Alberta's approach to the transfer of liability for carbon capture and storage projects

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Abstract: The Province of Alberta has assumed a leadership role in Canada in developing a legal and regulatory framework for encouraging the adoption of carbon capture and storage (CCS) technology. One element of that framework deals with liability issues. This paper reviews the different liability issues associated with CCS projects as well as the case for transferring liability post-closure to the government. The paper then examines how Alberta has chosen to accept a transfer of that liability and how Alberta seeks to recover at least a portion of the costs associated with that liability from the injection industry through the mechanism of the Post-Closure Stewardship Fund. Some reference is made to the European Union's CCS Directive as a point of comparison.

Keywords: carbon capture and storage; CCS; law and regulation; liability.

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Biographical notes: Nigel Bankes was a member of the steering committee for Alberta's Regulatory Framework Assessment. He was also a member of the working group struck by Alberta to advise it in relation to the Post-Closure Stewardship Fund discussed in part 4 of the paper.

1 Introduction

A legal and regulatory framework for carbon capture and storage (CCS) needs at a minimum to address the following four issues: property issues including the ownership of pore space and a scheme for leasing or disposing of rights to pore space; regulatory or permitting issues to review the merits of particular projects and to establish the terms and conditions under which projects might proceed; liability issues; and greenhouse gas accounting issues to ensure that CCS projects are fully integrated into national or regional approaches to manage greenhouse gas emissions including cap and trade or baseline and credit systems (Bankes et al., 2008).

The province of Alberta took an important first step to address these issues in 2010 with the adoption of the CCS Statutes Amendment Act (Alberta, 2010; Bankes, 2011)

which amended a series of provincial energy statutes including the Oil and Gas Conservation Act (OGCA) (Alberta, 2000a) the Environmental Protection and Enhancement Act (EPEA) (Alberta, 2000b) and the Mines and Minerals Act (MMA) (Alberta, 2000c). It supplemented this in 2011 with the Carbon Sequestration Tenure Regulation (Alberta, 2011a) and amendments to the Specified Gas Emitter Regulation (SGER) (Alberta, 2011b) to clarify the greenhouse gas crediting treatment of CCS projects. The province also finalised an offset protocol for CCS saline sequestration projects. In addition, the province carried out a comprehensive multi-stakeholder and expert review of the adequacy of its regulatory framework for CCS during 2012. The resulting Regulatory Framework Assessment (RFA) produced some 71 recommendations (Alberta Energy, 2013; Larkin et al. 2018a).

CCS saline sequestration projects require deep wellbore injection of carbon dioxide (CO_2) into suitable porous rock formation(s) 800–2000m underground, where a variety of geophysical and geochemical trapping mechanisms support permanent CO_2 storage. Four projects, including Canada's Quest Carbon Capture and Storage Project, are currently operational and one is being executed (GCCSI, 2018; MIT, 2018). The Shell Quest project received regulatory approval and started injection in 2015 (AERCB, 2012).

This contribution focuses on liability as one of the four crucial issues outlined above. The paper proceeds as follows: Section 2 discusses the categories of liability issues associated with the storage element of CCS projects and the case for a transfer of liability from the proponent to the state in the post-closure phase of a project. Alberta ultimately decided that it would be appropriate to take a transfer of liability for CCS projects post-closure through amendments to the MMA. The RFA confirmed this policy decision. Section 3 discusses how this transfer is to be effected and the terms and conditions of the transfer. This section also discusses the treatment of this topic by the RFA. One of the ideas discussed in the literature is that there are some post-closure costs that can be estimated in advance and, consistently with the polluter pays principle, the operator should be required to pay (in advance) for these costs. Alberta has accepted this proposition and Section 4 of the paper examines Alberta's Post-Closure Stewardship Fund (PCSF) to which CCS operators must contribute on the basis of a fee per ton of CO_2 injected. The RFA elaborates on some of the ideas for implementing the Fund. Section 5 offers some concluding comments.

2 Categories of liability for CCS projects and the case for transfer

2.1 Categories of liability

The term liability is a composite term referring to the obligation to make redress for some harm for which a person has been held responsible. Such obligations might arise from general law (e.g., tort liability) or pursuant to a specific statutory provision. Liability rules are important because they determine to what extent a person may be able to obtain compensation in the event that they suffer harm [Morgan and McCoy, (2012), p.126]. It is useful to recognise different categories of liability that may arise for the operator or licensee of a CCS storage facility post-closure (Havercroft, 2018; Gibbs, 2018). I will refer to three categories of liability (Bankes, 2008). The first is the potential for tort liability (i.e., liability for harm) to third parties. It is possible that a leak of CO_2 from a storage complex may cause economic or physical harm to a third party. Possible

scenarios include acidification of ground water and mobilisation of trace metals, releases to the surface causing accumulations of CO_2 in low-lying areas, or damage to an oil recovery operation. While the risk of such a release may be low (IPCC, 2005; Larkin et al., 2018b; Haszeldine and Ghaleigh, 2018) much may depend on the characteristics of the individual storage site. Relevant considerations include the existence of natural faults, the characteristics of the geological seals, the tectonic stability of the region and the existence of legacy wells that penetrate the storage complex (Sarkarfarshi et al., 2018; Haszeldine and Ghaleigh, 2018). It is not necessary to assess for present purposes whether the operator's liability for harm suffered by a third party would be strict or fault-based, it is enough to recognise this as a head of potential liability.

A second category of liability is represented by a licensee's statutory or regulatory liability under a variety of statutes for various remedial activities that may be required in the event of an incident. For example, the licensee of any well has a continuing liability for the downhole (re)abandonment of that well (Alberta, 2000a) as well as liability for a limited period of time for surface reclamation (Alberta, 2000b). For example, in the event that a cementing job fails the licensee (and its working interest co-venturers) will be required to re-abandon that well. Ongoing monitoring obligations are a form of statutory or regulatory liability.

A third category of liability (or perhaps just a subset of the second category of statutory liability) that a project operator might have is its liability under greenhouse gas emissions reduction legislation to true up its accounts in the event of leakage from the storage complex.

It is important to emphasise that liability does not guarantee the availability of funds to discharge that liability. In order to achieve that goal, it is necessary to take steps to ensure that the person liable has funds on hand to cover that liability. Governments may take various measures to achieve this result including compulsory insurance (if available from the insurance industry), financial assurance instruments, and industry-wide funds or some combination of these measures (Klass and Wilson, 2008).

2.2 The case for transferring liability

The case for transferring liability for CCS projects to the government post-closure has been discussed extensively in the literature and in government policy documents. Various government reports and policy frameworks have advocated for a transfer of responsibility, either to assure the public that there will be a responsible entity even if the operator becomes insolvent or simply disappears over the long time that CO_2 is expected to be sequestered, or as an incentive to encourage CCS development (IOGCC, 2007; Alberta Energy, 2013; ecoEnergy Task Force, 2008; Alberta Carbon Capture and Storage Development Council, 2009). Most jurisdictions have followed this advice (Jacobs and Stump, 2010; Havercroft and Macrory 2014; IEA, 2018); but not all – for example both Victoria and Queensland leave liability with the operator post-closure (Gibbs, 2011, 2018; IEA, 2018; Larkin et al., 2018c). Most writers also support the post-closure transfer of liability although most also suggest that the industry should be responsible for some or all of this liability through an industry fund that is financed by a fee per tonne of sequestered CO_2 (Jacobs and Stump, 2010; Morgan and McCoy, 2012; Klass and Wilson, 2008).

The transfer of liability to government for any industrial activity is exceptional. In virtually all cases in the resources sector the default assumption of the general legal

system (i.e., tort law) as well as related statutory liability provisions leave liability with the operator in perpetuity, subject only to the application of general limitations rules (i.e., the period within which a plaintiff must commence an action). This is the case, for example, with the conventional oil and gas sector including enhanced oil recovery projects but it is also the case with respect to acid gas disposal projects (Bankes et al., 2008). This suggests that if a government is prepared to accept a transfer of liability for CCS projects it will need to carefully delineate what is within and what is outside scope of the transfer and perhaps be prepared to defend how it has elected to draw that line [Alberta Energy, (2013), pp.114–115, recommendations 69 and 71].

3 Effecting the transfer

Once the policy decision has been taken to accept a transfer of specific liabilities it is then principally a technical legal question as to how to effect the transfer in the most effective and efficient manner. After all, if the goal is to relieve the project operator or licensee from its liability and the risk of that liability, the rules should be clear, transparent and certain. If they are not then the government will have undermined its policy goal and there is the risk of wasteful litigation over liability. This section considers how these issues have been dealt with in Alberta with some cross references to the situation in the European Union (EU). One author has noted that the Alberta scheme offers some of 'the most generous transfer provisions' of any CCS regulatory scheme [Clarke, (2011), p.188].

3.1 The trigger for the transfer

All CCS regulatory schemes begin with the assumption that during project planning, construction and active injection all of the categories of liability referred to above should be fixed on the operator or licensee and their working interest co-venturers. It is therefore crucial to define the circumstances under which the government will assume (or indeed can be obliged to assume) a transfer of the liabilities referred to above. In the case of Alberta, the MMA (Alberta, 2000c) defines the moment for the transfer of liability as the issuance of a closure certificate. The minister may issue a closure certificate 'if the minister is satisfied' that the application is complete and accurate and if the lessee meets a number of conditions including: compliance with all monitoring requirements post cessation of injection, abandonment of all wells and facilities, compliance with surface reclamation requirements, the prescribed closure period has passed and 'the captured carbon dioxide is behaving in a stable and predictable manner, with no significant risk of future leakage' [Alberta, (2000c), Sec. 120]. The province has yet to prescribe a 'closure period'.

The EU's CCS Directive has similar substantive tests. Thus the EU Directive contemplates that the operator must be able to show containment by filing a report that demonstrates:

a the conformity of the actual behaviour of the injected CO_2 with the modelled behaviour

b the absence of any detectable leakage

c that the storage site is evolving towards a situation of long-term stability.

The Directive suggests that the closure period should be no shorter than 20 years unless in any particular case all available evidence indicates that the stored CO_2 will be completely and permanently contained before that time [EU, (2009), Article 18]. Alberta's RFA has recommended that the closure period should be no shorter than ten years although this might be revisited as more experience is gained [Alberta Energy, (2013), recommendation 62; Fernandez et al., (2013)].

The closure certificate in Alberta's scheme must be viewed in the context of all of the regulatory requirement that apply to sequestration lessees throughout their term. In particular, each lessee must, from the outset, file with the minister both a monitoring, measurement and verification (MMV) plan and a closure plan each of which must be renewed (evergreened) every three years [Alberta, (2011a), Sections 9(2), 15 and 19]. The closure plan should, inter alia, include an evaluation of whether the injected CO_2 is behaving as anticipated, as well as integrity testing of each well used for injection purposes [Alberta, (2011a), Sec. 19]. The RFA considered that closure plans should also include an assessment of all wells that have penetrated the storage complex within the area of review [Alberta Energy, (2013), recommendation 59].

It is evident that the minister still retains a significant discretion in deciding whether or not to issue a closure certificate. It would be very difficult to persuade a court to review the minister's exercise of discretion given that the tests (unlike the similar tests in the EU's Directive (Havercroft and Macrory, 2014) are couched in subjective terms, i.e., 'if the Minister is satisfied that…' Given that one of the purposes of the transfer of liability is to transfer the risk from industry to government so as to encourage adoption of this technology it is perhaps surprising that the test is not expressed in more objective terms (e.g., 'if the Minister is satisfied on reasonable grounds that…') and also surprising that the government did not give this responsibility to the province's independent regulator of the industry the Alberta Energy Regulator (AER) (formerly the Energy Resources Conservation Board (ERCB) rather than the minister (Bankes, 2011; Havercroft, 2018).

The RFA further elaborated on the criteria for the issuance of the closure certificate emphasising that the regulator and the operator should agree on how the project will demonstrate that CO_2 behaviour is predictable and trending towards stability [Alberta Energy, (2013), p.104, recommendation 63]. This may give the operator additional comfort during the course of the project that the Crown will indeed assume liability for the project at some point. The EU has issued a guidance document to member states to help clarify how operators might satisfy the three elements of permanent containment referred to above (EU, 2011a).

A closure certificate can only be issued to a person that has a sequestration lease. A person engaged in a CO_2 enhanced oil recovery (EOR) operation rather than a saline CCS operation would not have a sequestration lease and instead would have some form of production tenure. As such, an EOR operator that is also sequestering CO_2 will not be eligible for a transfer of liability until it has first moved over from a production tenure to a sequestration tenure.

3.2 The mechanism for effecting the transfer

The statutory scheme adopts three different techniques for effecting the transfer of liability. The three mechanisms are:

1 statutory substitution

2 a statutory indemnity

3 transfer of liability by way of transfer of ownership of the injected CO_2.

Some of these techniques are more apt for some forms of liability than others.

3.2.1 Statutory substitution

As noted in Part 2, an operator/licensee may have a statutory obligation to take a number of remedial measures post-closure including, for example, re-abandonment of a well in the event of a cementing failure. The MMA (Alberta, 2000c) deals with this in the case of CCS operations by stipulating that the Crown 'assumes all of the obligation of the lessee' as a licensee under the OGCA (Alberta, 2000a), as 'the person responsible' or the 'operator' as the case may be under EPEA (Alberta, 2000b), and any obligations under the Surface Rights Act (Alberta, 2000d). In effect the Crown stands in the shoes of the lessee with respect to the lessee's obligations under the three listed statutes. These provisions do not expressly deal with the transfer of continuing MMV obligations but, as noted below, these obligations become the responsibility of the PCSF and thus the practical result is the same.

3.2.2 Statutory indemnity

An 'indemnity' is an undertaking by a party to cover all of the liabilities of another person in relation to the activities covered by the terms of the indemnity. For example, a principal may agree to indemnify an agent in relation to any losses that the agent suffers in the course of transacting business for the principal. It should be noted that an indemnity never expands liability. Thus, to use the same example, if the agent would have a limitations defence if sued by a third party the principal would equally be able to claim the benefit of that defence. Similarly, if the plaintiff (e.g., a landowner) cannot show causation, or some other essential element of a tortious cause of action, then neither the indemnified party (the CCS operator) nor the party giving the indemnity (here the Crown) will have any liability to the landowner.

The MMA provides that the Crown is obliged to indemnify the lessee 'against liability for damages in an action in tort' brought by a third party 'if the liability is attributable to an act done or omitted to be done by the lessee in the lessee's exercise of rights under the agreement in relation to the injection of captured carbon dioxide' [Alberta, (2000c), Sec. 121(2)]. The MMA contemplates that other conditions might be added by way of regulations but at present the regulations are silent on this matter.

3.2.3 Transfer of ownership

Section 121(1)(a) of the MMA (Alberta, 2000c) provides that upon issuing a closure certificate the Crown 'becomes the owner of the captured carbon dioxide injected pursuant to the agreement'. In my view this provision is inserted out of an abundance of

caution to ensure that the lessee has no residual liability for the injected CO_2. Ordinarily, tort liability is associated with control of the relevant activity rather than simply ownership – thus the transfer of ownership merely serves to provide additional comfort to the operator that all potential sources of liability have been covered.

Under the EU's scheme the transfer includes all legal obligations relating to monitoring and corrective measures, the surrender of allowances under the European emissions trading scheme in the event of leakage, and certain responsibilities under the EU's Liability Directive (which deals with damage to the environment rather than losses suffered by third parties). The actual mechanism by which the transfer is to be effected will be governed by national law in the EU as part of each government's responsibility to transpose the Directive.

3.3 What is not transferred?

The 2010 amendments to the MMA did not deal with the potential liability that a CCS operator might have under emissions legislation [in Alberta, formerly the SGER (Alberta, 2011b)], now the Carbon Competitiveness Incentive Regulation under Alberta's carbon levy program (Alberta Treasury Board and Finance, 2018) as a result of emissions from the storage site for which it had claimed carbon credits. In Alberta a CCS operator may obtain offset credits for sequestered CO_2 and thus may be responsible for any subsequent leakage. The RFA recommended that that this potential liability should also be transferred to the Crown (as is the case under the EU scheme) and furthermore that this liability should also become a responsibility of the PCSF [Alberta Energy, (2013), recommendations 65 and 66; Havercroft, (2018)].

4 Financing elements of the transfer of liability: the PCSF

As noted above, the literature and government policy documents frequently suggest that the operator or the storage industry generally should bear responsibility (through some sort of fund arrangement) for at least some of the costs that the government will incur after the issuance of the closure certificate. Reference is frequently made, for example, to the costs of any ongoing monitoring of the project site, although some contemplate that an industry financed fund should cover a broader suite of liabilities (Morgan and McCoy, 2012; Klass and Wilson, 2008). The 2010 amendments to the MMA accepted this argument at least with respect to ongoing MMV and any statutory liabilities that are transferred to the Crown. The government elected to achieve this result through the creation of the PCSF to be financed by contributions from sequestration lessees. The PCSF cannot be used to fund the Crown's indemnity for tort liability. The RFA confirmed this policy conclusion and observed that the province could 'use the stringency of site selection, MMV and closure requirements to minimise the public's exposure to potential risks in the post-closure period' [Alberta Energy, (2013), p.110 and conclusion 9; Fernandez et al., (2013)].

The EU's scheme is less specific and definitive and leaves substantial discretion to the member states. Thus the Directive contemplates that the operator's financial contribution must cover at least the anticipated monitoring costs for 30 years but may be used to cover any costs post-transfer to ensure that the CO_2 is completely and permanently contained. The EU has also offered additional guidance on this aspect of the

Directive (EU, 2011b). It is beyond the scope of this contribution to assess how the individual member states have transposed this set of provisions but the EU's own assessment notes that some members states have gone beyond the minimum requirements of the Directive (EU, 2014).

4.1 The problem of orphan CCS projects and facilities

In the context of the conventional oil and gas sector, an orphan well is a well that has not been successfully abandoned and for which there is no responsible solvent party; that is to say, neither the well licensee nor any of its co-venturer working interest owners has any assets within the jurisdiction that can be used to satisfy any statutory liabilities for downhole abandonment or surface reclamation. Alberta has addressed this problem in the context of the conventional oil and gas sector by creating an Orphan Well Fund – principally financed by an orphan levy on all well licensees. The Fund can be used to meet these statutory liabilities for wells that are designated as orphans by the Alberta Energy Regulator [Alberta, (2000a), Sec. 70]. The principle enshrined in the Orphan Well Fund is that of industry default liability (i.e., pooled liability) for at least a subset of potential liabilities (abandonment and reclamation) associated with oil and gas drilling and production activities. The Orphan Well Fund cannot be used to cover any third party tort liability which means in effect that victims will go uncompensated in such a situation unless the government decides to make an ex gratia payment.

Given this experience with the conventional sector it is perhaps not surprising that the province also sought to address the potential problem of orphan CCS projects and facilities within the context of the liability scheme that it was creating for CCS operators. In the CCS scheme outlined above liability is transferred once a closure certificate has been issued; it follows from this that an orphan CCS facility is a facility that fails to progress to that point i.e. it is in some sense a failed project. The project may fail on the basis of economics: the cost of the CCS chain is simply too high and thus projections of injection volumes turn out to be flawed. Alternatively, the project may fail because of a leakage from the storage structure which requires that the project be abandoned. However, a failed project can only be designated as an orphan project if the project licensee and its working interest co-venturers are insolvent and have no assets in the jurisdiction to pay for proper project abandonment.

The 2010 amendments to the MMA address the problem of orphan CCS projects and facilities not by having the Crown assume liabilities for these projects (although the legislation [Alberta, (2000c), Sec. 121(3)] does provide that the Crown may assume ownership of CO_2 injected by a lessee that 'ceases to exist') but (and by analogy with the Orphan Well Fund for conventional operations) by having the CO_2 injection industry as a whole assume liability for orphans by having the costs of orphan facilities become a charge on the PCSF [Alberta, (2000c), Sec. 122(2)(c)]. While this does violence to the name of the Fund (post-closure) it is a coherent way of mimicking the scheme that the province has created for conventional operations.

The RFA made one concrete proposal to reduce the risk of a project being orphaned. The RFA's recommendation was that the ERCB (now the AER) should require CCS licensees 'to post sufficient financial security sufficient to cover the full expected costs of suspension, abandonment, remediation and reclamation, including surface and sub-surface costs, in case a CO_2 sequestration operation becomes orphaned before the issuance of a closure certificate' [Alberta Energy, (2013), D62]. This is fully in accord

with the financial security provisions of the EU's Directive [EU, (2009), Article 19; EU, (2011b)] which refers not to orphans but to projects for which a storage permit has been withdrawn (i.e., the concept seems to be similar).

4.2 Assessing the level of contributions to the Fund

The province will determine the level of contributions to the Fund by sequestration lessees on a project by project basis. The RFA did make some recommendations on this issue and the province retained (2013–2014) a consultant, DNV-GL, to help it develop an appropriate methodology. It is apparent that contributions to the Fund should be set by reference to the Fund's potential liabilities. To summarise the preceding discussion, the Fund's liabilities are limited by the legislation to:

1 any continuing post-closure monitoring

2 the statutory substitution liabilities

3 any suspension, abandonment and related reclamation or remediation costs associated with orphan facilities.

Third party tort liabilities are not for the account of the PCSF but remain with the province following the transfer of liability. Emissions liability may be for the account of the Fund but only if the province amends the legislation or regulations as recommended by the RFA. The costs of administering the Fund itself may also be for the account of the Fund.

In considering the appropriate methodology for assessing the level of contributions it is likely useful to consider separately each of the three main heads of liability of the Fund and consider the statutory conditions under which liability is transferred. For example, with respect to the projected costs of post-closure monitoring, it is important to emphasise that this refers to the period in time after the minister has already issued a closure certificate signaling that in her opinion 'the captured carbon dioxide is behaving in a stable and predictable manner, with no significant risk of future leakage' [Alberta, (2000c), Sec. 120(3)]. The lessee's closure plan should contain advice and recommendation as to any MMV activities that should be continued post the closure certificate [Sequestration Tenure Regulation (Alberta, 2011a), Section 12(1)(h)]. The RFA took the view that the MMV contribution to the Fund should be assessed on a site-specific basis while recognising that the monitoring program would not be finalised until the operator submitted its final closure plan. The RFA addressed this problem by suggesting that contributions should be 'trued-up' at the time of issuing a closure certificate. [Alberta Energy, (2013), D63]

The RFA departed from the statutory language with respect to the second category of liability (statutory substitution liability) referring instead to an 'unforeseen events' component. I think that this is unfortunate since it perhaps suggests that the potential liability of the Fund is greater than contemplated by the statute. It is the statutory characterisation of these liabilities that must prevail over the more general wording adopted by the RFA. This second category of liability is therefore principally limited to the downhole abandonment and surface reclamation obligations of a licensee or operator under the OGCA and EPEA. As with the continuing MMV program the RFA clearly believed that a rate for the unforeseen events component of any contribution should also be project specific since it believed that the rate should be set by reference to a number of

project specific factors including the number and condition of legacy wells within the project boundary and the composition and toxicity of the CO_2 stream. [Alberta Energy, (2013), D64].

As for the orphan facility component of fund contributions the RFA suggested that any such contribution should be relatively small relative to the two other heads of liability if only because the RFA had already recommended that all projects should post financial security adequate to cover abandonment and reclamation costs associated with their projects. The RFA suggested a number of different ways of calculating this component of the levy referring to an industry wide per-tonne levy or something that was more project specific (e.g., a percentage of posted security).

It is important to emphasise that the legislation does not require the minister to set the levy at a rate that guarantees that there will be always be adequate funds available in the Fund to cover all of the three categories of liability referred to above. At the end of the day the province will have to set the levy based on the level of risk of under or over recovery that it is prepared to accept. In the case of under recovery the consolidated revenue fund of the province will have to pay for these costs (since the liability has been transferred to the province) in exactly the same way as the tort liability for which the province gives an indemnity; both represent unfunded liabilities of the province. This is consistent with the province's goal of encouraging adoption of CCS technology, its assessment that the risk is small and that it has significant ability to manage the risk by careful site selection procedures. The risk of over recovery is the risk that the province accumulates a large fund which is not put to effective use and which means that licensees are paying more than necessary to cover the Fund's liabilities.

There are some very difficult passages in the RFA report dealing with site-specific levies but pooled responsibility. As noted above, the RFA report contains several references to project-specific levels of contribution. However, the report also contains a general recommendation that 'funds paid into the PCSF should be pooled amongst all PCSF payees' [Alberta Energy, (2013), D66]. The RFA justified this recommendation with the comment that pooling will help ensure the availability of funds in the event of a low probability, high impact event and suggesting that 'without pooling some projects may need to pay significantly higher rates to achieve the same level of protection' [Alberta Energy, (2013), D66]. It is not clear that it is possible to reconcile these seemingly contradictory statements which, on the one hand, favour risk and probability based contributions assessed on a project specific basis, and, on the other hand, favour pooling to reduce the contributions that would otherwise be payable by higher risk projects. With only the Quest sequestration project operating, and no other project in an advanced stage of development, this issue will be discussed in later years as necessary.

As required by s. 20 of the regulation (Alberta, 2011a), the minister did establish an injection fee for the Quest Project. The level of the fee has not been gazetted or otherwise published but it is understood to be in the range of 20–30 cents per ton, As noted above, the current view in government is that the injection fee will be established for each project and the rate may vary with the characterisation of the risk associated with the storage site.

5 Conclusions

Any jurisdiction that makes the policy decision to accept a transfer of liability for the storage sites of CCS projects post-closure must also make a number of additional policy decisions. These decisions include decisions as to the trigger for the transfer (and the degree of discretion retained by the state); decisions as to the different categories of liability and what is included in or excluded from the transfer; decisions as to the appropriate legal arrangements to give effect to the transfer; decisions as to the funding of the transfer and the extent to which the state should seek to recover (in advance) a portion of the costs associated with the liabilities that are being transferred either from the industry as a whole (a pooling approach) or from particular operators; and decisions as to the level of risk for over-recovery or under-recovery that the state is prepared to accept.

In making these decisions the government should continue to be informed by the reasons that led it to accept a transfer of liability in the first place. These reasons typically include the public importance of the activity, the need to incent (or at least avoid a disincentive to) participation, and the importance of assuring the public that some entity will be around in the future to cover liabilities associated with CCS activities.

The scheme adopted by the Alberta has three elements. First, all liabilities remain with the operator until the closure occurs and the closure certificate issued. Second, the Crown accepts a transfer of certain prescribed liabilities (statutory liability and third party tort liabilities) of the licensee. This transfer of liabilities does not expand the scope of liability associated with a CCS project (i.e., it does not create a liability where there was no prior liability). Third, the Alberta scheme contemplates that operators should fund the transfer of statutory liabilities as well as certain other liabilities (the risk of orphans and continuing MMV, but not third party tort liability) through contributions to the PCSF. The scheme still needs to definitively resolve the balance between fees based on the concept of pooled liability and risk-based project specific assessments. Financial assurance provisions such as security deposits or bonding arrangements can be used to help adjust the balance between these two ideas.

References

AERCB (2012) *Application for the Quest Carbon Capture and Storage Project*, Radway Field, AERCB 008, Alberta Energy Resources Conservation Board, Shell Canada Limited [online] http://www.aer.ca/documents/decisions/2012/2012-ABERCB-008.pdf (accessed 9 October 2018).

Alberta (2000a) *Oil and Gas Conservation Act*, Revised Statutes of Alberta, Chapter O-7 [online] http://www.qp.alberta.ca/documents/Acts/O06.pdf (accessed 9 October 2018).

Alberta (2000b) *Environmental Protection and Enhancement Act*, Revised Statutes of Alberta, Chapter E-12 [online] http://www.qp.alberta.ca/documents/Acts/E12.pdf (accessed October 9, 2018).

Alberta (2000c) *Mines and Minerals Act*, Revised Statutes of Alberta, Chapter M-17 [online] http://www.qp.alberta.ca/documents/acts/m17.pdf (accessed 9 October 2018).

Alberta (2000d) *Surface Rights Act*, Revised Statutes of Alberta, Chapter S-24 [online] http://www.qp.alberta.ca/documents/Acts/S24.pdf (accessed 9 October 2018).

Alberta (2009) *Final Report. Accelerating Carbon Capture and Storage Implementation in Alberta*, Alberta Carbon Capture and Storage Development Council [online] http://www.canadiancleanpowercoalition.com/pdf/GS26%20-%20CCS_Implementation.pdf (accessed 9 October 2018).

Alberta (2010) *Carbon Capture and Storage Statutes Amendment Act*, Statutes of Alberta, Chapter 14.

Alberta (2011a) *Carbon Sequestration Tenure Regulation*, Alberta Regulations 68/2011 [online] http://www.qp.alberta.ca/documents/Regs/2011_068.pdf (accessed 9 October 2018).

Alberta (2011b) *Amendment to the Specified Gas Emitter Regulation*, Alberta Regulations 127/2011 [online] http://aep.alberta.ca/climate-change/guidelines-legislation/specified-gas-emitters-regulation/documents/SpecifiedGasEmittersRegulation-139-2007.pdf (accessed 9 October 2018).

Alberta Energy (2013) *Carbon Capture and Storage: Summary Report of the Regulatory Framework Assessment* [online] https://open.alberta.ca/publications/9781460105641 (accessed 1 October 2018).

Alberta Treasury Board and Finance (2018) *Carbon Levy Administration – Overview* [online] http://www.finance.alberta.ca/publications/tax_rebates/carbon-levy/overview.html (accessed June 2018).

Bankes, N. (2008) 'Legal issues associated with the adoption of commercial scale CCS projects', *Paper prepared for Carbon Capture and Storage Forum*, *A Pembina-ISEEE Thought Leaders Forum*, Calgary, 10 November, 32p. [online] http://pubs.pembina.org/reports/ccs-discuss-legal.pdf (accessed 9 October 2018).

Bankes, N. (2011) 'Alberta's new carbon capture and storage legislation', *Greenhouse Gases: Science and Technology*, Vol. 1, No. 2, pp.134–144.

Bankes, N., Poschwatta, J. and Shier, E.M. (2008) 'The legal framework for carbon capture and storage in Alberta', *Alberta Law Review*, Vol. 44, No. 3, pp.585–630.

Clarke, C. (2011) 'Long-term liability for CCS: some thoughts about specific risks, multiple regimes and the EU directive', in Havercroft, I. et al. (Eds.): *Carbon Capture and Storage: Emerging Legal and Regulatory Issues*, pp.179–198, Hart Publishing, Oxford.

ecoEnergy Task Force (2008) *Carbon Capture and Storage Task Force, Canada's Fossil EnergyFuture: The Way Forward on Carbon Capture and Storage*, Report to Minister of Alberta Energy and The Minister of Natural Resources Canada [online] http://www.nrcan.gc.ca/publications/fossil-energy-future/1167 (accessed 9 October 2018).

EU (2009) *Directive 2009/31/EC on the Geological Storage of Carbon Dioxide* [online] http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32009L0031&from=EN (accessed 9 October 2018).

EU (2011a) 'Implementation of directive 2009/31/EC on the geological storage of carbon dioxide*', Guidance Document 3*, *Criteria for Transfer of Responsibility to the Competent Authority* [online] https://ec.europa.eu/clima/sites/clima/files/lowcarbon/ccs/implementation/docs/gd3_en.pdf (accessed 9 October 2018).

EU (2011b) 'Implementation of directive 2009/31/EC on the geological storage of carbon dioxide', *Guidance Document 4*, *Article 19 Financial Security and Article 20 Financial Mechanism* [online] http://ec.europa.eu/clima/policies/lowcarbon/ccs/implementation/documentation_en.htm (accessed 5 October 2018).

EU (2014) 'Report from the commission to the European parliament and the council on the implementation of directive 2009/31/EC on the geological storage of carbon dioxide', *COM 99 Final* [online] https://ec.europa.eu/clima/sites/clima/files/docs/pages/com20017_37_ccs_directive_implementation_report_en.docx (accessed 9 October 2018).

Fernandez, M., Leask, C. and Arnot, C. (2013) 'Liability for sequestered CO2: the path forward for Alberta', *Energy Procedia*, Vol. 37, pp.7709–7722, DOI: 10.1016/j.egypro.2013.06.717.

GCCSI (2018) *Status of CCS Project Database*, Global Carbon Capture Storage Institute [online] https://www.globalccsinstitute.com/projects/large-scale-ccs-projects (accessed 13 June 2018).

Gibbs, M. (2011) 'The regulation of geological storage of greenhouse gases in Australia', in Havercroft, I. et al. (Eds.): *Carbon Capture and Storage: Emerging Legal and Regulatory Issues*, pp.159–178, Hart Publishing, Oxford.

Gibbs, M. (2018) 'The regulation of underground storage of greenhouse gases in Australia' in Havercroft, I. et al. (Eds.): *Carbon Capture and Storage: Emerging Legal and Regulatory Issues*, 2nd ed., pp.213–230, Hart Publishing, Oxford.

Haszeldine, S. and Ghaleigh, N. (2018) 'Geological factors for legislation to enable and regulate storage of carbon dioxide in the deep subsurface', in Havercroft, I. et al. (Eds.): *Carbon Capture and Storage: Emerging Legal and Regulatory Issues*, 2nd ed., pp.5–31, Hart Publishing, Oxford.

Havercroft, I. (2018) 'Long-term liability and CCS', in Havercroft, I. et al. (Eds.): *Carbon Capture and Storage: Emerging Legal and Regulatory Issues*, 2nd ed., pp.307–321, Hart Publishing, Oxford.

Havercroft, I. and Macrory, R. (2014) 'Regulating the operational and long-term liabilities associated with carbon capture and storage (CCS): approaches and lessons from Europe, Australia and Canada', *Energy Procedia*, Vol. 63, pp.6694–6704, DOI: 10.1016/j.egypro.2014.11.705.

IEA (2018) *CCS Law and Regulations Database* [online] https://www.iea.org/ccsdatabase/ (accessed 8 September 2018).

IOGCC (2007) *Inter State Oil and Gas Compact Commission. Task Force on Carbon Capture and Geologic Storage, Storage of Carbon Dioxide in Geologic Structures: A Legal and Regulatory Guide for States and Provinces* [online] http://iogcc.publishpath.com/Websites/iogcc/pdfs/Road-to-a-Greener-Energy-Future.pdf (accessed 9 October 2018).

IPCC (2005) 'Intergovernmental panel on climate change', in Metz, B. et al. (Eds.): *Special Report on Carbon Dioxide Capture and Storage* [online] https://www.ipcc.ch/pdf/special-reports/srccs/srccs_wholereport.pdf (accessed 8 September 2018).

Jacobs, W.B. and Stump, D.L. (2010) *Proposed Liability Framework for Geological Sequestration of Carbon Dioxide*, Harvard Law School, Emmett Environmental Law and Policy Clinic [online] http://live.belfercenter.org/files/Proposed%20Liability%20Framework%20for%20Geological%20Sequestration%20of%20Carbon%20Dioxide.pdf (accessed 9 October 2018).

Klass, A.B. and Wilson, E.J. (2008) 'Climate change and carbon sequestration: assessing a liability regime for long-term storage of carbon dioxide', *Emory Law Journal*, Vol. 58, No. 1, pp.103–179.

Larkin, P., Leiss, W., Arvai, J., Gracie, R.G., Fall, M., Dusseault, M.D., Heyes, A. and Krewski, D. (2018a) 'An integrated risk management framework for carbon capture and storage in the Canadian Context', *Int. J. Risk Assessment and Management*, in this issue.

Larkin, P., Dusseault, M., Gracie, R.G., Sarkarfarshi, A., Shafiei, A., Aspinall, W. and Krewski, D. (2018b) 'Uncertainty in risk issues for carbon capture and storage: findings from a structured expert elicitation', *Int. J. Risk Assessment and Management*, in this issue.

Larkin, P., Leiss, W. and Krewski, D. (2018c) 'Risk management frameworks for carbon capture and storage: a global perspective', *Int. J. Risk Assessment and Management*, in this issue.

Massachusetts Institute for Technology (MIT) (2018) *Carbon Capture & Sequestration Project Database* [online] http://sequestration.mit.edu/tools/projects/index.html (accessed 13 June 2018).

Morgan, M.G. and McCoy, S.T (2012) *Carbon Capture and Sequestration: Removing the Legal and Regulatory Barriers*, RFF Press, New York.

Sarkarfarshi, M., Ladubec, C., Gracie, R., Dusseault, M., Leiss, W. and Krewski, D. (2018) 'A taxonomy of hazards associated with four North American carbon capture and sequestration projects', *Int. J. Risk Assessment and Management*, in this issue.