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Policy Option Paper – Closing the Liability Gap

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Policy Option Paper – Closing the Liability Gap

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1. Introduction

1.1 The Issues

A number of regulatory issues relating to carbon capture and storage (CCS) need to be addressed before large-scale CCS can proceed. Since Alberta is the most advanced in its plans for long-term geological storage of carbon dioxide (CO_2) within Canada,[1] the regulatory regime in Alberta provides a starting point for identifying the issues that need to be addressed. Legal issues, such as the ownership of pore space, are addressed in a separate paper. This paper focuses on long-term liability issues.

The Alberta government is reviewing the current regulatory framework for large-scale implementation of geological storage. The Carbon Capture and Storage Development Council has released its interim report,[2] and will report back to the government before the end of 2008 with final recommendations for the implementation of CCS, including a legal and regulatory framework.[3] One issue of importance to both industry and the public is the assignment of long-term liability.[4] The most immediate concern is liability for slow or fast leakage of CO_2 from the formation where it is stored, and its impact on other underground resources (such as oil or gas reservoirs, groundwater, the soil and soil fauna) and on the surface (on humans, animals and vegetation).

A separate issue relates to liability for any CO_2 credits that have been obtained as a result of CCS operations. A release of CO_2 to the atmosphere will negate some credits obtained when the CO_2 was injected. It can be expected that this issue will be dealt with under international rules for greenhouse gas credits for CCS,[5] but the federal or provincial government will need to identify the Canadian body responsible for long-term liability for leaks.

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[1] Here we refer only to the long-term geological storage of CO_2. We recognize that EnCana's project in Weyburn, Saskatchewan has provided the most detailed information on enhanced oil recovery using CO_2.

[2] Alberta Carbon Capture and Storage Development Council, *Accelerating Carbon Capture and Storage in Alberta: Interim Report* September 30, 2008, www.energy.gov.ab.ca/Org/pdfs/CCSInterimRept.pdf See also Interstate Oil and Gas Compact Commission, *Status by State and Province of CO_2 Storage Legal and Regulatory Development* (2008), www.iogcc.state.ok.us/carbon-sequestration

[3] Interstate Oil and Gas Compact Commission, *Status by State and Province of CO_2 Storage Legal and Regulatory Development* (2008), www.iogcc.state.ok.us/carbon-sequestration

[4] ICO2N, *Carbon Capture and Storage: A Canadian Environmental Superpower Opportunity* (2007), p. 13, identifies several outstanding issues, which include "Defining CCS regulations on such items as the ownership of underground pore space and the issue of long-term liability for storage."

[5] See, for example, European Commission, *Proposal for a Directive on the Geological Storage of Carbon Dioxide* (2008), Preamble, section 23, p. 13, where this distinction is made, eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2008:0018:FIN:EN:PDF

Since the CO_2 will be stored indefinitely, the liability for leakage exists in perpetuity. The long-term (geological) time frame associated with the storage of CO_2 must be considered against the relatively short life of most commercial or industrial organizations. As pointed out in *A Regulatory Perspective on Carbon Capture and Storage in Alberta,* "Realistically, firms do not 'live' long enough to make private liability an acceptable policy in the case of CCS. Moreover, even long-lived firms often transfer their outstanding liabilities to smaller firms with shorter life spans."[6]

Thus, it is often suggested that government should be responsible. However, even if government bears the ultimate responsibility, it does not necessarily have to bear the financial costs.

Another reason cited for government to share the risks with industry if CCS is widely adopted[7,8,9,10] is that "industry is not willing to take an undefined, undetermined and unlimited liability of putting carbon dioxide in the ground."[11] Even if industry was willing to undertake an undefined liability, it would probably be a disincentive for investment in CCS and delay timely development.

However, the public is likely to be concerned if the long-term responsibilities and costs fall on taxpayers, both now and for an indefinite period into the future.

Under current regulatory requirements a company is liable during the operations phase, so we assume that long-term liability would start once a well has been abandoned. Questions that must be resolved include:

1. How is long-term liability defined and what does it include?
2. Who should be responsible for long-term liability?
3. If long-term liability is transferred from the company to government or another body, when and under what conditions should this occur?
4. How should the costs be covered?

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[6] Jeff Sansom, *A Regulatory Perspective on Carbon Capture and Storage in Alberta* (2005), 15. Prepared for Dr. J. Doucet, University of Alberta School of Business.

[7] The EcoEnergy Carbon Capture and Storage Task Force, *Canada's Fossil Energy Future: The Way Forward on Carbon Capture and Storage,* Immediate Action #2, (2008), 27, www.energy.gov.ab.ca/Org/pdfs/Fossil_energy_e.pdf

[8] Integrated CO_2 Network (ICO_2N), *Carbon Capture and Storage: A Canadian Environmental Superpower Opportunity* (2007), 13, www.ico2n.com/media.php

[9] Interstate Oil and Gas Compact Commission (IOGCC), (2007), Footnote 8, 35. The IOGCC task force "felt that release of operator and generator liability would be necessary to encourage timely development."

[10] Jeff Sansom, *A Regulatory Perspective on Carbon Capture and Storage in Alberta* (2005), 15. Prepared for Dr. J. Doucet, University of Alberta School of Business."Without a clear and orderly method for transferring liability to public entities, private firms may be very reluctant to commit resources to CCS projects, even in the face of direct incentives for CO_2 storage or strong constraints on CO_2 emissions."

[11] Stefan Bachu, cited by Gord Jaremko in "A Cautionary Tale of Carbon Capture," *Edmonton Journal,* December 10, 2007, A16.

We need to provisionally determine what to include under the heading of "long-term liability," in order to identify what should be covered in our overview of other jurisdictions. We propose that long-term liability should focus on:

> **the liability for leaks to any area outside the designated storage zone after the abandonment of the injection well.**

This includes leaks via the well bore or fractures or faults to other underground formations or to the surface.[12] If leaks are to be effectively identified in a timely fashion, there must be some process to monitor for leaks and for remedial action once a leak has been identified. Costs associated with leakage could include remedial action to prevent the leak, work to restore damage incurred underground (e.g., to shallow groundwater) or on the surface (e.g., impacts on vegetation). Thus, there must be a mechanism to finance these actions. In addition to dealing with the physical issues associated with leakage, it may be necessary to provide compensation to third parties (people, animals and property) impacted by a leak.

1.2 The EcoEnergy Carbon Capture and Storage Task Force

The federal/provincial EcoEnergy Task Force identified one of the gaps in the current regulator regime as the "Articulation and assignment of responsibility for the different liability types (operations, local and climate) and for the span of timeframes associated with storage."[13]

The task force recognized four stages for liability obligations and indicated that government should bear the liability obligations for the first and last stages, approval and post-abandonment, while individual companies should be liable for the operational stage and the monitoring stage. The task force indicated that the government may require the posting of a bond or other guarantee to cover the two intermediate stages, but it would be returned once an abandonment certificate has been issued.

The task force did not specify the time that should elapse, if any, between the termination of injection and well abandonment and the issuance of an abandonment or other certificate to indicate that liability had transferred to government.

1.3 Types of Liability

There are two types of liability: legal liability and remedial liability.[14]

General legal liability laws can apply to CO_2 leaks, and a legal case may be made for such things as negligence, nuisance or trespass (if CO_2 migrates onto the property of another, below or above

[12] One reviewer pointed out that some saline aquifers have no clear physical boundaries. They are, however, bounded by overlying formations which form a cap rock. Moreover, one of the criteria when identifying a "designated storage zone" should be that the zone will be suitable for safe storage, even if the CO_2 migrates.

[13] The EcoEnergy Carbon Capture and Storage Task Force (2008), 29.

[14] Nigel Bankes, Jenette Poschwatta and E. Mitchell Shier, "The Legal Framework for Carbon Capture and Storage in Alberta," *Alberta Law Review,* Vol. 45, No. 3, March 2008, 620-628. Both types of liability are discussed.

ground). In Canada, for example, CO_2 is classified as a toxic substance under the Canadian Environmental Protection Act, so a company may be liable even if proper care has been taken to avoid a leak.

Remedial liability may be covered by specific laws relating to injection operations and/or the post-abandonment period.

The next chapter briefly describes how long-term liability issues are currently addressed in Alberta. A summary of the legislation or proposed legislation in several other jurisdictions, including Australia, the European Union and the U.S. Environmental Protection Agency, as well as proposals from the Interstate Oil and Gas Compact Commission, follows. In Chapter 3, we propose criteria for evaluating different options for managing long-term liability and provide a list of options.

2. The Regulation of Long-Term Liability in Various Jurisdictions

2.1 The Current Situation in Alberta

Although we envisage that long-term liability would start after injection has ceased and the injection well has been abandoned, we will address the well abandonment stage to clarify what regulations will be in place before any consideration of long-term liability begins.

2.1.1 Well Abandonment

The Alberta Energy Resources Conservation Board (ERCB) regulates the injection of CCS under Directives 51 and 65.[15] A well for injecting CO_2 is a Class III well, the same class as a well for acid gas injection. Directive 65 has a section on acid gas injection that is often regarded as a prototype for the regulation of CO_2 injection (since acid gas contains a certain percentage of CO_2).

In Alberta, the Oil and Gas Conservation Act would apply to remedial action for a leak during the operations phase of CCS. [16] If a company fails to take the required action, it can be undertaken by the ERCB. To ensure that there are adequate funds, the ERCB requires companies to post security. According to Directive 68, "The security deposit is intended to offset potential suspension, abandonment, remediation, and reclamation costs."[17]

Once injection operations cease, a company must abandon the well, in accordance with *Directive 20: Well Abandonment Guide.*[18] In this context, to "abandon" means to follow a specified procedure to safely close down a well, which requires plugging the well, cutting off the casing below the surface and capping the well (e.g., with a welded steel plate). For cased wells, the ERCB requires testing for emissions through the surface casing prior to abandonment. It also

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[15] ERCB, *Directive 51: Injection and Disposal Wells – Well Classifications, Completions, Logging and Testing Requirements* (1994), www.ercb.ca/docs/documents/directives/Directive051.pdf

ERCB, *Directive 65: Resource Applications for Conventional Oil and Gas Reservoirs* (2007), www.ercb.ca/docs/documents/directives/Directive065.pdf

[16] Government of Alberta. Oil and Gas Conservation Act, www.qp.gov.ab.ca/documents/Acts/O06.cfm?frm_isbn=9780779733828

[17] ERCB, *Directive 68: ERCB Security Deposits* (2008), 4, www.ercb.ca/docs/documents/directives/directive068.pdf NB Directives 006 and 024 are being revised later in 2008 as a result of Directive 68, and will in the future only apply to specific program funds.

[18] ERCB, *Directive 20: Well Abandonment Guide* (2007), www.ercb.ca/docs/documents/directives/Directive020.pdf

recommends testing for gas migration to ensure that no gas is escaping outside the outermost casing. In the central and eastern part of Alberta it is mandatory to test for gas migration due to the nature of the geology. After a well is abandoned, the surrounding land can be reclaimed and Alberta Environment can issue a reclamation certificate.[19] Once these tasks are completed, any security posted by a company may be returned (see section 2.1.2.2, below).

If a problem is identified with the well site at a later date, Alberta Environment can issue an environmental protection order, requiring the company to undertake further reclamation work.[20] Such an order can be issued up to 25 years after the reclamation certificate was issued for a well site.[21] While Alberta Environment regulates reclamation on private land, Alberta Sustainable Resource Development is responsible for reclamation on public land.

2.1.2 Post-abandonment

2.1.2.1 Liability

Usually, the owner of a well is responsible for the well even after it has been abandoned.[22] No time frame is specified. However, based on the wording in the Oil and Gas Conservation Act, it seems this only applies to a well or facility. It is not clear if this provision would apply to leaks other than those due to deficiencies in the well itself. It would not cover CO_2 leaks which might occur along natural faults or fractures in the rock. Given that CO_2 can migrate within a geological formation, if more than one company is injecting into a formation it may be challenging to identify who is liable for post-abandonment leaks along faults or fractures.

The Mines and Minerals Act requires a company to compensate the government for any damage caused by an injection well,[23] but if an individual wants compensation for damage caused by a leak they may have to take the Crown to court.

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[19] Alberta Environment and Alberta Sustainable Resource Development may also access the security deposit to deal with reclamation of wells and pipelines on lands under their jurisdiction. Alberta Environment may also require the deposition of security to cover reclamation on "specified land." Environmental Protection and Enhancement Act, section 32, Environmental Protection Security Fund, www.qp.gov.ab.ca/documents/Acts/E12.cfm?frm_isbn=9780779729241 See also sections 134 and 135 with respect to requirements for specified land.

[20] Environmental Protection and Enhancement Act, section 142.

[21] Conservation and Reclamation Regulation, section 15, www.qp.gov.ab.ca/documents/Regs/1993_115.cfm?frm_isbn=9780779731084

[22] Oil and Gas Conservation Act, section 29, states, "Abandonment of a well or facility does not relieve the licensee, approval holder or working interest participant from responsibility for the control or further abandonment of the well or facility or from the responsibility for the costs of doing that work." www.qp.gov.ab.ca/documents/Acts/O06.cfm?frm_isbn=9780779733828

[23] Mines and Minerals Act, section 56, states that a person who has the right to drill a well for the injection of any substance into an underground formation "shall indemnify the Crown in right of Alberta for loss or damage suffered by the Crown in respect of any claims or demands made by reason of anything done by that person or any other person on that person's behalf in the exercise or purported exercise of that right," www.qp.gov.ab.ca/documents/Acts/m17.cfm?frm_isbn=9780779730384

There does not seem to be any provision for surveillance and reporting after abandonment. The ERCB requires some monitoring and reporting during the operation of an injection well, but there is no provision for monitoring and verification once injection is complete, except for natural gas storage.[24] It seems that in the post-abandonment period, the board would only investigate if there was a complaint. There is no separate reporting of post-abandonment complaints in the *Provincial Surveillance and Compliance Summary.*[25]

2.1.2.2 Security Deposits

Even if a company is liable, it is not clear whether a company would have funds to undertake any remediation work that results from a leak following abandonment. A company is required to have security to cover liabilities and costs of remediation, but it can apply to have any deposit refunded when the security is no longer required (which would normally occur following satisfactory abandonment and reclamation).[26] If the owner of a well can no longer be found, any work required is paid for by the Orphan Fund (which is financed by a levy on the industry).[27] The fund is intended to cover liability due to suspension, abandonment and reclamation of oil and gas wells and acid gas injection wells. However, "the statutory scheme does not create a special liability regime to cover harms suffered by others as a result of a release."[28] There may be other issues related to how large the orphan well fund should be, and whether operators of CO_2 injection wells should pay more into the fund for their new injection wells.[29]

The ERCB is usually responsible only for activities on a well site, so remedial action for CO_2 leakage away from a well or pipeline might be covered by the Environmental Protection and Enhancement Fund.[30] Again, this fund applies to remedial work as a result of an emergency, not to compensation of third parties.

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[24] ERCB, *Directive 65: Resource Applications for Conventional Oil and Gas Reservoirs (*2007), www.ercb.ca/docs/documents/directives/Directive065.pdf

[25] ERCB, *ST-2008: Provincial Surveillance and Compliance Summary 2007* (2008), www.ercb.ca/docs/products/STs/ST99_current.pdf

[26] ERCB, *Directive 68: ERCB Security Deposits,* section 7, (2008), www.ercb.ca/docs/documents/directives/directive068.pdf

See also *Oil and Gas Conservation Regulation, section 1.100(2),* www.qp.gov.ab.ca/documents/Regs/1971_151.cfm?frm_isbn=9780779733668

Once abandonment is complete, a company can apply to have a portion of the security returned, and once a reclamation certificate has been issued, it can apply for a refund of the remainder. ERCB personal communication with Mary Griffiths, August 12, 2008.

[27] ERCB, *Directive 68: ERCB Security Deposits* (2008), www.ercb.ca/docs/documents/directives/directive068.pdf

[28] Nigel Bankes, Jenette Poschwatta and E. Mitchell Shier, "The Legal Framework for Carbon Capture and Storage in Alberta," *Alberta Law Review,* Vol. 45, No. 3, March 2008, 603. This article provides a thorough overview of the current regulatory system, p. 620–627.

[29] One issue is likely to be the risk of leaks in the post-abandonment period.

[30] Environmental Protection and Enhancement Act, section 30, www.qp.gov.ab.ca/documents/Acts/E12.cfm?frm_isbn=9780779729241 Section 30(2) states that this fund is to be

2.1.3 Release of Greenhouse Gases

The release of greenhouse gases (GHGs) to the atmosphere is regulated under the Climate Change and Emissions Management Act. [31] This act permits the government to make regulations with respect to sequestration, which includes geological storage.[32] It deals with credits and sink rights and makes provision for inspections where the investigator believes a specified gas (such as CO_2) is being, has been or may be released to the environment.[33] Although this enables the investigation of a leak,[34] the act does not appear to make provision for routine monitoring. It is not clear which provincial body would assume the direct responsibility for monitoring and verifying leaked or vented CO_2, but this needs to be determined. The reported volumes must then be deducted from the volume injected.

One issue which needs to be addressed with respect to the release of GHGs relates to an ERCB provisions that allow a company to vent CO_2 to the atmosphere, not only from equipment but from wells.[35] Venting should cease when a well is capped and abandoned (and, as noted earlier, this must be checked as part of the well-abandonment process). However, since there is no plan for monitoring for leaks except as part of the abandonment process, any subsequent leaks would probably not be identified.

> "A CCS project requires verification in order to assess the amount of CO_2 that is stored underground, to assess the behaviour of the CO2 plume, and to assess how much, if any, CO_2 is leaking back into the atmosphere. Effective monitoring and verification are a key component to minimizing the risks associated with CCS by providing a trigger for remedial action."[36] — Bankes et al., *Alberta Law Review*

The management of CO_2 emissions to the atmosphere also comes under federal jurisdiction, since CO_2 is listed as a toxic substance under the Canadian Environmental Protection Act.[37] This legislation requires reporting of emissions from large final emitters. If large final emitters are offsetting some of their emissions by injecting CO_2 into geologic formations, any leaks of CO_2

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used "for the purpose of environmental protection and enhancement and emergencies with respect to any matter that is under the administration of the Minister."

[31] Government of Alberta, Climate Change and Emissions Management Act, www.qp.gov.ab.ca/documents/Acts/C16P7.cfm?frm_isbn=9780779723386

[32] Climate Change and Emissions Management Act, sections 1(e)(ii) and 60(1)(q). This act, section 9, also identifies a sink right as a property right.

[33] Climate Change and Emissions Management Act, section 13(1)(a), www.qp.gov.ab.ca/documents/Acts/C16P7.cfm?frm_isbn=9780779723386

[34] See section 1(d) in the act, which includes leaks and seeps in the definition of a release.

[35] ERCB, *Directive 60: Upstream Petroleum Industry Flaring, Incinerating and Venting* (2006), 66, www.ercb.ca/docs/documents/directives/Directive060.pdf

[36] Bankes et al., *Alberta Law Review* (2008), 618.

[37] Canadian Environmental Protection Act, Regulation of Toxic Substances and Release of Toxic Substances, sections 90–99, laws.justice.gc.ca/en/showtdm/cs/C-15.31 CO_2 is listed in Schedule 1, section 74.

during or after injection would need to be included in the company's GHG accounting. The federal government might require monitoring to verify that the injected CO_2 is not returning to the surface, since it bears responsibility for meeting its international commitment to reduce GHG emissions. It can be expected that this issue will be dealt with under international rules for GHG credits.

2.1.4 Gaps in Responsibility for Long-Term Liability

Whereas no time frame is specified for the duration of a company's responsibility after a well has been abandoned, there is a time limit to their liability with respect to the reclamation of the well site (see section 2.1.1).

It is important to identify who is responsible for ongoing monitoring of the movement of CO_2 in the formation after a well has been abandoned, and who is responsible for remedial action and, potentially, compensation, if leaks occur. It is also important to identify who is responsible for reporting on emissions of CO_2 to the atmosphere and the adjustment of credits received for the initial injection of CO_2. Since there is no provision for post-injection monitoring and verification, there is currently no mechanism for assigning responsibility and liability for long-term monitoring of a storage site.

2.2 Australia

The draft Australian legislation is designed to provide for the geological storage of CO_2 under offshore Commonwealth waters. The proposed Australian approach to liability issues is set out in several documents.[38,39] The Regulation Impact Statement recommended "That there should be no

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[38] Australian Government, Department of Resources, Energy and Tourism, *Carbon Dioxide and Geological Storage: Greenhouse Gas Storage Legislation* (2008), main web site, www.ret.gov.au/resources/carbon_dioxide_capture_and_geological_storage/Pages/ccs_legislation.aspx

[39] Ministerial Council on Mineral and Petroleum Resources (Australia), *Carbon Dioxide Capture and Geological Storage: Australian Regulatory Guiding Principles* (2005), www.ret.gov.au/resources/Documents/ccs/CCS_Aust_Regulatory_Guiding_Principles.pdf The Australian government examined three options for addressing long-term liability in its Regulatory Guiding Principles.

Option 1: Status Quo. There are currently a range of Commonwealth, state and territory laws which impose statutory obligations to do or not do certain things, with financial and criminal penalties for non-compliance. However, not all jurisdictions have regulations for post-closure responsibilities that could apply to CCS projects, which could result in inconsistencies in the way CCS projects are regulated and uncertainty for industry.

Option 2: Self Regulation. This is not considered a viable option given the long-term time scales.

Option 3: Additional/Amendments to Government Regulation. Decommissioning and rehabilitation regulations that are used for mining and petroleum facilities could probably be adopted for CCS. Government will permit site closure when they are satisfied that future land use objectives are met, the residual risks of leakage and liability is at an acceptably low level, and any ongoing costs are low or can be managed.

The option chosen was a combination of options 1 and 3, with current regulatory principles and common law applying to liability issues for all stages of CCS projects, with a consistent regulatory framework for post-closure

new regulation and the issue of long-term liability be left to common law in the same way as it does for petroleum and other industries."[40]

The legislation has numerous references to liability, but they relate to strict liability under the Criminal Code for failure to comply with the legislation during operations and site closure.[41] There is no reference to long-term liability. "But this is a case where silence speaks volumes since silence will serve to leave liability with the licensee/operator,"[42] according to Nigel Bankes and Jenette Poschwatta in the article "Draft Australian Legislation on Carbon Capture and Storage: A Canadian Perspective." Thus, companies would need to cover their common law liability as a cost of doing business. This approach is chosen, according to Australia's Ministerial Council on Mineral and Petroleum Resources, because "If Government were to explicitly assume long term liability this would effectively be a subsidy."[43] The Regulation Impact Statement recognizes that a fund could be set up to require industry to meet liabilities, but this would be an additional cost to industry compared to existing law. The potential for government and industry to share long-term liability is also mentioned, but as the Regulation Impact Statement states, "the 'no new regulation' option effectively provides a system where liabilities would be shared between industry and the community, with Government effectively assuming a greater share of liability due to the passage of time."[44]

The Government invited stakeholder input during discussion of the draft legislation. A House of Representatives Committee endorsed the proposals, with one key exception: the government should be legally liable if anything were to go wrong in the long term.[45] However, this proposal was rejected by the Government,[46] which confirmed that once a closure certificate had been issued common law would apply.

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storage that aims to "minimize exposure to health, environmental and financial risks for project operators, governments and future generations." *Australian Regulatory Guiding Principles,* 46.

[40] Ministerial Council on Mineral and Petroleum Resources (Australia), *Amendments to Offshore Petroleum Legislation to Provide for Greenhouse Gas Transport, Injection and Storage in Commonwealth Waters: Regulation Impact Statement* (2008), 29, www.ret.gov.au/resources/Documents/ccs/Regulation_Impact_Statement.pdf

[41] The Parliament of the Commonwealth of Australia, *Offshore Petroleum Amendment (Greenhouse Gas Storage) Bill 2008* (2008), www.ret.gov.au/resources/Documents/ccs/os_Petroleum_Amendment_Bill_2008.pdf

[42] Nigel Bankes and Jenette Poschwatta, "Draft Australian Legislation on Carbon Capture and Storage: A Canadian Perspective," *Resources,* Number 102 (2008), wcmprod1.ucalgary.ca/cirl/files/cirl/Resources102.pdf This paper refers to the draft legislation, but the final legislation does not appear to have changed on this point.

[43] Ministerial Council on Mineral and Petroleum Resources (Australia), *Amendments to Offshore Petroleum Legislation to Provide for Greenhouse Gas Transport, Injection and Storage in Commonwealth Waters: Regulatory Impact Statement* (2008), 27.

[44] Regulation Impact Statement, 27.

[45] House Standing Committee on Primary Industries and Resources, *Down Under: Greenhouse Gas Storage. Review of Draft Offshore Petroleum Amendment (Greenhouse Gas Storage) Bill* (2008), www.aph.gov.au/house/committee/pir/exposuredraft/report.htm

[46] Government of Australia, *Response to the House of Representatives Standing Committee on Primary Industries and Resources Recommendations* (2008), Recommendation 14, www.aph.gov.au/house/committee/pir/exposuredraft/report/CCS Govresponse.pdf

2.3 European Union

The European Commission has adopted a proposal for a Directive on the Geological Storage of Carbon Dioxide,[47] which applies to the European Union (EU). The directive provides a legal framework which sets out objectives and general requirements for geological storage, but allows the member states to work out the details.[48] It makes provision for the transfer of responsibility, including all legal obligations, from the operator to the "competent authority." No time frame is specified; the directive states that the storage site "shall be transferred to the competent authority on its own initiative or upon request from the operator, if and when all available evidence indicates that the stored CO_2 will be completely contained for the indefinite future."[49] Before the transfer is made, the operator must seal the site, remove all injection facilities and write a report detailing how this criterion has been met.[50] Once the transfer is complete, the former operator is not liable for any costs[51] and financial security is no longer required.[52]

Each member state must establish or designate a "competent authority" to carry out the duties set out in the directive.[53] The member states are also responsible for determining how "adequate provisions" are made for financial security to cover operations, closure and post-closure costs.[54] This must cover liability for climate damage due to leakage from storage sites, as set out in an earlier directive.[55]

Environmental liability for local environmental damage is regulated by a separate directive.[56] It makes clear that the operator is liable for costs for preventative and remedial actions (Article 8) and addresses financial security (Article 14). The directive does not make provision for compensation to be paid to private parties who suffer as a result of environmental damage (Article 3).

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[47] European Commission, *Commission Proposal for a Directive on the Geological Storage of Carbon Dioxide* (2008), eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2008:0018:FIN:EN:PDF This directive is referred to in the footnotes hereafter as "*Directive on GSCO2*." For more information see ec.europa.eu/environment/climat/ccs/eccp1_en.htm

[48] European Commission, *Directive on GSCO2*, Proportionality Principle (2008), 7.

[49] European Commission, *Proposal for a Directive on the Geological Storage of Carbon Dioxide, Article 18.1* (2008), eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2008:0018:FIN:EN:PDF

[50] European Commission, *Directive on GSCO2*, Article 18.1 and 18.7 (2008).

[51] European Commission, *Directive on GSCO2*, Article 18.6 (2008).

[52] European Commission, *Directive on GSCO2*, Article 19.2 (2008).

[53] European Commission, *Directive on GSCO2*, Article 22 (2008).

[54] European Commission, Article 19.1 (2008).

[55] European Commission, *Directive 2003/87/EC Establishing a Scheme for Greenhouse Gas Emission Allowance Trading within the Community* (2003), eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2003:275:0032:0046:EN:PDF

[56] European Commission, *Directive 2004/35/EC on Environmental Liability* (2004), eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2004:143:0056:0075:EN:PDF

2.4 Interstate Oil and Gas Compact Commission

The Interstate Oil and Gas Compact Commission's *Model Statute for Geologic Storage of Carbon Dioxide* has a process to release the generator of the CO_2 and the operator of the injection project from future liability. The statute proposes that responsibility for the stored CO_2 should pass to the state ten years after storage operations cease, provided the storage operator can show "that the reservoir is reasonably expected to retain mechanical integrity and remain emplaced."[57] At that point the operator is issued a Certificate of Completion of Injection Operations and any performance bonds are returned. Any subsequent leakage becomes the responsibility of a Carbon Dioxide Storage Facility Trust Fund. This fund, which is managed by the state, is financed through a levy on each ton of CO_2 injected. The fund is intended to finance the long-term monitoring of a site as well as remediation.[58] There is no mention of the fund being used to compensate others for damages incurred as a result of a leak.

The task force that prepared the Model Statute decided that a ten-year time frame would allow sufficient time to determine that there are no known issues with the integrity of the storage facility.[59]

2.5 U.S. Environmental Protection Agency

In the U.S., the Environmental Protection Agency (EPA) has drafted legislation for *Federal Requirements Under the Underground Injection Control Program for Carbon Dioxide Geological Sequestration Wells.*[60] This falls under the federal Safe Drinking Water Act.

The draft proposal, which aims to protect each Underground Source of Drinking Water (USDW), requires "that owners or operators 1) develop a post-injection site care and closure plan, 2) monitor the site following cessation of the injection activity, and 3) plug all monitoring wells in a manner which prevents movement of injection of formation fluids that could engage a USDW."[61] The proposal was released for public comment on July 15, 2008, but it will be more than a year before the final legislation is ready.

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[57] Interstate Oil and Gas Compact Commission, *CO_2 Storage: A Legal and Regulatory Guide for States* (2007)*, 35,* iogcc.publishpath.com/Websites/iogcc/pdfs/Road-to-a-Greener-Energy-Future.pdf The IOGCC does not provide any criteria by which to judge whether the reservoir can be expected to maintain its mechanical integrity.

[58] "The Trust Fund shall be utilized solely for long-term monitoring of the site, including remaining surface facilities and wells, remediation of mechanical problems associated with remaining wells and surface infrastructure, repairing mechanical leaks at the site, and plugging and abandoning remaining wells under the jurisdiction of the State Regulatory Agency for use as observation wells." IOGCC. 2007, 34.

[59] IOGCC, Footnote 8 (2007) 35.

[60] U.S. Environmental Protection Agency (EPA), Geologic Sequestration of Carbon Dioxide website (2008), www.epa.gov/safewater/uic/wells_sequestration.html *Federal Requirements Under the Underground Injection Control (UIC) Program for Carbon Dioxide (CO_2) Geological Sequestration (GS) Wells,* (hereafter, "*CO2 GS Proposal*") www.epa.gov/safewater/uic/pdfs/prefr_uic_co2rule.pdf

[61] EPA, *CO2 GS Proposal* (2008), 118–119.

The proposal states that current regulations under the Underground Injection Control Program do not limit the duration of post-injection site care, but that many environmental programs use a 30-year period as a time of reference. It points out that while this may be sufficient for plugged wells containing liquids, "…characterizing post-injection site care timeframes for GS is more challenging."[62] The buoyancy of the CO_2, its viscosity and the large injection volumes mean that the area over which the CO_2 will spread is likely to be greater than that for other injected substances, and thus the potential for impact on underground sources of drinking water is greater. The actual time it takes for a CO_2 plume to stabilize will depend on a number of geologic factors (permeability, geochemistry and the degree of capillary trapping) and be very site specific. Various studies and models indicate that stabilization could take from 10 to 100 years after injection stops.

The EPA "is tentatively proposing a post-injection site care (monitoring) period of 50 years with Director's discretion to change that period to lengthen or shorten the 50-year period if appropriate."[63] Determining factors will include data on pressure, fluid movement, mineralization and dissolution of the CO_2. The proposal is thus a combination of a time-frame and a performance standard.

During the 50-year (more or less) post-injection site care period, the owner or operator would have to report on monitoring results and, when necessary, update modeling results. The company can ask the director to authorize site closure when the monitoring and predicted movement show that there is no risk to underground sources of drinking water. Despite the proposed 50-year limit, a company's responsibility for post-injection site care could last 100 years or longer if there is still a risk that a drinking water source could be endangered. The EPA also indicates that "owners or operators may still be held responsible after the post-injection site care period has ended, (e.g., for unanticipated migration that endangers a USDW)."[64]

Thus, under the EPA proposal, the owner or operator remains financially responsible for the potentially very long post-closure period and must have financial resources for well closure and remediation of the carbon storage project. However, the liability would cover only impacts on underground sources of drinking water, since the legislation does not cover risks to air, ecosystems or the public (except those relating to drinking water). To ensure that a company's financial security is adequate to cover potential costs, a company would have to update the cost estimate for post-injection site care, site closure and remediation on a regular basis, as required by the director.

The EPA suggests financial security may include performance bonds, letters of credit or a corporate guarantee, but is requesting public comment on whether its proposals need amending. The EPA has discussed, but not yet determined, how to cover the indefinite liability after the post-injection care period is over. Also, due to the limitations of the Safe Drinking Water Act, the current proposal does not identify any ways in which the liability for damage to the air, ecosystems or the public would be addressed.

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[62] EPA, *CO2 GS Proposal* (2008), 120.

[63] EPA, *CO2 GS Proposal* (2008), 123.

[64] EPA, *CO2 GS Proposal* (2008), 134.

3. Criteria and Options for Assigning Long-Term Liability for CCS

This chapter proposes a number of criteria which should be considered when selecting a model for assigning long-term liability. In a separate document, the Pembina Institute will propose a straw model to compare various options against these criteria.

3.1 Evaluation Criteria for Liability Options

The guiding principles are that the system of managing long-term liability should

- minimize risk to the environment and humans;
- be equitable, both to taxpayers and companies;
- be transparent, so that all can understand who bears liability at each stage;
- protect individuals from costs resulting from a CO_2 leak;
- avoid creating undue barriers to the deployment of CCS;
- be practical and realistic, recognizing that government owns the pore space and that the companies which inject the CO_2 will not be in existence for ever;
- be flexible, so that requirements can be updated, if necessary, with improved scientific knowledge. While the proposed liability regime should be the best that can be devised with current knowledge, it is recognized that as operations proceed, more information will be gained from practical experience. It should thus be possible to modify and improve requirements for long-term liability in the light of experience.

The above principles should act as a checklist of evaluation criteria when reviewing the options.

3.2 Issues to be Addressed

In evaluating different options for long-term liability, four main issues, as identified in section 1.1, need to be addressed:

1. A clear definition of what is included in long-term liability.
2. Identification of who is responsible at all stages.
3. A clear timeline and/or process for any transition in responsibility.
4. Fair distribution of costs.

Each of these items is discussed below.

3.2.1 Clear Definition of Long-Term Liability

We interpret liability to include liability for

- monitoring and modeling, to identify where the CCS is moving and how it can be expected to move;
- financial liability for monitoring, modeling and remediation, including claims for damage to ecosystems and the public;
- costs which the government (or a delegated body) incurs for inspection and verification of monitoring and modeling data, and maintaining long-term records.

It must also be determined whether liability for CO_2 leaks to the atmosphere, which affect GHG accounting and crediting, should be included within the definition. The government must identify which body is responsible for collecting this information.

3.2.2 Identification of Who Is Responsible

At issue is whether a company should retain liability for its operations and CO_2 storage site indefinitely or whether responsibility should, at some stage, transfer to government or some other body.

Matters to consider when making this decision include:

- A company is likely to exert the maximum diligence if they know that they will be liable for any failures in their operations.
- Individual companies will very likely not be in existence for as long as the CO_2 will be stored.

Thus, it is often suggested that liability should, at some future date, transfer to government, a government-appointed body or some other organization.

If responsibility is to transfer to a central body in the future, clear rules are needed to determine when that transfer occurs.

3.2.3 Clear Timeline/Process for Transfer of Responsibility

It is important to have clear definitions for each of the phases. Different regulatory proposals use slightly different terminology. For this paper, we propose the following:

Abandonment: This term is used here as it is in Alberta. Thus, a company bears liability during operations and the liability continues until the abandonment and reclamation of a project is complete, and all security is returned to the company.

Post-abandonment monitoring: This is the period subsequent to abandonment, during which the movement of CO_2 is traced. It is also referred to as the decommissioning period.[65] Once all

[65] Alberta Carbon Capture and Storage Development Council, *Accelerating Carbon Capture and Storage in Alberta: Interim Report,* September 30, 2008, 17.

available evidence indicates that the CO_2 is safely stored and completely contained, a site may be closed (to use EPA terminology).

Post site-closure: This is the final, indefinite period during which it is expected that the CO_2 will be stable.

The issue that needs to be resolved is whether a company remains responsible for all phases, or whether at some stage (post-abandonment, post site-closure or at some other time) responsibility is transferred.

If liability will transition from an individual company to government based on a performance standard rather than a set period of time, it will be necessary to identify what conditions must be met for the transition to occur.[66]

There are various options for determining when long-term liability starts, as outlined in the table below. If liability is to transfer from a company to a central body, there must be clear rules in place to determine when that transition occurs.

3.2.4 Equitable Distribution of Costs

The equitable distribution of costs should ensure that

- the taxpayer does not bear an undue burden
- individual citizens do not have to bear the costs of any problems which may occur
- industry is not prevented from undertaking CCS due to excessive costs.

If it is assumed that CCS is necessary in certain circumstances to reduce GHG emissions to the atmosphere, it may be considered in the public interest for it to proceed. However, if costs are to be borne by industry, this may reduce the willingness or ability of industry to undertake what is currently a costly activity.

3.3 Options for the Regulation of Liability

The table below sets out various options under the four issue headings identified in section 3.2. The principles set out at the start of section 3.1 should guide the evaluation of the different options. Preferences may be ranked in the fourth column. In some cases, more than one option may be selected for an issue.

[66] See proposed EPA legislation, page 119–126, especially pages 119 and 123. Various measurements may be required, including data on pressure, fluid movement, mineralization and/or dissolution of the CO_2. This information will help determine whether movement of the plume and the pressure front have ceased. The post-injection site care and site closure plan would be submitted as part of the permit application and, when permanent injection ceases, the company would submit an amended plan or indicate through monitoring and modelling results that no amendment is needed. The company would "monitor the site to show the position of the CO_2 plume and pressure front and demonstrate that USDWs are not being endangered." This is because the EPA legislation is solely concerned with the protection of underground sources of drinking water (USDWs). The EPA does not specify the full range of techniques which must be used. Since conditions may vary depending on the geologic situation, this level of detail is likely to be written into a permit or post-closure plan. This is also the case in Article 17 of the Directive of the European Parliament and of the Council on the Geological Storage of Carbon Dioxide.

Issue	Options	Comments	Rank
What is included in long-term liability?	Legal liability for leaks through wells and for leaks through fractures and fissures.	This would include liability for damage to wells, other mineral resources, soils, groundwater and on the surface.	
	Liability for remediation.	This would include repair of wells to prevent leakage and any other measures to prevent movement of CO_2 beyond the confining zone.	
	Liability for environmental damage.	In the EU, environmental liability for local environmental damage is separate from legal liability.	
	Liability to compensate individuals for damage to property or persons as a result of leaks.	This would reassure members of the public that they would be able to obtain compensation for any damages without having to sue a company or the government. This may reduce public resistance to CCS and also provide clarity, since it may be difficult to identify the source of the CO_2. The EU Directive makes no provision for compensation to private parties who suffer damage, nor do EPA regulations, since EPA legislation relates to the protection of drinking water only.	
	Monitoring, measurement and verification (MMV) of movement of CO_2 plume.	MMV is necessary over a long period of time to determine if there are any leaks, and is thus probably best addressed by whatever body has responsibility for liability. Should MMV be included as part of liability requirements?	
	Maintenance of records of injection sites, volumes injected and plume movement for future generations.	It is important that transference of records be included with the transference of liability to ensure that maximum knowledge about the site is retained. The EPA proposal sets clear requirements for transfer of information on post-injection site care and site closure plans. Should this transfer be included as part of liability transfer? Should caveats be registered against surface leases to advise future buyers of subsurface storage of CO_2?	
	Leaks of CO_2 to the atmosphere.	Such leaks will need to be reported to the agency which keeps records of GHG reductions, so that any credits for CO_2 injection can be appropriately adjusted.	

Issue	Options	Comments	Rank
Who has responsibility?	Company retains permanent liability.	This fails to recognize that most companies will eventually go out of business or undergo change, providing no guarantee that records will be fully maintained.	
	Company responsible until after well-abandonment and site reclamation.	This is the current process for oil and gas wells.	
	Company responsible until site closure, which would be at some defined time after well abandonment. The following sections provide more detailed options related to site closure.	The EPA refers to "site closure" as the time when liability transfers from a company to government. The same term is adopted here to identify a specific point some time after abandonment.	
	Time of site closure determined by performance standard, i.e., when CO_2 plume is stable.	The EU Directive states that a company can apply to transfer responsibility for all legal requirements "if and when all available evidence indicates that the stored CO_2 will be completely contained for the indefinite future."	
	Site closure possible after a fixed period.	The Interstate Oil and Gas Compact Commission suggests transfer to the state ten years after abandonment (or other time frame), if the operator can show that "the reservoir is reasonably expected to retain mechanical integrity and remain emplaced." The commission considers release of operator and generator liability necessary to encourage timely development of CCS.	
	Site closure determined by a period of time and performance standard (CO_2 plume stability).	EPA draft legislation states that sites would be closed after 50 years – but could be closed earlier if plume has ceased to move, or later if plume is not stable at 50 years.	
	Differential time for site closure, depending on the geologic characteristics of site.	Different time frame for CO_2 used for enhanced oil recovery than for deep saline aquifers, since deep saline aquifers have fewer penetrating wells so could be more secure. There is no precedent for this to our knowledge.	

Issue	Options	Comments	Rank
	To ensure that storage zone is undisturbed by future drilling, etc.	Should storage area be sterilized for future drilling that would penetrate the storage zone?	
Which body takes over from company?	A "competent authority." This may be a government department.	The term "competent authority" is used by the EU, but the exact nature of the authority is left for individual countries to determine. Government department likely to have continuity in some form.	
	A semi-independent body, such as the Energy Resources Conservation Board, authorized by government.	Such a body should be able to ensure continuity in record keeping and has the ability to conduct MMV. Would need to engage industry experts for remedial action.	
	An independent body organized by industry.	Industry experts likely to have the expertise to undertake remedial work. No precedent for this noted in the CCS regulations examined.	
Who pays?	The company.	May need to clarify if the owner or operator is liable. The company would need to provide security (in the form of performance bonds, letters of credit, etc.). Alternatively, the government could rely on powers to sue companies under the Criminal Code.	
	Companies pay into a fund to cover MMV after well abandonment.	This charge would be to cover government inspection activities and verification in the post-abandonment phase, while companies are still liable for any leaks, etc. This cost is likely to be relatively small and could, if desired, be combined with a company liability fund (see next box).	
	Company pays into a fund to cover liability and costs of remediation of leakage, etc., after responsibility has transferred to government or other body.	This is based on the concept of polluter pays, so that there is no cost to taxpayers for any activity associated with CCS. Such a fund could also cover any orphan wells if a company ceases to exist (although the problem of orphan wells should not arise if the government requires adequate security in advance).	

Issue	Options	Comments	Rank
	Government covers all costs associated with geologic storage after site closure.	Some would regard this as a subsidy. It recognizes that there is some public benefit to CCS, and that, in the event of a major leak, the money in a fund may not be adequate to cover costs.	