Carbon Capture and Storage

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Long-Term Liability and CCS

IAN HAVERCROFT

I. THE CHALLENGE

THE ABILITY OF policymakers and regulators to regulate effectively and efficiently carbon capture and storage (CCS) processes remains a critical element of efforts to facilitate the technology's deployment. Central to this effort, and an ongoing focus for many regulators worldwide, has been the capacity of modern legal and regulatory frameworks to manage the risks associated with the particularly novel elements of the technology—their consideration and resolution within early policy and regulatory responses has proved critical.

A first example of these challenges may be found in the technical feasibility and novelty of the CCS process itself. While several individual aspects of the technical processes involved are well understood and have been practised for decades, their innovative application in sequence, across the full chain of the CCS process, has posed a number of challenges. The unique nature of aspects of these processes and applications has similarly created some uncertainty surrounding their future impacts. The risks and the management of the impact of CO_2 leakage from a storage site, upon the natural and human environment for example, was just one of the issues to be addressed in early legal and regulatory frameworks.

A further novel element, which is peculiar to CCS, are the temporal aspects to be addressed when contemplating geological storage. Unlike existing oil and gas operations, or analogous waste disposal activities, the climate mitigation objective of the technology ultimately requires the high threshold of the 'permanent' storage of the injected CO_2. The management and responsibility for the stored CO_2, beyond the traditional lifetime of a commercial entity, has therefore had to be addressed in many early legal models.

The need to address liability for CCS operations has been emphasised by policymakers, regulators and industry as one of the crucial elements for meeting these novel challenges. This requires defining the parameters and potential magnitude of liabilities during both the operational phase of a CCS project and following the cessation of injection activities, and has been viewed as critical for ensuring public, investor and operator confidence in the technology.

In the case of the wider public, liability regimes may offer confidence that a potential harm will be effectively addressed and that there are processes in place to manage the risks associated with many of the novel technical elements of the technology, or the impacts of a potential leakage. For operators and investors, liability

regimes provide an opportunity to delineate responsibilities during the operational phases and, in some instances, afford an opportunity to limit exposure following the cessation of operations and the closure of a storage site.

This chapter considers the approach taken by regulators to date in the design of CCS-specific responses to liability, and the emergence of the dedicated regimes that attempt to address the technology's novel features. The author also considers the constraints and challenges of these new and varied approaches for those seeking to operate CCS projects, and the potentially wider consequences for the development and deployment of the technology as a whole.

II. EMERGENCE OF THE CCS-SPECIFIC REGIME

While many of the initial feasibility studies considered the technical, spatial and financial challenges of deploying the technology, early legal analysis largely focused upon the legality of deployment and the manner in which particular challenges were to be managed in national and supra-national regulatory regimes.[1] Broad consideration was given to the ability of existing environmental and energy law and regulation to address these technical processes, as well as whether current approaches to monitoring and verification would be capable of meeting the demands of permanent storage. Perhaps most challenging of all, however, were the temporal aspects and the significant time frames required by permanent geological storage.

The issue of liability and who should bear responsibility for both storage operations and the sequestered CO_2, during both the operational and post-closure phases, was a central consideration in many of these early studies.[2] The subject was discussed within both academic analysis and discussion papers and guidance that accompanied early drafts of legislation, and served to highlight the tensions at play between policymakers and regulators seeking to address all aspects of the technological process and those seeking to invest in and deploy the technology.

Despite these early challenges, the past decade has seen the emergence of a broad corpus of CCS-specific legal and regulatory models in many countries around the world. While this legislation ranges in its complexity and scope, a number of these individual examples contain well-characterised and detailed approaches to liability across the CCS project lifecycle.[3]

[1] These contrasting approaches are particularly evident in the 2005 Special Report from the Intergovernmental Panel on Climate Change (IPCC), IPCC 2005, Working Group III of the IPCC, B Metz et al (eds), *IPCC Special Report on Carbon Dioxide Capture and Storage* (Cambridge, Cambridge University Press, 2005).

[2] See, for example, the discussion in R Purdy and R Macrory, *Geological carbon sequestration: critical legal issues*, Tyndall Centre for Climate Change Research Working Paper Number 45 (2004); and C Hendriks, MJ Mace and R Coenraads, *Impacts of EU and International Law on the Implementation of Carbon Capture and Geological Storage in the European Union* (Brussels, European Commission, Directorate-General Environment, June 2005).

[3] An assessment of the status of legal and regulatory regimes for CCS across 55 countries was published by the Global CCS Institute: Global CCS Institute, *Global CCS Institute CCS Legal and Regulatory Indicator: A Global Assessment of National Legal and Regulatory Regimes for Carbon Capture and Storage* (Melbourne, Global CCS Institute, September 2015), at hub.globalccsinstitute.com/sites/default/files/publications/196443/global-ccs-institute-ccs-legal-regulatory-indicator.pdf.

A. The Nature of Liability

While only a few CCS-specific regimes specifically address the various types of liability to be borne throughout the project life cycle, it remains important in all instances to take into account the nature of these individual liabilities when considering the approach to be adopted and the extent of both operator and regulator responsibilities.

As described in an earlier work from 2014, there are conceivably three distinct strands of liability in the case of CCS operations: 'civil', 'administrative' liability and what is described as 'climate change liability'.[4] Civil liability encompasses those liabilities resulting from damage caused by CCS activities to the interests of a third party, and which are likely to be determined in legislation or through principles developed through decisions of the courts, depending on the nature of the jurisdiction in question. Despite limited experience with liability regimes for permanent storage to date, the application of these particular liabilities is likely to be broadly familiar to operators and regulators alike. A history of analogous industrial, oil and gas activities, in addition to a well-characterised body of case law, has resulted in a relatively well-understood civil liability regime in many jurisdictions. The specific regime may impose such liability on particular parties (such as the storage operator) but, as Lawrence describes in Chapter 16 of this volume, in practice commercial arrangements familiar to other industrial activities involving multiple parties are likely to be used to spread the potential liability risks.

The second category, 'administrative liability', may be borne by an operator and is in addition to the range of obligations required under a licence or permit for storage operations. These liabilities, traditionally observed within a jurisdiction's wider body of environmental and energy-related laws, result from the exercise of a competent authority's statutory powers and may compel an operator to undertake some form of action, be it to remediate or prevent a specific incident.

The peculiar nature of CCS is further highlighted by the fact that projects may have been incentivised (say, by gaining credits under an emissions trading scheme), and some liability accounting provisions must be made should leakage subsequently occur. This is also a form of administrative liability, but sufficiently distinctive that it has been characterised here as 'climate change liability', discussed in greater detail in section III.D.

B. Similarity in Approach

Closer examination of both the legal and regulatory frameworks and the policy positions adopted by several jurisdictions in recent years reveals a significant number of similarities in the approach adopted to managing liability. These similarities are particularly apparent when considering the legal and regulatory response to the storage

[4] I Havercroft and R Macrory, *Legal liability and carbon capture and storage: a comparative perspective* (Melbourne, Global CCS Institute, 2014).

aspect of the CCS process, which has posed a more significant challenge by virtue of the novelty of the time frames and technology involved.

Several early-mover jurisdictions, which have developed a comprehensive statutory response to CCS, have a permitting or licensing model at the core of their legal and regulatory frameworks.[5] It is in these permitting models, notably those found in the United States (US), Canada, Europe and Australia, where a number of parallels may be drawn in their treatment and management of liability.

In many instances the permitting models observed in these jurisdictions have sought to clearly allocate a wide range of potential liabilities between the operator and regulator, throughout the lifetime of a CCS project. In some instances this has been achieved through the design and implementation of new mechanisms; however, in other instances far broader obligations are likely to be borne by operators through the implicit application of a wider body of legislation and/or case law.[6]

Regulatory models that share similar methods to managing factors such as site selection, monitoring, measurement, verification and operator performance offer a further example of how many jurisdictions have approached the issue of liability. In several instances, law and regulation prioritise the identification and characterisation of the most suitable sites for storage, as well as ensuring that operator best practice is maintained. As a consequence, a strong emphasis is placed upon minimising and 'front-loading' risks in the early stages of the CCS project life cycle, and on ensuring that future liabilities (from leakage, etc) are minimised through initial good site selection and characterisation.

While there are noticeable differences in the approach adopted by many of the jurisdictions, it is clear that the opportunity for operators to 'transfer' some of their liabilities to the state at an agreed point it time has also proved to be a key element of these early regimes. To date, several of the CCS-specific models presently in operation include provisions that limit or envisage the transfer of an operator's responsibility for a storage site post-closure.[7]

A further feature of these early legal and regulatory frameworks, and one which is similarly allied to the management of risk throughout the project life cycle, is the inclusion of obligations concerning the provision of financial security or the use of broader 'financial mechanisms'. In addition to traditional insurance products, some

[5] A review of the development of these early regimes may be found in T Dixon, S McCoy and I Havercroft, 'Legal and Regulatory Developments on CCS' (2015) 40 *International Journal of Greenhouse Gas Control* 431.

[6] European Parliament and Council Directive 2009/31/EC of 23 April 2009 on geological storage of carbon dioxide and amending Council Directive 85/337/EEC, European Parliament and Council Directives 2000/60/EC, 2001/80/EC, 2004/35/EC, 2006/12/EC, 2008/1/EC and Regulation (EC) No 1013/2006 [2009] OJ L140/114 (CCS Directive), for example, applies the provisions of the EU's Environmental Liability Directive (European Parliament and Council Directive 2004/35/EC of 21 April 2004 on environmental liability with regard to the prevention and remedying of environmental damage [2004] OJ L143/56) and amends the EU Emissions Trading Scheme (European Parliament and Council Directive 2003/87/EC of 13 October 2003 establishing a scheme for greenhouse gas emission allowance trading within the Community and amending Council Directive 96/61/EC [2003] OJ L275/32) to address damage caused to the local environment and the climate resulting from any failure of permanent containment of CO_2.

[7] Examples of these transfer mechanisms are to be found in the CCS Directive, the Australian Commonwealth Government's *Offshore Petroleum and Greenhouse Gas Storage Act 2006* (Cth) and the Canadian province of Alberta's Mines and Minerals Act RSA 2000, c M-17.

regimes oblige operators to make up-front payments into funds or schemes, or specify forms of financial security products. These mechanisms are designed to ensure that the public purse is protected in the event of a serious incident, or to cover the costs of monitoring during the operational and post-closure phases.

C. Reliance upon Existing Liability Mechanisms

Early legal and regulatory models have often relied upon existing liability regimes to address discrete aspects, or indeed the entirety of the CCS process. In addition to the civil liability provisions observed in the decisions of the national courts, national regulators have also sought to include CCS activities within the scope of existing legislation.

An example of this approach may be found in the CCS Directive (2009/31/EC of 23 April 2009), which amends both the existing EU Emissions Trading Scheme (Directive 2003/87/EC) (EU ETS) and the Environmental Liability (ELD) CCS Directive (Directive 2004/35/EC) to explicitly include CCS activities. The implications for the EU ETS Directive are considered in greater detail in the climate liabilities section below, but the ELD Directive, which was designed to 'to establish a framework of environmental liability based on the "polluter-pays" principle, to prevent and remedy environmental damage',[8] and will ultimately apply to CCS storage operations, is discussed here.

Despite its title, the ELD is essentially confined to environmental restoration and the powers of regulators to impose obligations on operators (within the concept of 'administrative liability' as used here), rather than civil liability to third parties. Under the provisions of the ELD, CCS operations are included as an occupational activity within Annex III of the Directive, and are therefore subject to its strict liability provisions. An operator will be required to carry out preventive and remedial action as required under the ELD where damage, which is within the scope of the Directive, is threatened or has occurred. While not all forms of environmental damage are covered, the ELD does cover damage to protected species, water and damage to humans resulting from land contamination.[9]

An operator will remain liable under the provisions of the ELD throughout the operational and post-closure phases of a CCS project. These particular liabilities, however, may be transferred to the state in the event of a successful transfer of liability under the CCS Directive.

D. Transfer and Long-Term Stewardship

The significant geological time frames characterised by successful CCS operations, together with a desire to ensure the permanency of the storage of CO_2, have proved

[8] ELD, Art 1.

[9] ELD, Art 2(1). The limitations of the type of damage covered by the Directive are hardly logical, but represent political compromise during the legislative process and sensitivities as to the scope of EU competence in the field of liability.

to be a contentious issue during the design and development of legal and regulatory models. Regulators' ambition to achieve certainty around geologic storage and to ensure that the technology is comprehensively regulated has at times given rise to concern for those seeking to invest in the technology and develop projects. For potential operators, who would conceivably be liable for storage sites in perpetuity, the need for a distinctive approach to liability was a critical element of any proposed CCS regime.

To address these tensions, some regulatory frameworks contain provisions that allow for the transfer of liability from an operator to a state's 'competent authority', following the cessation of storage activities and the completion of several mandated requirements.[10] However, while these CCS-specific legal and regulatory models have largely adopted a similar perspective regarding the nature of liability across the project life cycle, there are a number of nuances in the operation and scope of these transfer provisions.

Where provision is made for a transfer, the focus of regulation has been the manner in which this is to be effected and the nature of the liabilities which are eventually to be transferred. Some of these regimes include explicit performance criteria that must be met by an operator prior to a transfer's being effected.[11] In some instances, this includes the completion of a post-closure time limit, during which an operator will remain fully accountable for the storage site and all associated obligations. The trigger conditions in some examples of law are expressed in strict language; others leave more discretion to the judgement of the Minister or relevant authority.

The nature of the liabilities to be transferred is also a critical consideration—more specifically, what forms of liability may be transferred to the state and, conversely, where no clear provision is made for their transfer, which liabilities will remain with an operator in perpetuity. Once again, the legal and regulatory models developed to date reveal a range of national and sub-national approaches.[12] For project proponents, the scope of the liability provisions offered, and any potential ambiguity in their application, remains a critical concern when considering their long-term risk exposure.

III. CONSTRAINTS AND CHALLENGES

The development and implementation of CCS-specific legal and regulatory frameworks in recent years have done much to clarify the nature and scope of liability for CCS operations. There are now several fully-defined models, which set out how policymakers and regulators intend to address the issue during both the operational and post-closure phases of a project.

Despite these developments, however, the topic of liability continues to be cited by a number of stakeholders as potentially challenging, and presents several issues that

[10] See n 7 above.

[11] The CCS Directive, Art 18, for example, requires that 'all available evidence indicates that the stored CO_2 will be completely and permanently contained'.

[12] For a comparison of the liabilities/responsibilities transferred in the UK, the Australian State of Victoria and the Canadian province of Alberta, see Havercroft and Macrory, n 4 above, 44.

will likely require further clarification.[13] It would appear that while policymakers and regulators have made considerable efforts to address the critical elements and provide comprehensive models, project proponents and investors have raised tangible examples of the challenges posed by these new and emerging models and how they represent ongoing barriers to investment.[14]

The need to address these particular issues in a timely manner will prove significant when considering their potential impact upon the taking of investment decisions and, ultimately, the deployment of CCS projects. Importantly for those jurisdictions contemplating and reviewing their own national regimes to regulate the technology, subsequent efforts to address these remaining issues will likely prove both persuasive and instructive.

A. The Scope and Practicality of Transfer Provisions

The design and implementation of mechanisms to transfer liabilities and broader responsibilities proved to be an intrinsic element of several of the early legal and regulatory models, and their development has proved a significant factor for improving operator and investor confidence in the regulatory framework. As such, their inclusion appears to have been driven by the need to balance a number of potentially competing interests. The establishment of time frames for effecting a transfer, and which have been clearly defined within law and regulations, is perhaps one example of where these interests have been reconciled.[15]

Two issues that remain critical to the effectiveness of these transfer mechanisms, however, are their scope and practicality. While some regulatory frameworks include clearly defined provisions, with the opportunity for the post-closure transfer of liabilities and obligations, others do not include these provisions, or remain silent as to the nature of the responsibilities and liabilities transferred. A further and perhaps more complex issue concerns the practicality of transfer provisions, and in particular the ability of operators to demonstrate their compliance with the thresholds defined within legislation.

In some jurisdictions, where the legal and regulatory model remains silent as to which liabilities are transferred to the relevant authority upon the surrender of a licence or authority, potential operators and investors face uncertainty as to their ongoing liabilities post-closure. One example may be found in the Australian State of

[13] See, for example, the various stakeholder perspectives included in the recent report prepared by consultants to support the European Commission's review and evaluation of the CCS Directive, as required by Art 38 of the Directive, and including consideration of the Directive under the new Regulatory Fitness and Performance programme (REFIT). European Commission, Directorate General for Climate Action, *Study to support the review and evaluation of Directive 2009/31/EC on the geological storage of carbon dioxide (CCS Directive)* (Luxembourg, Publications Office of the European Union, 2015), at www.publications.europa.eu/resource/cellar/3f0867e1-8e88-11e5-b8b7-01aa75ed71a1.0001.01/DOC_1.

[14] See, for example, the views concerning the Dutch ROAD project in T Jonker, The permitting process: Special report on getting a CCS project permitted (Melbourne, Global CCS Institute, 2013).

[15] The Australian Commonwealth Government's *Offshore Petroleum and Greenhouse Gas Storage Act 2006* (Cth), for example, requires the conclusion of a 15-year 'Closure Assurance Period' following the issue of a Site Closure Certificate, before an operator may apply to transfer liability to the Government. See further ch 11 of this volume.

Victoria's *Greenhouse Gas Geological Sequestration Act 2008* (Vic), where despite clear provision for the surrender of 'authorities', the legal framework is silent as to exactly which liabilities or responsibilities are transferred to the State. It may be presumed that all future administrative liabilities will be included within the surrender; however, it is unlikely that any civil liabilities will be transferred to the State. While this would appear to be in line with the Victorian government's policy position during the development of the legislation, the Victorian legislation stands at odds with the model developed under the Australian Commonwealth regime.[16] This misalignment was highlighted as an issue to be addressed by Victorian regulators in the recommendations of the State government's regulatory test toolkit exercise, undertaken in 2013.[17]

The State of Victoria's approach stands in contrast to that of the Canadian province of Alberta, where CCS-specific amendments to the existing regime will see the Crown assume future responsibilities under environmental legislation and a former licence holder may also be indemnified against damages in tort.[18] The policy decision by the Alberta government to indemnify lessees against liability for tort damages, which may arise in the post-closure period, has proved to be an important aspect of the province's regulatory response, and was highlighted in the province's Regulatory Framework Assessment.[19]

The ability of an operator to meet the standards and thresholds necessary to enable a transfer has been similarly highlighted as challenging, particularly where broad regulatory provisions prove ambiguous or offer very few (or no) technical parameters.[20] In this instance, it is likely that monitoring and verification (M&V) during the project's operational phase will become of critical importance to both the operator and regulator.

An example of this tension may be found in the CCS Directive's transfer provisions. Under the provisions of the Directive, a transfer may only take place once 'all available evidence' indicates that the CO_2 is completely and permanently contained.[21] A literal reading of these provisions imply a technical standard with which it will be challenging for an operator to comply. Indeed, it may be suggested that any opposing expert view may frustrate an operator's request.[22]

[16] N Swayne and A Phillips, 'Legal liability for carbon capture and storage in Australia: where should the losses fall?' (2012) 29 *Environmental and Planning Law Journal* 189.

[17] AECOM Pty Ltd, 'Carbon capture and storage regulatory test toolkit for Victoria, Australia: outcomes and recommendations' (Melbourne, Global CCS Institute and Victorian Department of Industry, 2013).

[18] Mines and Minerals Act RSA 2000, c M-17, s 121(2).

[19] Alberta Energy, *Carbon Capture and Storage—Summary Report of the Regulatory Framework Assessment* (Alberta, Alberta Energy, 2013), at www.energy.alberta.ca/CCS/pdfs/CCSrfaNoAppD.pdf.

[20] Jonker, n 14 above.

[21] CCS Directive, Art 18(1).

[22] The meeting report of the International Energy Agency's International CCS Regulatory Network, for example, highlighted that many regulators and operators found this term 'problematic to define', particularly given the natural variability of CO_2 levels in soil, air and oceans, and the technological limits of monitoring. International Energy Agency (IEA), '6th IEA International CCS Regulatory Network Meeting: Taking stock of progress and identifying next steps' (IEA/OECD, 2013).

The more demanding requirements of Article 18(1) of the CCS Directive are to some extent mitigated by the subsequent provisions of Article 18(2). Under this subsection, an operator is obliged to submit a report demonstrating at least:

(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.[23]

The Directive's provisions in relation to transfer are further supported by Commission Guidance, aimed at 'providing an overall methodological approach to implementation of the key provisions of the CCS Directive'. Guidance Document 3, governing the transfer of responsibility to a competent authority, was adopted by the Commission in 2011 and provides further detail as to the manner in which Member States address the requirements of Article 18.[24] The Guidance confirms the reliance an operator will be required to place upon the M&V process and data gathering throughout the lifetime of a storage project, and its ultimate significance in the preparation of the transfer report. Reference is made throughout the document to the operator's ability to demonstrate conformity with predicted models, the absence of leakage and the site's evolution towards long-term stability.

It would appear, however, that the ultimate decision whether or not to transfer will rest with the regulator. The wording of Article 18 is such that only when the regulator is completely satisfied with an operator's compliance with the requirements, will a transfer be effected.

The more challenging provisions of the CCS Directive stand in contrast to those found in the Canadian province of Alberta's regulatory model. Under the province's Mines and Minerals Act, the Minister need only be satisfied that 'the captured carbon dioxide is behaving in a stable and predictable manner, with no significant risk of future leakage'.[25] The language avoids the more absolutist terminology of the CCS Directive, and explicitly rests responsibility on the judgement of the relevant Minister—a judgement that would be difficult to challenge in the courts unless there was evidence of irrationality.

B. Technical Cooperation

The need to engage technical expertise in the development and operation of legal and regulatory models similarly remains a critical consideration for addressing liability issues. In many instances regulators will be required to interpret profoundly technical information, when determining compliance with the requirements of the regulatory model. The role of regulators and project proponents, when seeking

[23] CCS Directive, art 18(2).
[24] European Commission, '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' (European Commission, 2011).
[25] Mines and Minerals Act RSA 2000, c M-17, s 120(1).

to operationalise aspects of early regimes, is one area in particular where there is opportunity for far closer collaboration and engagement.

The interpretation of site-specific monitoring information, as well as efforts to determine a storage site's performance and impact upon the environment prior to a proposed transfer, are just two examples where a high degree of technical expertise and understanding will likely be necessary. Interpretation of these materials will require the operator to share their technical knowledge, or present data in a manner which is suitable for a regulator addressing a host of novel considerations.

For an operator faced with a regulatory model that contains many elements yet to be fully tested, it will be important to establish a flexible and practical relationship with the regulator. The effective operation of the many of the early CCS-specific regimes' regulatory mechanisms will likely depend upon the nature of this relationship and the ability for these parties to accommodate each other's requirements. Perhaps unsurprisingly, there are few examples of this type of cooperation to date. The novelty of the various legal and regulatory models, and the fact that early projects have yet to address the technical issues associated with long-term liability or transfer, means that this type of engagement remains hypothetical.

A 2016 Australian CCS workshop highlighted these issues, in particular the challenges faced by regulators and operators when determining the type and extent of M&V necessary to demonstrate compliance with regulatory requirements.[26] As suggested previously, M&V will undoubtedly play a significant role in determining whether CO_2 is behaving as predicted, whether leakage from a storage site has occurred or whether the regulatory criteria for enabling a transfer have been satisfied. Regulators and operators have suggested, therefore, that where M&V data are refined, updated and improved, perhaps as a part of an approved monitoring plan, it will be critical to maintain a dialogue and for industry to continue to educate regulators on the implications of the data.[27]

National regulators have, however, started to consider some of the technical elements associated with CCS operations in the permitting of early storage projects. The submission and approval of plans and programs for monitoring, corrective measures and financial security, all required as part of the permitting of projects, have required close cooperation between regulators and project proponents to identify thresholds and parameters for action.[28] A long history of oil and gas operations, including the operation of enhanced oil recovery projects, also provides an important analogy for both parties.

C. Liability Post-Transfer

For those regimes that do not include transfer provisions, it is clear that an operator will remain liable for a storage site in perpetuity. It will also be important

[26] Full details of the workshop may be found in MK Gibbs, *Effective enforcement of underground storage of carbon dioxide* (Melbourne, HWL Ebsworth Lawyers, 2016).

[27] ibid 42.

[28] Jonker, n 14 above.

to consider, however, whether an operator may also be held liable for operations following a formal transfer of its responsibilities to the state.

The CCS Directive includes a novel provision that allows the state to recover costs from an operator following a transfer. The 'claw back' provisions of Article 18 of the Directive allow recovery of costs where there has been fault on the part of the operator, notably in instances of 'deficient data, concealment of relevant information, negligence, wilful deceit or a failure to exercise due diligence'.[29]

In the UK, the transposed provisions of Article 18 enable the authority to recover any costs, to 'the extent that such costs arise due to fault on the part of the operator'.[30] The Storage of Carbon Dioxide (Termination of Licence) Regulations 2011, including the definition of fault, are drafted to apply to all liabilities to be transferred under the CCS Directive. Under the UK Regulations, however, other leakage liabilities are also included within their scope, including those arising out of tort. The information requirements prescribed by the UK Regulations also go further than those of the CCS Directive, and require an operator to provide a far wider range of materials following the issue of a termination notice.

While the claw-back provisions of Article 18 are broadly drafted and would appear to cover any activity where an operator is subsequently found to have been at fault, the UK Regulations go somewhat further. In both instances, these wide grounds mean that in the case of fault on the part of the operator, liabilities may be effectively 'reactivated' following their transfer.

For an operator, these requirements will place considerable emphasis upon the need to effectively monitor and accurately account for all activities throughout the lifetime of a project. In the case of operators in the UK, this will include exercising considerable diligence when preparing documentation at the point of transfer.

D. Climate Change Liabilities

A further and perhaps more complex sub-category of administrative liability may also be distinguished in the case of CCS operations. The technology's ultimate objective to mitigate the impacts of climate change, and the need therefore to ensure permanency of CO_2 storage, has required regulators to adopt a novel approach to liability in situations where there is a failure in storage operations. In these instances, a liability is borne because leakage of this nature would ultimately frustrate the environmental objective of the activity.

The need to address this form of 'climate change liability' is particularly significant where an operator has also secured a financial benefit for storing CO_2 as a part of a domestic emissions trading scheme. Consequently, the approach adopted by regulators to date will see an operator account for any leakages within a jurisdiction's national trading scheme through the surrender of an equivalent number of allowances.

[29] CCS Directive, Art 18(7).

[30] Storage of Carbon Dioxide (Termination of Licence) Regulations 2011 (SI 2011/1483), reg 16 (UK Regulations).

Liability of this nature, however, raises several unique challenges for operators and regulators alike. The ability of both parties to determine the exact amount of CO_2 that has leaked into the atmosphere from a storage reservoir, and the time frame within which such leakage occurred, are just two examples. Coupling climate change liabilities with any advanced financial security to be provided by storage operators, as required under the CCS Directive, adds further difficulties. Where liability is based on future unpredictable prices under emission trading schemes at the time of leakage, operators are faced with virtual unknowable and uninsurable risks. Placing caps on such liability (such as the financial benefits gains at the time of storage) may not be consistent with the pure economic logic of a trading scheme, but may be realistic from a practical perspective.

A further issue concerns the ability of an operator to transfer climate change liabilities in the post-closure period. To date, the early legal and regulatory models have adopted divergent approaches, the CCS Directive including these liabilities within the category to be transferred to a Member State's competent authority. A different approach has been adopted in the Canadian province of Alberta, where these liabilities have been formally excluded from those to be transferred to the Crown.[31]

IV. CONCLUSIONS AND THE WAY FORWARD

While liability throughout the project life cycle continues to be identified as problematic, it is important to assess the magnitude of the issue and consider how these liabilities may potentially be minimised for an operator.

A. Assessing Different Forms of Liability

Clarifying the 'type' of liability, in particular the exact nature of those liabilities applicable throughout the lifetime of a CCS project, is an important factor in determining the challenges posed to CCS operations. In many instances, it may be necessary for regulators and operators to approach each type differently.

In common law jurisdictions, the core principles governing civil liabilities, borne in instances where damage is caused to the interests of third parties, are largely determined through the courts' application of case law. The absence of any litigation to date means that suggestions as to the courts' application of these principles, particularly in instances of damage resulting from novel aspects of CCS operations, are at best hypothetical. The likelihood of some forms of damage caused by storage operations to remain undiscovered for many years, for example, would mean

[31] Note, however, that the final report of the Alberta Regulatory Framework Assessment (RFA) process included a recommendation that the Mines and Minerals Act be amended to include responsibilities under the province's Climate Change and Emissions Management Act SA 2003, c C-16.7. See Alberta Energy, *Summary Report*, n 19 above, recommendation 65.

that the application of limitation periods for bringing a civil claim will inevitably be brought into consideration. In some jurisdictions, therefore, it will be challenging to bring claims where legislation includes restrictive time limits, triggered from when the damages originally occurred.

It will likely prove difficult in many jurisdictions for regulators and policymakers to influence and/or determine the extent and application of third-party liabilities through legislation and in the absence of CCS-specific case examples. Notwithstanding these uncertainties, significant experience gained through analogous industrial, oil and gas activities, in addition to a substantial body of case law, may prove instructive and afford some clarity for potential investors and operators.[32]

Administrative liabilities, including the perhaps more complex sub-category of climate change liabilities, are likely to be viewed as more challenging for operators and regulators alike. These liabilities, which centre upon the powers afforded to public authorities to require an operator to take action in the event of actual or potential environmental damage, for example, will present several novel challenges for CCS operations. Contained within existing law and regulation, as well as more recent CCS-specific regimes, their provisions are broad enough to encompass incidents arising from storage operations. In many instances these liabilities are ambiguous in their scope, and contain limited rights to review or appeal a particular decision.

Climate change liabilities, notably those attaching to CCS activities where incorporated within a greenhouse gas trading scheme, will likely pose further challenges to both operators and regulators.[33] From an operator's perspective, these liabilities present a financial risk which it may prove difficult to forecast.

B. Positive Models of Law and Regulation

While there is no archetypal model of CCS-specific law and regulation, several early legal and regulatory frameworks contain particularly detailed approaches to addressing liability throughout the CCS project life cycle. Aspects of these regimes may serve as potential models, particularly for those jurisdictions still in the process of reviewing or developing legislation.

The approach taken to the transfer of liability, in instances where such a mechanism is contemplated, has proved a significant feature for regulators and project proponents globally. The clarity of these transfer provisions and the exact nature of the liabilities transferred are particularly critical to this approach. The UK's regulatory model, which envisages the transfer of liabilities relating to personal injury, damage to property and economic loss, may be highlighted as an example of a particularly

[32] D Adelman and I Duncan, 'The Limits of Liability in Promoting Safe Geologic Sequestration of CO_2' (2011) 22 *Duke Environmental Law & Policy Forum* 1, 1.

[33] See, for example, the discussion on the management of climate-related leakage risk in the International Energy Agency Report, *IEA, 20 years of Carbon Capture and Storage: Accelerating future deployment* (Paris, IEA/OECD, 2016) 43.

comprehensive approach, and one which has the potential to offer operators and commercial proponents increased confidence. The conditions for enabling a transfer are also likely to be important, providing operators with clear thresholds and objectives. The inherent flexibility of the regulatory models found in the Canadian Province of Alberta and the Australian State of Victoria offer perhaps more practical models when contrasted with the more objective terms of models found in the UK and EU legislation.

The issue of financial security, and in particular the approach adopted by regulators when determining financial contributions to be made by the storage operator, is a further area where lessons may be drawn from early legal and regulatory frameworks. Aimed at reducing the state's exposure to an operator's insolvency, or inability to meet the demands of a regulatory framework, a number of schemes have been proposed by regulators worldwide. The example of the approach adopted by regulators in the Province of Alberta and the State of Victoria, which would see operators making financial contributions throughout a project's operational phase, rather than at the point of transferring responsibility to the State, may be viewed as a practical and realistic approach to addressing this particular issue.

C. Project-Specific Experience

Limited project-level experience of the operational elements of these new regulatory frameworks has meant that much of the commentary surrounding liability remains largely speculative. A small number of projects have, however, been permitted under these CCS-specific regimes, and their experiences to date reveal that some aspects of the liability frameworks are proving challenging.

Material published by projects participating in the former UK CCS Commercialisation Program reveal some of the challenges posed by liability regimes. The insurance strategy produced by the Peterhead CCS Project highlights a several issues with the UK's regime, noting in particular the absence of insurance solutions to address particular risks:

> Until the regulatory regime is defined, it is uncertain what the extent of liability for CO_2 release is. At present, no requirement for re-purchase of credits or financial penalties is expected in the case of accidental CO_2 release from the reservoir. Protection against repayment of carbon credits (European Union Allowances (EUAs)) is currently uninsurable.[34]

The Peterhead Project also noted that other liabilities, to be addressed throughout the construction and operational phases of the project, would have to be addressed by the venture in the absence of insurance solutions. Ongoing dialogue with the insurance and professional services sectors, as well as government and environment agencies, was similarly highlighted as critical to mitigating 'CO_2 risks exposures'.

[34] Shell UK Limited, *Peterhead CCS Project, Insurance Plan* (Shell UK Limited, 2014) 8. The plan is one of the 86 commercial, project management and lessons learned knowledge reports, gathered from the Peterhead and White Rose Carbon Capture and Storage Projects' Front End Engineering and Design (FEED) contracts.

A more collaborative approach between regulators and project proponents, in the design and implementation of these new regulatory regimes, is likely to be critical. The nature of this interaction will be particularly important where regulators are required to interpret profoundly technical information to establish an operator's compliance with the requirements of the regulatory model. Determining a storage site's effective retention of stored CO_2 and its associated impact upon the environment, prior to any proposed transfer of liability, is one example where a high degree of technical expertise will be needed to corroborate an operator's compliance.