaration and may be attached to the site plan documentation).
- It is important that the titleholder obtain sufficient base-line data before injection begins to serve as a reference point where necessary. This is particularly important if proposed monitoring programs include monitoring of factors such as air or water composition, which may exhibit significant natural variations.
- The site plan must include a provisional plan for the monitoring activities to be undertaken after the injection ceases (see paragraph 9.1 of these guidelines). This will assist the applicant in assessing potential costs associated with the plan. However, the applicant must be aware that inclusion of this information in the site plan and approval of the site plan will not necessarily mean that the specific long-term monitoring plan will be accepted. It is likely to need revision as a result of operational experience and technological development during the life of the project.
- The monitoring plan should be revisited and possibly modified when the further monitoring and site characterisation activities have improved or altered the understanding of the geological characteristics of the storage formation.
- Monitoring plans are likely to be highly site-specific and thus the titleholder has the flexibility to choose the specific monitoring techniques and protocols that will be deployed at each storage site, as long as the methods selected provide data at resolutions that will meet the stated monitoring objectives. The proposed monitoring and verification procedures contained in the monitoring plan should be reviewed as needed throughout the lifetime of the GHG storage project, as site-specific operational data become available.

#### **f. Risk assessment**

- The site plan must include a comprehensive risk assessment plan covering all risks that could conceivably arising from GHG operations. The risk management plan should:
  - encompass the potential for leakage of injected or displaced fluids via wells, faults, fractures, and seismic events, with a focus on potential impacts on the integrity of the confining zone and risks to human health and the environment;
  - provide site-specific information such as prevailing ocean currents, faults, and the potential for unidentified borehole locations within the project footprint;
  - include non-spatial elements or non-geologic factors (such as shipping lanes, fish breeding zones, or critical marine areas) that should be considered in evaluating a specific site;
  - detail possible actions/plans for mitigation/ remediation for response to unexpected events (such plans should be included in the site plan to enable the RCM to ascertain the titleholder's risk assessment approach).
- The titleholder should conduct periodic updates of risk assessment throughout the life of the project, based on updated monitoring and verification data and revised models and simulations, as well as knowledge gained from ongoing research and operation of other storage sites. These updates of risk assessment could be as part of the review of the site plan or in the light of any incidents.



**Note:** As indicated in section 11 of these guidelines, the site plan should clearly describe how the site plan will interact with the Environment Plan and the Safety Case to avoid overlaps or duplications or gaps of risk assessment related information in various plans.

**g. Interactions with the petroleum industry**

- The site plan should provide a description of potential impacts on petroleum operations, which the RCM will take into account deciding whether or not there is a SROSAI (refer to section 7 of these guidelines and **Figure 1**). It is emphasised that in many cases, the RCM will be able to reach a decision as to whether or not there is a significant risk of a significant adverse impact on the basis of straight forward considerations. (For example the proposed storage formation is believed not to contain any commercial petroleum and that GHG operations in that formation will not interfere with petroleum operations.)
- As set out in paragraph 6.14 of these guidelines, if the GHG titleholder has entered into any designated agreements with any petroleum titleholder, then the contents of that agreement must be summarised and included in the site plan. This is important because the terms of any designated agreement(s) entered into is directly relevant to whether the SROSAI test needs to be invoked and may also have consequences for the project planning and management.

**h. Impact on other users**

- Must provide details of:
  - potential impacts on other resources and the rights and interests of other users of the sea, including any impacts that could arise from changes in reservoir pressure (such as water tables); and
  - plans for reducing any such impacts to acceptable levels.

**Note:** The Act requires that offshore GHG operations be carried out in a manner that does not unduly interfere with such matters as the environment, navigation, fisheries, defence, occupational health and safety, transport, communications and possible impacts on other resources.

**i. Preliminary plan for site closure**

- The titleholder must submit a provisional decommissioning plan at the same time as the draft site plan, outlining the proposed approach and activities to be undertaken in decommissioning of the site after injection ceases (the provisional decommissioning plan may be provided as an attachment to the site plan). See section 10 of these guidelines.

**j. Consultation**

- Must provide details of:
  - consultation the titleholder has had with relevant agencies to ensure the proposed GHG injection and storage activities will not have any impact on other activities such as fishing, navigation etc;
  - consultations between the titleholder and holders of petroleum titles that overlaps the GHG title, or located in the vicinity of the GHG title;
  - key issues that arose during those consultations; and
  - stakeholder engagement strategy to engage in with relevant agencies and stakeholders, on a regular basis, over the life of the project.

## **Attachment 2 Contents of Summary of Site Plan**

The objectives of the summary of the site plan are to provide stakeholders with an overview of the project, contribute to public acceptance of the project and provide a basis for any comments. To achieve this, the summary should include:

- Information on project ownership and the operator;
- A description of the project, including the source of the GHG substance, major facilities and a map showing their proposed locations;
- The amount of GHG substance to be injected and stored;
- Descriptions of the storage formation, including information aimed at demonstrating why the formation will contain the stored GHG substance permanently. This should include stratigraphic sections and information on predicted plume migration. This part of the summary site plan should be directed at underpinning public acceptance of the project;
- Information on how the behaviour of the GHG substance will be monitored. This part of the summary site plan should be quite detailed to help underpin public acceptance of the project;
- An explanation of when other relevant plans will be submitted for approval (especially the environment plan and any requirements under the EPBC Act);
- Contact information for the titleholder/operator.

### Attachment 3: Examples of the significant risk of a significant impact test

P:- Probability of the Event

C/V:- relative cost of event

C:- Absolute Cost of Event

P/C:- probability weighted Absolute impact

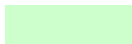
V:- Project Value


PC/V:- probability weighted Relative Impact

#### Threshold Criteria

PC \$5,000,000

PC/V 0.0015

 = pass (no SROSAI)

 = fail (yes, there is SROSAI)

#### *Scenario 1 : Large Project*

P	C (\$ ,000,000)	V (\$ ,000,000)	C/V	PC (\$ ,000,000)	PC/V
0.9	1	20000	0.00005	0.9	0.000045
0.9	10	20000	0.0005	9	0.00045
0.75	1	20000	0.00005	0.75	0.0000375
0.75	10	20000	0.00050	7.50	0.00035
0.5	9	20000	0.00045	4.5	0.000225
0.5	20	20000	0.001	10	0.0005
0.25	10	20000	0.0005	2.5	0.000125
0.25	20	20000	0.001	5	0.00025
0.1	20	20000	0.001	2	0.0001
0.1	50	20000	0.0025	5	0.00025
0.05	20	20000	0.001	1	0.00005
0.05	100	20000	0.005	5	0.00025
0.01	100	20000	0.005	1	0.00005
0.01	500	20000	0.025	5	0.00025
0.001	1000	20000	0.05	1	0.00005
0.001	5000	20000	0.25	5	0.00025

**Scenario 2 Mid Project**

P	C (\$ ,000,000)	V (\$ ,000,000)	C/V	PC (\$ ,000,000)	PC/V
0.9	1	2000	0.0005	0.9	0.00045
0.9	5	2000	0.002	4.5	0.0018
0.75	1	2000	0.0005	0.75	0.000375
0.75	5	2000	0.0025	3.75	0.001875
0.75	10	2000	0.005	7.5	0.00375
0.5	5	2000	0.0025	2.5	0.00125
0.5	10	2000	0.005	5	0.0025
0.25	2	2000	0.001	0.5	0.00025
0.25	20	2000	0.01	5	0.0025
0.1	10	2000	0.005	1	0.0005
0.1	50	2000	0.025	5	0.0025
0.05	20	2000	0.01	1	0.0005
0.05	100	2000	0.05	5	0.0025
0.01	20	2000	0.01	0.2	0.0001
0.01	1000	2000	0.5	10	0.005
0.001	2000	2000	1	2	0.001

**Scenario 3 Small Project**

P	C (\$ ,000,000)	V (\$ ,000,000)	C/V	PC (\$ ,000,000)	PC/V
0.9	0.2	200	0.001	0.18	0.0009
0.9	0.5	200	0.0025	0.45	0.00225
0.75	0.2	200	0.001	0.15	0.00075
0.75	0.5	200	0.0025	0.375	0.001875
0.5	0.5	200	0.0025	0.25	0.00125
0.5	1	200	0.005	0.5	0.0025
0.25	1	200	0.005	0.25	0.00125
0.25	2	200	0.01	0.5	0.0025
0.1	2	200	0.01	0.2	0.001
0.1	4	200	0.02	0.4	0.002
0.05	5	200	0.025	0.25	0.00125
0.05	10	200	0.05	0.5	0.0025
0.01	20	200	0.1	0.2	0.001
0.01	40	200	0.2	0.4	0.002
0.001	200	200	1	0.2	0.001

The absolute impact test is more likely to be the determinative test in large projects, while the relative impact test is more likely to be the determinative test for small projects. This is highlighted by the above examples.

## **Attachment 4: Environmental and Safety Approvals**

### **a. Approvals under EPBC Act**

Under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), any “controlled action” (ie, an action that is likely to have a significant impact on the environment) in a Commonwealth marine area is subject to a rigorous referral, assessment and approval process. Therefore, a company which intends to undertake an offshore GHG storage project must refer the proposal to the Department of Sustainability, Environment, Water, Population and Communities (SEWPAC) to determine whether the proposal is a “controlled action” under the EPBC Act.

If the proposal is determined to be a controlled action, based on the information provided by the titleholder of the storage project, the Commonwealth Environment Minister will direct an appropriate level of environmental impact assessment (EIS) of the proposal. The Environment Minister's approval of the proposal usually provides for environment conditions that may have implications for project operation. The RCM may take the Environment Minister's conditions into consideration in the site plan approval process. If the environmental approval is given subsequent to the approval of a site plan, the RCM may ask the titleholder to vary the site plan to address matters arising from the environment conditions.

### **b. Approvals under the Sea Dumping Act**

The 1996 Protocol to the London Convention (“*London Convention on the Prevention of Marine Pollution by Dumping Waste and Other Matter*”) was amended in November 2006 to allow for the disposal (storage) of CO<sub>2</sub> in sub-seabed formations. Following the introduction of this amendment, the contracting parties to the London Protocol have developed new Guidelines for CO<sub>2</sub> disposal, “*Specific Guidelines for Assessment of Carbon Dioxide Streams for Disposal into Sub-seabed Geological Formations*”. These Guidelines are at [http://www.imo.org/includes/blastDataOnly.asp/data\\_id%3D25527/9-CO2SequestrationEnglish.pdf](http://www.imo.org/includes/blastDataOnly.asp/data_id%3D25527/9-CO2SequestrationEnglish.pdf).

Australia is party to the 1996 Protocol to the London Convention and now implements the Protocol under the *Environment Protection (Sea Dumping) Act 1981*. Therefore, a titleholder who proposes to store CO<sub>2</sub> under the seabed in an offshore area may be required to apply for the grant of a permit for the storage activity, under the Sea Dumping Act. Prior to commencing GHG injection and storage operations, the titleholder must consult with SEWPAC to determine whether the proposed GHG storage would require approval(s) under the Sea Dumping Act.

### **c. Environment Plan**

In addition to the approval process under the EPBC Act and the Sea Dumping Act, the titleholder will be required to address environmental aspects of the project under the Environment Regulations. Regulation 9 of the Environment Regulations provides that before commencing a GHG activity the titleholder must submit an Environment Plan for the activity for approval. The Guidelines for Preparation and Submission of an Environment Plan is at: <http://www.ret.gov.au/resources/Documents/Offshore%20Petroleum%20Environment/Guidelines%20for%20the%20Preparation%20and%20Submission%20of%20an%20Environment%20Plan-%20October%202008.pdf>.

In accordance with the Environment Regulations, any of the following operations constitute a GHG activity:

- seismic or other surveys;
- drilling;
- construction and installation of a facility;
- operation of a facility;
- significant modification of a facility;
- decommissioning, dismantling or removing a facility;
- construction and installation of a greenhouse gas pipeline;
- operation of a greenhouse gas pipeline;
- significant modification of a greenhouse gas pipeline;
- decommissioning, dismantling or removing a greenhouse gas pipeline; or
- injection and storage of greenhouse gas.

**d. Safety Approvals**

Prior to the commencement of operation of an offshore GHG storage project, the titleholder must obtain relevant approvals for safety aspects of the projects from NOPSEMA, under the Safety Regulations. Accordingly, the titleholder must submit to NOPSEMA, for approval, a Safety Case for GHG facilities used in the project to ensure that:

- the activities at an offshore GHG facility are conducted in accordance with the safety case that has been accepted by NOPSEMA.; and
- the risks to the health and safety of persons at the facility are reduced to a level that is as low as reasonably possible.

## **Attachment 5: Notes for Holders of Petroleum Titles**

As indicated elsewhere in these guidelines, petroleum title holders may in some circumstances apply to undertake GHG activities. This attachment is intended to outline those processes.

The Act (s98, 135 and 161) provides for the RCM to make regulations allowing a permittee, lessee or licensee to explore for GHG storage formations in their title area. These regulations have been made and appear as Part 6 of the *Offshore Petroleum and Greenhouse Gas Storage (Resource Management and Administration) Regulations 2011*. Thus a petroleum title holder can undertake GHG exploration within their title area. Such activities are administered under their petroleum title. This does not, however, provide a GHG title.

Petroleum retention lessees and production licences, however, can apply for GHG holding leases and injection licences over a declared GHG storage formation wholly located within their title areas. If a petroleum title holder wishes to take up this opportunity, they must first obtain a Declaration using the same process as a GHG title holder.

To give petroleum lessees and licence holders an opportunity to exercise this option, the Act (s297 and s304) requires the RCM to give petroleum lessees and licensees at least 60 days notice of any intention to release whole or part of the lease or licence area for bids for a GHG assessment permit. If the petroleum title holder applies for a GHG title during this period, then the RCM cannot offer the area for bids unless the petroleum title holder's application lapses, is withdrawn or refused.

Petroleum production licensees can inject a GHG substance from any source for purposes relating to the recovery of petroleum (enhanced hydrocarbon recovery) without a GHG injection licence. In this case, the injection operation would be approved and administered as part of the field development plan.

However, if the injection of the GHG substance is for the purposes of disposing of the GHG, then the petroleum titleholder would be subject to the GHG injection and storage provisions of the Act and would need to obtain a GHG title.

## References

1. “*Offshore Petroleum and Greenhouse Storage Act 2006*” (<http://www.comlaw.gov.au/Details/C2011C00044/Download>)
2. “*Offshore Petroleum and Greenhouse Gas Storage (Greenhouse Gas Injection and Storage) Regulations 2011*” (<http://www.comlaw.gov.au/Details/F2011L01106/Download>).
3. “*IPCC Special Report: Carbon Dioxide Capture and Storage*” by the Intergovernmental Panel on Climate Change, 2005 ([http://www.ipcc.ch/pdf/special-reports/srccs/srccs\\_wholereport.pdf](http://www.ipcc.ch/pdf/special-reports/srccs/srccs_wholereport.pdf)).
4. “*Carbon Dioxide Capture and Geological Storage – Australian Regulatory Guiding Principles*”, Ministerial Council for Minerals and Petroleum Resources, 2005
5. “*Guidelines for Carbon Dioxide Capture, Transport, and Storage*” by the World Resources Institute, 2008 (<http://www.wri.org/publication/ccs-guidelines>).
6. The report of the International Energy Agency “*CO<sub>2</sub> Capture and Storage, a Key Carbon Abatement Option*”, 2008 ([http://www.iea.org/textbase/nppdf/free/2008/CCS\\_2008.pdf](http://www.iea.org/textbase/nppdf/free/2008/CCS_2008.pdf)).
7. 1996 Protocol to London Convention, “*London Convention on the Prevention of Marine Pollution by Dumping Waste and Other Matter*” (<http://www.imo.org/OurWork/Environment/SpecialProgrammesAndInitiatives/Pages/London-Convention-and-Protocol.aspx>)
8. “*Specific Guidelines for Assessment of Carbon Dioxide Streams for Disposal into Sub-seabed Geological Formations*”, 1996 Protocol to the London Convention Guidelines, 2009 ([http://www.imo.org/includes/blastDataOnly.asp/data\\_id%3D25527/9-CO2SequestrationEnglish.pdf](http://www.imo.org/includes/blastDataOnly.asp/data_id%3D25527/9-CO2SequestrationEnglish.pdf)).
9. “*Environmental Guidelines for Carbon Dioxide Capture and Geological Storage – 2009*” by the Environment Protection and Heritage Council, 2009 ([http://www.ephc.gov.au/sites/default/files/Climate\\_GL\\_Environmental\\_Guidelines\\_for\\_CCS\\_200905\\_0.pdf](http://www.ephc.gov.au/sites/default/files/Climate_GL_Environmental_Guidelines_for_CCS_200905_0.pdf)).
10. “*Guidelines for Selection, Characterisation and Qualification of Sites and projects for geological Storage of CO<sub>2</sub>*” by Det Norske Veritas, 2009 ([http://www.dnv.com/binaries/co2qualstore\\_guideline\\_tcm4-412142.pdf](http://www.dnv.com/binaries/co2qualstore_guideline_tcm4-412142.pdf)).
11. “*Guidelines for Decommissioning of Offshore Petroleum Facilities*” Department of Resources, Energy and Tourism, 2002 ([http://www.ret.gov.au/resources/Documents/upstream-petroleum/Guidelines\\_for\\_the\\_Decommissioning\\_Australia%27s\\_Offshore\\_Oil\\_and\\_Gas\\_Facilities.pdf](http://www.ret.gov.au/resources/Documents/upstream-petroleum/Guidelines_for_the_Decommissioning_Australia%27s_Offshore_Oil_and_Gas_Facilities.pdf)).
12. “*OSPAR Guidelines for Risk Assessment and Management of Storage of CO<sub>2</sub> Streams in Geological Formations*” (<http://www.ucl.ac.uk/ccip/pdf/OSPAR2007-Annex-7.pdf>).