Managing long-term liabilities for CCS: an international perspective

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Executive Summary

This study compares the long-term liability regimes for CO_2 storage in Europe, the US, Canada, Australia and Norway. The research question focuses on the division of the long-term liabilities between government and industry and the lessons that can be learn for the European situation.

A complication in the comparison of the cases was that the regulation of long-term liabilities in most cases was divided between a federal/union and state/provincial level. This means that in most cases, different sets of regulation apply. Where relevant, the most advanced sets of regulation have been incorporated in the comparison.

From the comparison, the following conclusions can be drawn:

- The continental law systems and the common law systems value different liabilities as most relevant and possibly most costly.
- Climate liability is only a relevant issue in countries or regions which internalize the cost of emitting CO_2 through regulation, for example CO_2 taxes or an emissions trading scheme. This is the case in Norway, Canada and the EU. However, only in the EU, climate liability is specifically viewed as a liability and because of the linkage to the Emissions Trading Scheme it is even viewed as the most unpredictable and possibly highest liability in the long-term.
- Norway is an exception in the sense that it does not explicitly manage the long-term liabilities. However, it is possible to negotiate the transfer of liabilities upon closure of a storage location.
- In all other cases the liabilities are managed to a certain extent, although different management options are chosen. The most common form of management are the options of a fund and a liability cap/exemption.
- In general, not all liabilities are managed. Only in a few jurisdictions, the operator is relieved from all liabilities (Alberta (Canada) and Australia offshore). And in these cases, in case of fault or negligence, the operator remains liable.
- Most common is the situation in which the liabilities are divided through a time limit, varying from 10, to 15, to 20 years. These time limits seem to be chosen arbitrarily. After the specified time limit, the liabilities are transferred to the government. The conditions for the transfer include a security to be paid by the operator. However, the conditions for the transfer are complicated and uncertain and the elements that build up the security are different as well.

Recommendations for the European legislator are:

- If CCS is to be strongly encouraged in the EU, policymakers should work with industry to explore options for reducing the uncertainty brought about by the potential 20 year period storage operators are liable for climate liability.
- The risk of climate liability can potentially be minimized by selecting a shortened liability period for operators, as has been done in Alberta, Canada.
- Legislators can potentially identify approaches to managing long-term liability, for example through insurance, liability caps and compensation funds.
- Encourage Member States to manage all liabilities, in order to provide certainty to industry.

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Abbreviations

CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
EDF	Environmental Damages Fund
EEA	European Economic Area
ELD	EU Environmental Liability Directive
EPBC	Environmental Protection and Biodiversity Conservation Act 1999
EU	European Union
EU ETS	European Union Emissions Trading System
EUA's	European Union Allowance Units
GCCSI	Global CCS Institute
IGCC	Integrated Gasification Combined Cycle
OPGGSC	Offshore Petroleum and Greenhouse Gas Storage Act
RCRA	Resource Conservation and Recovery Act
ZEP	Zero Emissions Platform

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1 Introduction

1.1 Introduction

In several reports and expert meetings, the management of long-term liability for CCS, specifically climate liability, has been identified as a major obstacle in the development towards large scale CCS. Previous reports in this work package have addressed the issue of liability onshore and offshore and in comparison to other regimes (oil, nuclear and LNG), but mainly from a national and European perspective. In this report, management of liability will be addressed from an international perspective. Several countries are well advanced in CCS, such as Norway, Canada, Australia and the US. This study will provide insight in the way in which these countries (are planning to) manage the long-term liabilities and the considerations for the design of the chosen regimes.

1.2 Research objectives

Liability is a heavily debated subject in the discussion on climate mitigation options. In essence, the main issue is who has to pay for what? The debate keeps occurring because the climate is everyone's and no one's responsibility. The fairness of attributing the costs for mitigation to specific actors seems to trigger constant debate on issues related to liability. When it comes to CCS, the debate focuses on the question to which extent governments should take on some of the liability issues. In this debate different types of liability can be distinguished, as well as different methods of managing these liabilities. In designing liability regimes, governments divide the risks and costs associated with these risks between society and industry. Governments might choose differently and based on different grounds. Therefore, it seems sensible to compare different regimes with regard to how they answer the 'who has to pay for what and when' question.

The objective of this report is to provide insight in the different ways in which the long-term liabilities for CCS are managed. This information might lead to new insights in the way in which Member States or the European Union as a whole should regulate the liabilities.

The research question that will be answered is: how do the selected countries divide the long-term liabilities between government and industry? The answer to this question will be sought through the following sub questions:

- Which possible liabilities exist?
- How can these liabilities be managed?
- Which options were chosen by the selected countries?
- Do these options differ with respect to the division of responsibility, the management style or the amount/timing?
- Which lessons can be learned for the European situation?

1.3 Approach

The study takes a comparative approach which consists of four steps. The first step is to construct a framework for comparison which consists of different types of liability and possible management styles. The second step is to select cases and roughly analyse the differences between the legal families and the way in which this might affect the chosen liability regimes. The third step is to describe and analyse the cases using the developed framework for comparison. Finally, the outcomes will be related to the European situation.

1.4 Reader guide

Chapter 2 will start with the analytical framework that is used to describe and analyze the different cases. The cases will be described in chapter 3. The lessons for the European situation will be addressed in chapter 4. Chapter 5 will conclude and provide recommendations for policy makers.

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2 Management of liability

2.1 Introduction

Before the regimes for managing liabilities for CCS are compared, a framework for comparison will be conceptualized. Previous reports of this work package provide relevant information on aspects to be considered when analyzing (management of) liability.[1] Based on these previous reports it is clear that the relevant liabilities for CCS might differ per country/set of regulation. Which liability regimes occur, depend on the law tradition of each country. In order to develop a framework for comparing the way in which the relevant countries have managed the long-term liabilities for CCS, first the possible grounds for liability will be explored (section 2.2.1), as well as the types of liabilities that can be distinguished (section 2.2.2). Liability can be managed in various manners, which will be explored in section 2.2.3 and 4. Section 2.3 will consist of the framework for analysis. Section 2.4 will discuss which cases will be analyzed and based on which information.

2.2 Management of long-term liability

2.2.1 Types of liabilities

In general, five categories of risks are distinguished that might be relevant in the long-term.[2] These categories are: CO_2 leakage, CH_4 leakage, seismic events, surface deformation and displacement of brine. The CO_2 might leak through the cap rock, or through or along geological faults. When leaking into the air, this type of risk results in damage to the climate. When migrating into other formations, environmental damage might occur. In case of migration into someone else's property, this might even result in trespass. CH_4 leakage might occur when the injected CO_2 forces the CH_4 to migrate into the atmosphere or into other formations. This might result in damage to the environment (it might affect water quality) or damage to the climate. In case of leakage into a confined space, such as a basement, the leakage of CO_2 and CH_4 might even pose a lethal threat to humans. The injection of large amounts of CO_2 might result in seismicity and small earth tremors. The tremors might cause damage to buildings and infrastructure. Furthermore, these tremors might break the cap rock and result in leakage of CO_2 into the atmosphere. The injection might also result in rising or sinking of the earth surface, as a result of which damages to property might occur and which might induce seismicity. When injected in aquifers, CO_2 might result in displacement of saline groundwater. This might cause environmental damage.

The risks mentioned above, might lead to several damages and matching categories of liability. Long-term liabilities that are relevant for CCS are generally summarized in three categories[3]:

- Liability for damage to human health and property
- Liability for environmental damage
- Liability for climate damage

These three categories fit the European framework of regulation rather well. Since the scope of this report consist of a comparison beyond European borders, it is useful to distinguish between the liability for damage to health and liability for damage to property. In non-European countries the liability for damage to property might also include issues of trespass due to migrating CO_2 plumes, as land ownership stretches out to the subsurface, which is not the case in most European countries. As this might lead to new solutions in dealing with liability, the liability for damage to property will be addressed as a separate category.

[1] Mikunda, T., Haan-Kamminga, A., de Wolff, J., de Joode, J., Meindertsma, W. and Nepveu, M. Transboundary legal issues in CCS - Economics, cross border regulation and financial liability of CO_2 transport and storage infrastructure. CATO2, Deliverable D4.1.05.
[2] See note 1.
[3] Marc de Figueiredo, The Liability of Carbon Dioxide Storage (MIT, 2007), 192–200. Nigel Banks and Martha Roggenkamp, 'Legal Aspects of CCS', in Donald Zillman et al, *Beyond the Carbon Economy* (Oxford University Press, 2008), p. 354. A. Haan-Kamminga, Long-term Liability for Geological Carbon Storage in the EU, Journal of Energy & Natural Resources Law Vol 29 No 3 2011, p. 315.

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In the comparison, all four categories will be addressed. These four categories will be addressed briefly, thereby focusing on the probability of occurring and the likely magnitude of the damages. The description is based on previous research and interviews/expert sessions with relevant stakeholders.[4] For the magnitude, only more generic terms can be used as no research has been done to indicate the possible magnitude in detail.[5]

- Liability for damage to human health: the probability of occurrence is low, as possible storage locations both onshore and offshore will not be near basements or housing facilities. A specific combination of circumstances is needed to result in damage to human health. In relation to the annual turnover of the parties involved, this type of damage will never constitute to large amounts of damages to be paid.
- Liability for damage to property: within this category, damage as a result of trespass or ground movement and seismicity might occur. The probability of occurrence is estimated as low, because of the thorough site selection process. However, that these effects will occur to a small extent is likely, but the effects are manageable by monitoring and remediation during storage. Although the amount of damage will be higher in a populated area, the amount in relation to annual turnover is not dramatic.
- Liability for damage to the environment: environmental damage is not new to operators and is made manageable through thorough site selection, monitoring and remediation. These damages might be large, but a system of insurance is available.
- Liability for damage to the climate – this type of damage and liability is new to operators. 'Climate liability' is relevant in jurisdictions where emitting CO_2 into the atmosphere has been regulated through the application of a CO_2 tax, performance standard or a CO_2 price. Although the probability of a leakage occurrence is low, the possibility of financial penalization (i.e. having to unexpectedly comply with CO_2 taxes/prices in the future) represents significant financial risk to the operator. Furthermore, the long-term responsibility that storage operators assume, exposes them to CO_2 price fluctuations and carbon tax changes, escalating the risk. It is specifically this type of liability to which potential storage operators have raised concerns.

For the comparison the way in which the different countries have addressed these liabilities and the management of these liabilities will be discussed, as summarized in the table below.

Table 1: Long-term liabilities

Liability	Probability of occurrence	Magnitude	Cause
Climate	Low	Unpredictable, possibly high	CO_2 leakage CH_4 leakage
Environment	Low	Moderate	CO_2 leakage CH_4 leakage Displacement of brine
Property	Low	Small	CO_2 leakage Seismicity Ground movement
Health	Low	Small	CO_2 leakage CH_4 leakage

2.2.2 Relevant aspects of liability

Liability is the legal responsibility that one has to another or to society, enforceable by civil remedy or criminal punishment. The legal discussion on liability always involves three questions: Who can be

[4] Harmelink, M., P. Lako, A.J. van der Welle, , M.D.C. van der Kuip, A. Haan-Kamminga, F. Blank, J. De Wolff, M. Nepveu, M.M. Roggenkamp Support to the implementation of the CCS Directive Overview and analysis of issues concerning the implementation of the CCS directive in the Netherlands CATO2-WP4.1-D01, Mikunda, T., Haan-Kamminga, A., de Wolff, J., de Joode, J., Meindertsma, W. and Nepveu, M. Transboundary legal issues in CCS - Economics, cross border regulation and financial liability of CO_2 transport and storage infrastructure. CATO2, Deliverable D4.1.05.

[5] For a more detailed analysis, see: Climate Wise, Managing liabilities of European CCS, 2012.

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held liable, to whom and under which conditions? For the comparison of the liabilities in the different countries, several aspects can be distinguished.[6]

A first relevant aspect is who can be held liable. This is a relevant question especially when it might be possible that the liability might be divided between two or more actors. If large companies together engage in activities that result in damage, can they both be held liable? And is this liability joint or several?[7] Furthermore, liability might be regulated and a specific division of liabilities might occur between two or more different organizations (i.e. parties liable to a certain extent, some other organization for the rest).

A second relevant aspect is to whom the operator might be liable. For some types of liability the plaintiff is a natural person suffering damage, in other cases it might be a government or interest group.

The third group of relevant aspects are the conditions under which liability exists. In general strict and fault based liability are distinguished. Fault based/tortuous liability is the basic form of liability whereby one can only be held liable if that person was at fault. Strict liability is a form used for specific high risk activities, which makes a person liable for simply engaging in such an activity. Strict liability is a more severe form of liability in which the plaintiff has a smaller burden of proof. Other aspects that determine the conditions under which liability exists are the duration of the liability (timing) and conditions related to the amount and type of damage.

The relevant aspects to be compared are summarized in the table below:

Table 2: Aspects of liability

Aspect of liability	**Options**	
Liable person	- Different parties in the chain - Joint or several - One or two tier liability	
Plaintiff	- Natural person - Interest groups - Government	
Conditions for liability	Type of liability	- Strict - Fault based
	Timing	- Statutes of limitation - Statutes of repose
	Amount	- Unlimited - Limited
	Types of damage	- Specific damages indicated - All possible damages

2.2.3 Managing liability

Wherever large and long-term liabilities exist, different methods of managing these liabilities have occurred. These methods exist not only to manage the liability for the operator, but also to guarantee that damages will be compensated even if the operators no longer exist. Choosing for the management of long-term liabilities should be an informed decision, in which both the interests of the industrial sector as well as the interests of society as a whole should be taken into account. Within the

[6] Harmelink, M., P. Lako, A.J. van der Welle, , M.D.C. van der Kuip, A. Haan-Kamminga, F. Blank, J. De Wolff, M. Nepveu, M.M. Roggenkamp Support to the implementation of the CCS Directive Overview and analysis of issues concerning the implementation of the CCS directive in the Netherlands CATO2-WP4.1-D01.

[7] Joint liability means that all relevant parties are individually liable for the total amount, several liability is proportional, each party is liable for the amount of their respective obligations, in joint and several liability, the claimant might pursue payment from each of the parties. The parties themselves have to pursue payment based on their several liability between each other.

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literature, discussion on relevant motives for managing liability has been addressed and several management styles are distinguished.[8] These styles are:

- Insurance
- Liability cap/exemption
- Compensation fund

These management styles will be addressed briefly, focusing on the general effect on the division of risks and the actors that might be responsible for the management instrument.

- Insurance: one can take insurance and pay on a periodic basis to the insurer. If a risk manifests itself and damages have to paid, the insurer will pay for the damages. Risk is thus transferred to the insurer and the insurer might do so for multiple parties thereby creating a pool. The complexity is in putting a price on the level of risk. The insurer could be a commercial party, but might also be a non-profit or government driven party. The insurance provides the operator with a certain annual manageable and predictable cost perspective and guarantees the compensations of damages.
- Liability cap/exemption: in this option, liability is managed by putting a cap on the amount of liability to be paid by the operator. If damages are to be compensated above the cap, another party, such as a government might take on the liability. The cap might be fixed on a per person basis or a per incident basis. The cap might be set in the form of a time limit. This means that for a specific period of time the operator is liable, whereas beyond the time limit another party or institution takes on the liability. A variation is the liability exemption whereby specific types of damages or plaintiffs are exempted from claiming liability. This type of management of liability limits the liability for the operator in time or amount and channels liability to specific cases and specific plaintiffs. This might also result in a limit on the liability as a whole. However, more often a two tier system occurs, in which the liability above the cap or beyond the exemption is channeled to another actor.
- Compensation fund: in this situation a fund is created from which damages will be compensated. This fund might have a private or government authority and might receive contributions from operators, the government, or both. Of course, issues such as the damages that will be compensated, the method of financing and the measure of compensation to be awarded to the victims will have to be defined in creating the fund. Just as is the case with insurance, the amount of money to be paid by the operator is managed and compensation is guaranteed. However, a fund is not a commercially driven enterprise, insurance companies are.

The possible management styles are summarized in the table below:

Table 3: Management of liability

Management style	Domain in which it is regulated	Related to which aspects of liability
Insurance	Either market or government, more likely market driven	Liable person
Liability cap	Defined by legislation	Conditions - Amount - Timing - Type of liability
Liability exemption	Defined by legislation	Plaintiff
		Conditions - Types of damage - Type of liability
Compensation fund	Either market or government, more likely government driven	Liable person
		Plaintiff
		Conditions

[8] Report of the Interagency Task Force on Carbon Capture and Storage, August 2010, online: http://www.fe.doe.gov/programs/sequestration/ccstf/CCSTaskForceReport2010.pdf, accessed October 22nd 2013. A. Haan-Kamminga, Long-term Liability for Geological Carbon Storage in the EU, Journal of Energy & Natural Resources Law Vol 29 No 3 2011, p. 329.

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		- Amount - Timing - Types of damage

2.2.4 Considerations for choosing management styles

The basic decision in designing and managing the long-term liability is thus: how is the liability divided between government and industry? This liability can be divided in time, amount and/or through the channeling of liability. A combination of all of these is also possible. The options for managing long-term liability each have different effects on the actors involved.[9]

In general three key issues are relevant in designing the management of long-term liability:

- Which objective is pursued? The objectives of liability management might be deterrence, risk spreading, stimulating activities or guaranteeing compensation. If deterrence is the main objective, no management at all might be the best option. In all the other options, the liability is divided by government and companies in some form, depending on which objective is favored. The classical instrument for spreading risk is insurance. The best way of guaranteeing compensation is a fund. The best way to stimulate activities is to provide certainty to operators by stating a cap or exemption.
- Who should decide on compensation? This might be judges in legal disputes, the legislator in advance or experts in panels. In making this choice, the duration of decisions, the costs of procedures and the equality of decision might be factors of interest. In case of insurance and a fund, decisions are made by experts. A cap or exemption is often prescribed by law. In case nothing is managed and in case of disputes, judges decide.
- How quickly should the instrument adapt itself to change? Regulating in advance or relying on court proceedings often results in rather rigid patterns. In a field in which scientific knowledge is developing rapidly, this might not always be the best option (as is the case with the cap/exemption or doing nothing). A fund or insurance are more flexible options.

The combination of the characteristics of each of the possible management instruments (as discussed in paragraph 2.2.3) is related to the considerations to be taken into account in managing liability. This results in either a good match (++), a match (+), a possible match (+/-), a mismatch (-). The considerations in choosing management styles are summarized in the table below:

Table 4: Considerations in managing liability

Consideration	Options	Insurance	Cap/ exemption	Fund	None
Objective	Deterrence	-	-	-	+
	Risk spreading	++	+/-	+	-
	Stimulating activities	+	++	+	-
	Guaranteeing compensation	+/-	+-	++	+/-
Decisions by	Judges	+/-	+/-	-	+
	Experts	+	-	+	-
	Legislators	-	+	-	-
Flexibility	High	+/-	-	+	-
	Low	-	+	-	+

[9] A. Haan-Kamminga, Long-term Liability for Geological Carbon Storage in the EU, Journal of Energy & Natural Resources Law Vol 29 No 3 2011, p. 330. M. Griffiths, Policy Option Paper – Closing the Liability Gap, Pembina Institute/ISEEE 2008.

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2.3 Framework for analysis

In the previous paragraphs, the possible variations in managing the long-term liabilities have been described. Based on this description, the framework for the analysis of how the different countries have managed their liabilities can be derived. Based on an analysis of each of the regimes, a conclusion can be drawn to the central question: how are the long-term liabilities divided between government and industry?

Table 5: Framework for analysis

Relevant questions:	**Possible outcomes:**
Which long-term liabilities are most prominent in each of the cases?	- Climate liability - Environmental liability - Liability for property - Liability for health
Are some or all of these liabilities managed?	The generic categories, or more specific liabilities within these categories.
Which of the aspects of the liabilities are managed?	- Liable person (channeling) - Plaintiff - Conditions for liability (type of liability, amount, timing, type of damage)
And by which style of management?	- None - Insurance - Liability cap/exemption - Compensation fund - Or a combination of these
Can conclusions be drawn with respect to the division of liabilities between government and industry?	- Division or no division - Division based on amount, timing or type of damage

2.4 Selection of cases

In a previous report, the regulation of CCS in several European countries has been compared.[10] This report compares specifically the regulation of long-term liability and includes non-European countries in the comparison as well. In doing so, the countries that will be selected are countries that are well advanced in either CCS legislation and/or CCS policy development or demonstration programs. These countries are Norway, Canada, the United States and Australia.[11] In order to complete the comparison, the European Union will also be selected. In the following section, the legal context for each of these cases will be discussed as to determine how this context will influence the comparison. Section 2.4.2 will focus on the sources of information that is used for the cases.

2.4.1 Legal comparison

Within comparative law several legal families are distinguished. These legal families have specific ways of dealing with issues such as liability. If we look at the selected cases, the European Union can be classified as a combination of the Romanistic and Germanic legal family, Norway can be categorized as part of the Nordic legal family and the US, Canada and Australia can be classified as part of the Anglo-American legal family (Common Law family).[12] The Nordic law family is closely related to the Germanic law family, but has not taken in as much influence of the Romanistic law

[10] Mikunda, T. & Haan-Kamminga, A., 2013. Overcoming national and European legal barriers to CO_2 transport and storage in the North Sea. CATO2 DWP4.1 D07. Retrieved - http://www.co2-cato.org/publications/publications/overcoming-national-and-european-legal-barriers-to-co2-transport-and-storage-in-the-north-sea

[11] Alphen, van K., Hekkert, M.P., Turkenburg, W. Comparing the development and deployment if CCS technologies in Norway, the Netherlands, Australia, Canada and the US – an innovation system perspective, Energy Procedia 1 (2009) 4591-4599.

[12] Zweigert, K., Kötz, H., An introduction to comparative law, Oxford University Press, 1998, p 69.

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family as the European Union has. For the purpose of this report, the main differences between the Common Law family and the Continental Law family seem to provide sufficient insight.

The two most important differences between these legal families are the distinctive mode of legal thinking and the sources of law. Where the continental legal family has a tendency to think in abstract legal norms, has a system of well-defined areas of law and thinks in generalizations, the common law family avoids generalization, thinks in terms of relationships, rights and duties and moves case by case. The continental legal families can be defined as statutory systems, the common law families as case law systems. With respect to liability and tort, this means that in the continental law family a few general principles of liability remained, where in the common law family separate types of cases and separate torts have developed. Although the outcomes of disputes are not that different, the reasoning towards these issues is. What might be relevant for the purpose of this report is the reluctance in the common law family to lay down regulation in legislation. Furthermore, common law countries are less inclined to impose strict liabilities. In common law countries liability is more often seen as an incentive for industry to incorporate standards of care. The expectation is that in the common law countries, statutory liabilities will have little importance.

2.4.2 Sources of information

The cases will be described and analysed mainly on the bases of secondary information as published in the country reports and details on the website of the Global CCS Institute.[13] If more detailed information is required, further inquiry into legal texts and documents will be made. However, these documents may not always be available online.

[13] http://www.globalccsinstitute.com/location last accessed October 25th 2013.

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3 Case description

This chapter consists of the description and analysis of the management of long-term liabilities in the selected cased. Each of the cases will be discussed in three subsections: the applicable liabilities, the management of these liabilities and the division of liabilities between government and industry.

3.1 European Union

3.1.1 Applicable long-term liabilities

In the European Union CCS is regulated in the CCS Directive, which is transposed into the national legislation of each Member State. With respect to CCS, the Directive regulates the minimum standards, Member States are allowed to provide for more stringent rules, as long as these do not hinder the common objectives. With regard to liabilities for CO_2 storage post closure, the Directive distinguishes environmental liability and climate liability. The Directive mentions the existence of liability for health and property, but does not regulate these on the European level. These liabilities do exist in the legislation of the individual Member States. Liability for property does not seem relevant after closure, as ownership of the pore space in most European countries lies with the government, so no issues of trespass can occur.

Environmental liability is regulated in the Environmental Liability Directive (Directive 2004/35/EC; henceforth, the 'ELD') and climate liability is regulated in the Emission Trading Scheme Directive (Directive 2003/87/EC) (both of which have been amended to include CO_2 storage within their remits). When analysing the environmental liability, it is in fact an obligation to remediate any damage, or pay for the costs of remediation as made by the government. The liable person is the licensee/operator (joint and several in case of a holding or joint venture). The possible plaintiff is the competent authority for the area in which damage has occurred. Natural persons or interest groups cannot hold the operator liable for environmental damage. When we analyse the conditions for liability, the types of damage that will be compensated are limited (significant adverse effect for species and water, measurable adverse effect for land/humans, costs made by plaintiff to prevent, limit or repair damage), as well as the liability horizon (30 years following the event that caused the damage, recovery within 5 years after execution of the measures). The environmental liability is a form of strict liability.[14]

Compensating damage to the climate is regulated not in the form of a liability arrangement, but in the form of an administrative system, the EU Emission Trading Scheme. In the case of a detected CO_2-leakage, one emission allowance for each ton of CO_2 leaked has to be surrendered to the competent authority. This is an annual system, in which the operator purchases a number of emission allowances each year. Any leaked CO_2 will have to be compensated through surrendering emissions allowances, which the operator may be in possession of or would have to purchase from the carbon emission market at the prevailing carbon price. For the long-term this means that in case of an event in which CO_2 is leaked, this can lead to significant financial damage to the operator both in terms of rectifying the leakage in accordance with the EU CCS Directive, but also the costs associated with surrendering the equivalent amount of emission allowances.[15] In order to be able to fulfil these obligations, prior to injection, the operator is obliged to provide a financial security to the competent authority, which reflects the costs of project abandonment and climate liability. Importantly, the provision of the financial security does not indemnify the operator from any form of liability.

3.1.2 Management of these liabilities

The CCS Directive has managed both environmental and climate liabilities, by setting a time limit for the operator. After a specific period of time, the operator is able to transfer the liabilities to the competent authority. The Directive specifies a series of steps that have to be taken before transfer can be concluded. First, four conditions have to be met:

[14] A. Haan-Kamminga, Long-term Liability for Geological Carbon Storage in the EU, Journal of Energy & Natural Resources Law Vol 29 No 3 2011, p. 319.
[15] Notes expert meeting Legal and Regulatory Barriers to CCS Projects in Europe, September 25th 2012.

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a) all available evidence indicates that the stored CO_2 will be completely and permanently contained;
b) a minimum period, to be determined by the competent authority has elapsed, that minimum being no shorter than 20 years, unless the competent authority is convinced that the condition specified in (a) has been met before that;
c) financial obligations (set out in Art.20), concerning a mandatory contribution towards post-transfer costs, have been fulfilled;[16] and
d) the site has been sealed and the injection facilities have been removed.

Is the operator at fault, then the operator remains liable, even after the transfer of responsibility. Art.18 (7) offers five examples of what would constitute fault in this context: cases of deficient data, concealment of relevant information, negligence, willful deceit or a failure to exercise due diligence. There are several potential limits to the transfer of responsibility and Member States are encouraged to formulate more specific guidelines with respect to this issue. Whether or not the liabilities for health and property are managed, is up to the Member States.

3.1.3 Division between government and industry

In summary,

- Environmental liability is managed in time, by limiting the possible plaintiffs and the types of damage. For the industry this means that only for specific types of damages, the government will hold the industry liable, and there is no liability towards third parties.
- For both environmental liability and climate liability a liability cap has been introduced in the form of a limited number of years for which the operator is liable. After this amount of time, the government is liable for possible damages.
- The transfer of responsibility and liability is still uncertain as not all liabilities might be transferred and under circumstances the liabilities may still be with the operator.

There is a division of liabilities with respect to the environmental and climate liabilities. After a specified amount of time, the government assumes liability. An exception is the situation in which the operator is at fault, in those cases, the operator remains liable. However, for the liabilities for health and property, no division exists and industry is fully liable.

3.2 United States

3.2.1 Applicable long-term liabilities

The Unites States has the most experience with CCS out of all regions/countries. However, the regulatory landscape for CCS is not that well developed. There is a federal regulatory scheme for permitting underground storage locations, but main issues, such as long-term liability and long-term stewardship have not been addressed on a federal level. Both the H2545 American Clean Energy and Securities Act and the S. 1733 American Clean Energy Security Act have provided for a task force to recommend mechanisms for long-term liability, but this has not resulted in Federal legislation yet. Some individual states have addressed these issues though. There is no regulation specifically for CCS, there are however, instruments applicable on a more general level and in case law several doctrines have developed.

The main issue with regard to liability is the variety in which tort liability might occur in the long-term (tort doctrines are used in case of damage to health and property). Possible doctrines that have developed in common law are trespass, conversion, nuisance and negligence.[17] Even though all of these could be used in case of leakage of CO_2, trespass is most likely to be chosen. Although no strict liability regime has been appointed in legislation, one might argue in court that strict liability should be applied in CCS, in which case the plaintiff has to prove less. There are no general statutes of

[16] By obliging the operator to reserve for a financial security and financial contribution, the EU guarantees that there will be funds available for compensation of possible damages. This can be viewed as some form of management of liabilities.
[17] Finch, Dill and Lokey,CCS briefing paper #3, March 13 2009.

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limitations and repose for these liabilities, although on a state level, several specific regulations might exist. In general it is left up to the courts to determine if a case can still be brought in court.

With regard to environmental damage and climate damage, no specific regulation has been drawn up on Federal level. However, the existing superfund (CERCLA, Comprehensive Environmental Response, Compensation and Liability Act) and the RCRA (Resource Conservation and Recovery Act) allow private parties to seek compensation for environmental damages. Liability under CERCLA is joint and several for current and past owners of facilities that have caused the damage. The fund compensates costs made for recovery. CERCLA only applies if CO_2 is seen as hazardous substance (which is not the case at the moment). RCRA provides a better vehicle for issuing liability for human health and the environment.[18] With regard to climate liability, the EPA (Environmental Protection Agency) may only gather data and require information, there are no emissions limitations. This in effect means that there is no climate liability as such in the US.

3.2.2 Management of these liabilities

On the State level, the issue of long-term liability has been addressed and regulated. Three different approaches to managing the long-term liabilities can be distinguished. First, some states have not managed or regulated the liabilities at all. Secondly, some states have established funds for long-term stewardship and take over a limited amount of the liabilities. Finally, some states have established funds and assume all liabilities.[19]

The structure for taking on liability is roughly the same as in Europe: there is a post closure period to verify the stability, the State grants a certificate of closure and assumes liability after this period. The amount of money to be paid in the fund differs, as well as the length of the post closure period and the type of liabilities that are taken on by the State.

3.2.3 Division between government and industry

In summary:

- It is hard to discuss the liability in the US in general, as the regulation is divided between the State level and the Federal level. The issue of management of liabilities however, in mainly addressed on the State level.
- When analyzing applicable liabilities, we see that climate liability is not an issue, that there are several funds from which the environmental damages are compensated, but that the main discussion on liability is to be found in tort liability (health and property).
- With regard to the division between government and industry, it can be concluded that it is different per State.
- The long-term liabilities are divided between government and industry by setting a time limit for the liability of industry, as well as setting a specific cap for the liability of industry.
- The degree to which government takes on liability differs significantly. In some States industry is exempted after a specified amount of time, in other States the government only takes on specific liabilities.

3.3 Canada

3.3.1 Applicable long-term liabilities

A number of Provinces within Canada are implementing CCS projects. Canada is a federal state, and powers have been divided based on the constitution. Issues such as CCS fall within the competence of the Provinces. Several Provinces have developed regulation with regard to CCS. CCS is explicitly seen as an instrument to combat climate change, although not all Provinces have established legislation with regard to CCS. CCS projects in Canada are most advanced in the three western

[18] Klass A.B., E.J. Wilson, Climate change and carbon sequestrations: assessing a liability regime for long-term storage of carbon dioxide, in Emory Law Journal, 2008, p 38.
[19] Pollak, CCS regulatory Project, presentation at the IES regulators webinar June 30, 2010.

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Provinces, Saskatchewan, Alberta and British Columbia. Although each of the Provinces has their own form of legislation, they take a similar approach in regulating CCS.[20]

An important issue in relation to CCS is the ownership of the land and the mineral rights. In Canada, the ownership of the mineral rights might be privately held, or held by the federation or Province. The federal government owns the land and might negotiate with the Provinces over mineral interest ownership or ownership of the subsurface. Although not a liability issue, this is typical for the Canadian situation.[21]

With regard to climate liability, there is no generic accounting system for Canada. Alberta for example, has a emissions intensity target for all large greenhouse gas point sources of over 50kt CO_2e per year. Companies can choose to either lower their emissions, pay a tax of $15 per ton of CO_2 or buy carbon offset credits generated in Alberta. The tax, is actually a contribution to the Climate Change and Emissions Management Fund, which uses the money generated sponsor the development and application of green transformative technologies. Such a fund is also established in Saskatchewan. In British Columbia there is also a carbon dioxide tax.[22]

Both federal and provincial environmental legislation prohibit any activity that may cause damage to the environment. In June 2009, the federal government passed the Environmental Enforcement Act, to amend nine existing environmental statutes and create the Environmental Violations Administrative Monetary Penalties Act. It establishes minimum penalties and increases maximum penalties for environmental offences, individuals, corporations, corporate officers and directors may be prosecuted for environmental offences, and if convicted, are liable for large fines and/or prison terms. If fines are to be paid, they are paid into the federal Environmental Damages Fund (EDF). The money is used to repair the actual harm done by the pollution, or allocated to fund projects in the community in which the pollution occurred. Environmental liability is thus addressed on a federal level. For specific types of damage, the government might fine or sue the polluters.[23]

Furthermore, a system of common law is applicable as well, in which liability for property and human health is addressed through tort. There have been few cases of subsurface trespass in Canadian law, though cases of nuisance are more common and may also be relevant to CCS activities. The more regulation with regard to notifying or asking permission of landowners, the less likely it is that trespass cases might still occur.[24]

3.3.2 Management of these liabilities

The management of liabilities is also addressed on a Provincial level. Alberta has addressed this issue in the CCS Statues and Amendments Act. A Post Closure Stewardship Fund will be established to cover costs associated with monitoring and remediation and environmental liability. Contributions to the fund will be made by storage license holders based on a fee per ton of CO_2 injected. The fund does not cover tort liabilities. However, upon issuing the closure certificate, the government indemnifies the operator for tort liabilities and becomes owner of the injected CO_2.[25] This means that after closure, the operator is relieved of liabilities. The climate and environmental liabilities are transferred and the operator is indemnified for the tort liabilities. Although not yet in Provincial law, a recent regulatory review recommends that a closure certificate may be granted after a period of 10

[20] See the country snapshots at: http://www.globalccsinstitute.com/location/canada, last accessed November 25th 2013.
[21] See the legal recourses at: http://www.globalccsinstitute.com/networks/cclp/legal-resources/property-rights/canada, last accessed November 25th 2013.
[22] Fisher, K. Report of CCS Environmental assessment and project approval requirements in ex-Alberta jurisdictions, Folder Associates, Feb. 2012.
[23] http://envirolaw.com/quick-intro-canadian-environmental-law/
[24] See the legal recourses at: http://www.globalccsinstitute.com/networks/cclp/legal-resources/property-rights/canada, last accessed November 25th 2013
[25] Section 121 of the Mines and Minerals Act.

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years and when the conditions have been met (with regard to monitoring, behavior of the CO_2 etc).[26] In British Columbia and Saskatchewan, there is no specific regulation, and no specific transfer of liabilities. However, there is a fund from which the costs for monitoring and remediation can be paid.[27]

Alberta has proposed the period of 10 years for two reasons: the minimum closure period is import to allow government to be confident about the sustained nature of compliance with the performance criteria when making the decision to issue a closure certificate (because standards are still developing and time is needed to prove conformity of the CO_2 to modeled behavior). Furthermore, the minimum period is necessary to enhance public confidence in the closure and transfer process.

3.3.3 Division between government and industry

In summary:

- All categories of liability apply in Canada.
- The management of liability is regulated on the provincial level. Some provinces have addressed the issue of management of liabilities specifically for CCS, others have not
- Alberta has managed all liabilities, for tort liabilities the operator is indemnified, for the other liabilities a fund is established. A general time limit before transfer is 10 years, or negotiable.
- The fund is also the preferred option in other provinces, although not all liabilities are addressed.
- With regard to the division of liabilities between government and industry can be concluded that it differs per province, but most advanced is Alberta, in which the government takes on all liabilities after a specified amount of time. Compensation occurs through a fund filled by industry. This fund does not cover tort liabilities, but after closure the operator is indemnified for tort liabilities.

3.4 Australia

3.4.1 Applicable long-term liabilities

In Australia CCS is regulated both on the federal level and the state level. On the federal level, offshore CCS is regulated **(**Offshore Petroleum and Greenhouse Gas Storage Act)**.** On the state level onshore CCS is regulated mainly through legislation on greenhouse gases. In Western Australia, a law specific for the Gorgon CCS project is developed.[28] The national sets of regulation are based on the regulatory guiding principles, so there is a nationally consistent framework.

Just as in Canada, the issue of property rights is also present in Australia. Based on traditional property doctrines, liabilities might be vested in the operator or in the owner of the land, pore space or CO_2. In case of leakage, potential claims based on trespass, nuisance or negligence might arise.

Environmental damages are addressed in the Environmental Protection and Biodiversity Conservation Act 1999 (EPBC). Based on this act several types of environmental harm are distinguished for which the relevant authorities might issue a variation of administrative, civil and criminal penalties as set out in the compliance and enforcement policy in 2009. Part of the civil instruments is the repair and mitigation of environmental damages. Government might sue possible polluters and ask the court to apply the measure. The liability thus is limited by issuing that only government might take action. The categories of damage, are rather broad (environmental harm, material environmental harm, serious environmental harm).[29]

[26] Alberta Energy, 2013. Carbon Capture and Storage – Summary Report of the Regulatory Framework Assessment. Retrieved: http://www.energy.alberta.ca/CCS/pdfs/CCSrfaNoAppD.pdf
[27] Ransom, S, Bankes, N, A Comparative review of Long-term Liability rules for Carbon Capture and storage, ICO_2N, October 2011.
[28] See the country snapshots at: http://www.globalccsinstitute.com/location/australia, last accessed November 25th 2013.
[29] See the articles and policies on http://www.environment.gov.au/topics/about-us/legislation/environment-protection-and-biodiversity-conservation-act-1999, last accessed November 22nd 2013.

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Climate liability is addressed through a carbon pricing mechanism. However, unlike the European Union, there is no system of permits for sequestration projects. There is a deduction in paying for emissions if these emissions are stored. Liability for an increase in emissions in the event of leakage has not been addressed yet. Currently, operators do not need to report any leakages.[30] The OPGGS Act does not address this issue and the Commonwealth government is still in the process of developing its policy on the appropriate regulatory framework to reduce emissions in Australia.

3.4.2 Management of these liabilities

The Federal regulatory framework for offshore CCS activities is unique in Australia in that it provides mandatory indemnification by the Commonwealth Government for specified long-term liabilities. The licensee must obtain a site closure certificate. Following site closure, the licensee will continue to remain at risk for liabilities arising from its operations. At least 15 years after the grant of a site closure certificate, the Minister may declare that a 'closure assurance period' has been reached. Once there is a valid site closure certificate and a declared closure assurance period, the Commonwealth is required to indemnify the injection licensee against specified liabilities. The scope of the Commonwealth's liability is limited by the following four conditions:

- the liability is a liability for damages;
- the liability is attributable to an act done or omitted to be done in the carrying out of operations authorised by the licence in relation to the formation;
- the liability is incurred or accrued after the end of the closure assurance period in relation to the formation; and
- such other conditions (if any) as are specified in the regulations.

The effect of the four conditions above is that the licensee will continue to be at risk of incurring liabilities that fall outside of the scope of the transfer. For example, the licensee will continue to be liable for acts or omissions in carrying out activities that were not authorized under the OPGGS Act.[31]

Although there are guidelines, the management of liability for onshore CCS differs throughout Australia. The Victorian and Queensland Act do not provide for such a wide transfer of liability. In the case of the Gorgon CCS Project, indemnity has been extended by the Commonwealth and Western Australian Governments based on the specific circumstances of the project. In New South Wales, the liability for actions carried out before and after closure transfers to the Crown. However, the operator is required to indemnify the Crown against claims in negligence and fraud. This means that if there is damage as a result of negligence and fraud by the former operator, the government can sue the former operator for the damages.

3.4.3 Division between government and industry

In summary:

- Offshore CCS is regulated on the federal level, onshore CCS on the state level
- Environmental liability applies and is manages in the same way as the EU, by referring to specific categories of damages and by channeling the liability to one specific plaintiff: the government. The most important form of liability is liability for health and property through the tort doctrines that have developed. Climate liability does not seem to play a role.
- With regard to the division of liabilities between government and industry can be concluded that for offshore CCS, the government takes on all liabilities 15 years after closure, upon payment of a security fee.
- The management of onshore liability differs per state and is not that extensive. Some states do manage liability, others only manage specific liabilities. In all cases, industry is still liable in cases of fraud and negligence.

[30] Swayne, N., Philips, A. Legal liability fir CCS in Australia, where should the losses fall?, Environmental and Planning law journal (29-3) 2012, p 39.
[31] See the legal recourses at: http://www.globalccsinstitute.com/networks/cclp/legal-resources/liability/australia, last accessed November 25th 2013.

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3.5 Norway

3.5.1 Applicable long-term liabilities

Norway is not an EU member, but being a member of the EEA (European Economic Area), it still has to implement the CCS Directive, because it qualifies as EEA relevant. By governmental decree of March 13th 2009 the Norwegian government stated that it would aim to develop rules comparable to the CCS Directive's regime. Key issues were already addressed in the well-developed body of oil and gas legislation. Although more specific CCS regulation is expected, the projects that are going on are regulated under the existing legal framework for oil and gas. Relevant statues with regard to CCS are:[32]

- the Pollution and Waste Act
- the Petroleum Act and Petroleum Regulations
- the CO_2 Tax Act
- the Continental Shelf Act
- the Royal Decree of 2009 on CCS

The Pollution and Waste Act imposes a duty to avoid pollution, stating that where there is a danger of pollution the person responsible shall take the measures to prevent it from occurring. If pollution has already occurred, the operator must take proportional steps to stop, remove or limit the pollution and its effects. More specifically, the holder of a "pollution permit" must take the action necessary "at any given time" to prevent pollution if a facility is closed or the operation has stopped. The pollution control authority may then further determine which measures are necessary to avoid pollution, including requiring the permit holder to provide a guarantee for payment of future expenses and any liability for damages which may arise. The Pollution and Waste Act stipulates that the cost of preventing or limiting pollution shall be met by the person responsible for the pollution.

For Norway, only offshore storage is suitable. CCS that stems from petroleum activities falls under the scope of the Petroleum Act. CCS that does not stem from petroleum related activities falls within the Continental Shelf act. The Petroleum Act imposes strict liability on operators for environmental damage which results from the emission or discharge of petroleum from a facility, including the costs of reasonable measures to avert or limit damage, and any damage as a consequence of the measure. If a CO_2 storage site can be considered part of the "facility" and a leakage of CO_2 would cause environmental damage, then a potential leakage of CO_2 out of the storage complex is likely to be caught by the scope of the Act.

Compensation for climate liability in Norway is regulated by introducing a system of taxes. In storing CO_2, the tax can be avoided. If leakage occurs, the tax will have to be paid. There are no specific liabilities for health and property other than those related to the environmental damage. However, for the effect on fishery, specific rules are adopted.

3.5.2 Management of these liabilities

Norwegian law contains no provision on where authorities are under the obligation to accept the transfer of liability from operators. However, this has occurred in circumstances where private commercial actors were no longer accountable.[33] Considering that pollution is likely to include a leakage of CO_2 into the atmosphere, it would seem that the operator of a CO_2 storage facility in Norway remains liable for remedying any post-closure corrective measures. However, both acts contain forms of management of the long-term liabilities. On the one hand, there is a discretionary upper limit as to the operators duty of action in case of leakage: the word reasonable is used in article 7-1 Petroleum Activities Act, Pollution and Waste Act article 7. There is also a restriction in the

[32] See the legal recourses at: http://www.globalccsinstitute.com/networks/cclp/legal-resources/liability/australia, last accessed November 25th 2013.
[33] Bugge, Hans Christian, Andre Lamark Ueland, Norway, Case studies on the implementation of Directive 2009/31/EC on the geological storage of carbon dioxide, UCL, November 2011, p 24.

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Petroleum Activities Act in case of a force majeure. Such a limitation is not present in the Pollution Control Act.

Another form of management is found in the lifespan of the petroleum production permit. The lifespan usually is 10 years. A petroleum production permit may be surrendered within 3 months' notice at the end of each calendar year, but the authority may require certain obligations to be continued to be carried out, so this does not necessarily affect the operator's obligations and liability for subsequent irregularities or leakage.[34] The transfer of liabilities is thus part of the negotiations between the operator and the authority as part of the decommissioning plan. This might include all or none of the liabilities. The operator is expected to provide the authority with some form of security.

3.5.3 Division between government and industry

In summary:

- As Norway has an extensive body of regulation for offshore activities including CCS, the distinguished categories of liabilities do not seem that relevant. Climate liability is addressed through a system of taxes. Environmental liability is regulated extensively and includes all kinds of damages (including health). Environmental liability is a form of strict liability, channeled to the operator of a facility. Property damage is not relevant as all pore space offshore is owned by the government.
- Liabilities are not managed in advance, although specific defenses against liability are accepted (such as force majeure and reasonable action). Management of liability does not lead to discussion, the liabilities are accepted by industry.
- In the regular lifecycle of a permit, lifespan 10 years) some form of management is visible. When a permit ends, negotiations over continuation or closure start. In these negotiation, the transfer of liabilities is an option. This is always determined on a case by case basis.
- With regard to the division of liabilities between government and industry can be concluded that in principle, there is no division, industry is always liable.

[34] Section 3-14 Petroleum Act.

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4 Comparative analysis

Based on the framework for analysis, five cases have been described and analyzed in the previous chapter. This chapter consists of the comparative analysis of the cases. It should be noted that a detailed comparison was not possible for two reasons; Firstly, the compared cases are not similar in scale or type of government. Federal states have been compared to unions or single states. The level at which CCS and/or the liability for CCS is regulated differs too much to compare into detail. Secondly, it was not possible to gain insight into the considerations used in designing the liability regimes or the choices in management of liability. However, it is possible to find some general insights with respect to the types of liability that apply and the way in which liabilities are managed and the division of liabilities between government and industry as a result of this.

4.1 Applicable liabilities

A first relevant difference in the applicability of liability regimes is related to the law family of the selected cases. In the cases in which common law is the main type of law (Australia, US and Canada), the most relevant liabilities for industry are the liabilities for health and property, often based on tort doctrines. The type of claim used differs slightly as a result of developed case law. In these cases, the possible tort claims are viewed as most unpredictable and possibly high. Issues such as ownership of pore space play a significant role in the liability regimes.

In the EU and Norway, statutory liability is viewed as most important. The environmental liabilities are regulated extensively and liabilities for health and property based on tort are possibly applicable, but are not viewed as significant.

Climate liability is only a relevant issue in countries or regions which internalize the cost of emitting CO_2 through regulation, for example CO_2 taxes or an emissions trading scheme. This is the case in Norway, Canada and the EU. However, only in the EU, climate liability is specifically viewed as a liability and because of the linkage to the Emissions Trading Scheme it is even viewed as the most unpredictable and possibly highest liability in the long-term.

4.2 Management of liabilities

When the management of liabilities is compared, Norway stands out, as management of liability does not seems to play a role. In Norway, industry in general accepts liability and when the permit ends or the site is closed a possible transfer of liabilities to the government is negotiated with the government. However such a transfer has only taken place in case of a company that did no longer exist.

In all other cases, there are forms of management of liabilities. All cases have in common that before a transfer, the operator has to pay some form of security to the government. Which liabilities are transferred differs per state, country or province. Not always all liabilities are transferred. When comparing the form of managing liabilities, the options of a fund and the options of a liability cap, mostly in time, are chosen.

In all cases, environmental liabilities is regulated to some extent. In most cases environmental liability is channeled to specific types of damage and can only be invoked by government. The type of action that might be taken or the form of compensation differs. In general, the environmental liability is managed through some form of liability exemption.

A common approach to such liability appears to be the transfer of responsibility from storage operator to the government after a period of time has elapsed after the seizure of CO_2 injection. Once the transfer of responsibility has taken place, the operator is no longer liable. The length of the time periods that precede the transfer of responsibility, vary between the countries investigated in this report. Alberta has chosen a minimum of 10 years, Australia 15 years, and the EU has chosen 20 years, although this could be shorter if agreed by the competent authority. In the US, states use different periods, from the moment of closure to terms comparable to the abovementioned cases. The conditions for transfer are not always clear, and under certain conditions, the operator might still be

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liable (in case of fault). The selection process of a minimum period prior to transfer of responsibility is unclear in the EU, and it has been stated that the period has no bearing of the behavior of geologically stored CO_2. However, Alberta has provided justifications for the Provinces provisional selection of 10 years. The minimum closure period is import to allow government to be confident about the sustained nature of compliance with the performance criteria when making the decision to issue a closure certificate. Furthermore, the minimum period is necessary to enhance public confidence in the closure and transfer process.

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5 Conclusions and recommendations

This study compared the long-term liability regimes for CO_2 storage in Europe, the US, Canada, Australia and Norway. The research question focused on the division of the long-term liabilities between government and industry and the lessons that can be learn for the European situation. In order to facilitate the comparison, a framework for analysis is developed and applied to all of the cases.

A complication in the comparison of the cases was that the regulation of long-term liabilities in most cases was divided between a federal/union and state/provincial level. This means that in most cases, different sets of regulation apply. Where relevant, the most advanced sets of regulation have been incorporated in the comparison. From the comparison, the following conclusions can be drawn:

- The continental law systems and the common law systems value different liabilities as most relevant. In common law systems (US, Canada and Australia), the most important, unpredictable and most costly liabilities are the liabilities for health and property based on different tort regimes (trespass or nuisance). In continental law systems (EU and Norway), statutory liabilities are more important. In these countries, environmental liabilities and climate liabilities are valued as most costly.
- Although the degree to which environmental liabilities are regulated and the way in which compensation is organized is different, in all cases environmental liabilities are channeled, so that only a government or government related body may hold the operator liable and only for specific damages. The EU and Australia have the most advanced regulation with regard to the environmental liabilities.
- Climate liability is only a relevant issue in countries or regions which internalize the cost of emitting CO_2 through regulation, for example CO_2 taxes or an emissions trading scheme. This is the case in Norway, Canada and the EU. However, only in the EU, climate liability is specifically viewed as a liability and because of the linkage to the Emissions Trading Scheme it is even viewed as the most unpredictable and possibly highest liability in the long-term.
- Norway is an exception in the sense that it does not explicitly manage the long-term liabilities. However, it is possible to negotiate the transfer of liabilities upon closure of a storage location. This has not happened yet, but the permitting system leaves the option open.
- In all other cases the liabilities are managed to a certain extent, although different management options are chosen. The most common form of management are the options of a fund and a liability cap/exemption.
- In general, not all liabilities are managed. Only in a few jurisdictions, the operator is relieved from all liabilities (Alberta (Canada) and Australia offshore). And in these cases, in case of fault or negligence, the operator remains liable.
- Most common is the situation in which the liabilities are divided through a time limit, varying from 10, to 15, to 20 years. These time limits seem to be chosen arbitrarily. After the specified time limit, the liabilities are transferred to the government. The conditions for the transfer include a security to be paid by the operator. However, the conditions for the transfer are complicated and uncertain and the elements that build up the security are different as well.

When relating the result to the European situation, it seems that the EU regulation is rather advanced. The way in which climate liability and environmental liability are addressed are sound from the perspective of the polluter pays principle. However, the uncertainties that come with the climate liabilities are viewed as a problematic issue by industry. Furthermore, not all liabilities are managed in EU legislation, the other liabilities are to be managed on a Member State level. The way in which specifically Alberta (Canada) has managed liabilities, might be an inspiration for the European Union. It provides industry with more flexibility in choosing a method for compensating climate liabilities and it provides more certainty by managing all liabilities.

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