The International Legal Issues Relating to the Facilitation of Sub-Seabed CO_2 Sequestration Projects in Australia

YVETTE CARR*

Abstract

In the last decade there has been growing momentum to develop carbon capture and storage technologies to address the adverse effects of climate change on marine ecosystems. In November 2006, the 1996 Protocol to the *London Convention*† was amended to expressly permit the storage of carbon dioxide in geological formations beneath the ocean floor ('sub-seabed sequestration'). Despite this new certainty, the consequences under international law of the occurrence of a leakage of carbon dioxide into the marine environment and the atmosphere are not clear cut. This article considers who should be liable for transboundary environmental harm as a result of a leakage event and the form any liability instrument should take.

Introduction

A general consensus has emerged that increases in global average temperatures since the middle of the 20th century have mostly been caused by increases in anthropogenic greenhouse gas concentrations in the atmosphere.[1] Carbon dioxide (CO_2) comprises almost 50 per cent of all anthropogenic greenhouse gas emissions,[2] and fossil fuels are responsible for about 75 per cent of anthropogenic CO_2 emissions.[3] It is predicted that without taking action to minimise CO_2 emissions, global average temperatures will increase by up to 6.4°C during the 21st century.[4]

---

* B Planning (Hons), LL.B (Hons) (UNSW), Tipstaff to the Hon. Justice J M Jagot of the Land and Environment Court of NSW. I wish to thank Professor Rosemary Rayfuse (UNSW) for her guidance while writing this paper.

† *Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter*, opened for signature 29 December 1972 (entered into force 30 August 1975) (*'London Convention'*).

1 Intergovernmental Panel on Climate Change ('IPCC'), *Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* (2007) at 10.

2 David Hunter, James Salzman and Durwood Zaelke, *International Environmental Law and Policy* (3rd ed, 2007) at 635.

3 IPCC, *IPCC Special Report on Carbon Dioxide Capture and Storage. Prepared by Working Group III of the Intergovernmental Panel on Climate Change* (2005) at 55.

4 IPCC, above n1 at 13.

Higher levels of atmospheric CO_2 concentrations have had an adverse impact on oceans. About one-third of CO_2 released into the atmosphere from the burning of fossil fuels is absorbed by the world's oceans, leading to increased ocean acidification.[5] There is growing evidence that ocean acidification is having a detrimental effect on marine ecosystems.[6]

There has been growing momentum in the last decade or two to take serious action to address these problems. In 1992, the *United Nations Framework Convention on Climate Change* (*'UNFCCC'*) established an international framework to respond to global warming.[7] The *UNFCCC*, to which Australia is a party,[8] aims to achieve 'stabilisation of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system'.[9] Article 4 requires all parties to promote the development, application and diffusion of technologies that control, reduce, or prevent anthropogenic emissions of greenhouse gases.[10]

Article 4 provided the impetus for the development of carbon capture and storage ('CCS') technologies. The two main storage types are geosequestration, which involves the storage of CO_2 in geological formations, and ocean sequestration, which involves the direct injection of CO_2 into the oceans. This article deals with offshore geosequestration — 'sub-seabed sequestration' — the storage of CO_2 under the seabed.

The legality of sub-seabed sequestration under international law was uncertain until the *1996 Protocol to the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter*[11] (*'1996 Protocol'*) was amended in November 2006.[12] Subject to specified criteria, the *1996 Protocol* now unequivocally authorises sub-seabed sequestration.

This article examines the international legal issues associated with the implementation of sub-seabed sequestration projects in Australia. It looks at the international conventions that are relevant to the permissibility of sub-seabed sequestration. It then considers whether and how, under international law, Australia would be responsible and liable for transboundary environmental damage caused by sub-seabed sequestration. This article also considers the measures taken thus far to develop a liability regime under the *1996 Protocol* and the form that liability regime should take. The final section briefly considers how Australian legislation will need to be amended to facilitate sub-seabed sequestration projects in Australia and ensure that Australia is able to meet its international legal

5 Ken Caldeira et al, 'Comment on "Modern-Age Buildup of CO_2 and its Effects on Seawater Acidity and Salinity" by Hugo A. Loáiciga' (2007) 34 *Geophysical Research Letters* 2.

6 The Royal Society, *Ocean Acidification Due to Increasing Atmospheric Carbon Dioxide* (2005) vi <www.royalsoc.ac.uk/displaypagedoc.asp?id=13539> accessed 1 October 2007.

7 *United Nations Framework Convention on Climate Change*, opened for signature 4 June 1992, 1771 UNTS 107 (entered into force 21 March 1994) (*'UNFCCC'*).

8 Australia ratified the *UNFCCC* on 30 December 1992.

9 *UNFCCC*, art 2.

10 *UNFCCC*, art 4(1)(c).

11 *1996 Protocol to the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter*, opened for signature 7 November 1996, 1046 UNTS 120 (entered into force 24 March 2006) (*'1996 Protocol'*).

12 International Maritime Organization ('IMO'), Notification of Amendments to Annex 1 to the London Protocol 1996, Doc LC-LP.1/Circ.5 (27 November 2006). The amendment to the 1996 Protocol was adopted on 2 November 2006 and entered into force on 10 February 2007.

obligations. First though, this article briefly explains the process of sub-seabed sequestration and then it looks at its benefits and risks, which influence the legal issues.

1. What is Sub-Seabed Sequestration?

Sub-seabed sequestration is a process involving the separation and capture of CO_2 emissions from industrial and energy-related sources like power stations, transportation of the captured CO_2 via vessels or pipelines to an offshore storage location and then injection of the CO_2 deep underground into geological formations for long-term (potentially indefinite) storage.[13]

Importantly, there are a number of methods by which CO_2 may be captured, transported and stored into sub-seabed geological formations. CO_2 can be transported and stored as either a liquid or a gas, depending on the transportation method and the geology of the storage site.[14] Where CO_2 is generated on land (for example, from industrial sources), it can be transported either by pipeline or by ship to an offshore structure (such as a platform) and then injected underground from the platform, or injected underground straight from the pipeline or ship itself.[15] Interestingly, the method of capture, transportation and storage of CO_2 is relevant to the permissibility of sub-seabed sequestration under international law.

2. Risks and Benefits of Sub-Seabed Sequestration

The greatest environmental risk[16] posed by sub-seabed sequestration is leakage of CO_2 from geological formations.[17] Another is the risk of induced seismicity (earthquakes).[18] While there is some experience with CO_2 and natural gas storage for periods of approximately 10-20 years, long-term storage is yet unproven.[19] In appropriately selected and managed storage reservoirs, the proportion of stored CO_2 is 'very likely'[20] to exceed 99 per cent over the first 100 years and is 'likely'[21] to exceed 99 per cent over the first 1000 years.[22] There is still a margin of uncertainty because of limited knowledge about the geology of many proposed storage sites, which must be evaluated on a case by case basis.[23]

---

13 IPCC, above n3 at 2.

14 See, generally, IPCC, above n3 at chapters 3 to 5.

15 IMO, *Report of the 27th Consultative Meeting of Contracting Parties to the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter*, Doc LC 27/16 (16 December 2005) at 88.

16 'Risk' denotes a combination of the probability of an event occurring and the consequences of the event: IPCC, above n3 at 250.

17 House of Representatives Standing Committee on Science and Innovation, Parliament of the Commonwealth of Australia, *Between a Rock and a Hard Place: The Science of Geosequestration* (2007) at 55.

18 IPCC, above n3 at 242, 249.

19 Id at 59.

20 'Very likely' is a probability between 90 and 99 per cent: IPCC, above n3 at 13.

21 'Likely' is a probability between 66 and 90 per cent: IPCC, above n3 at 11.

22 IPCC, above n3 at 246.

23 Greenpeace Australia Pacific, *Submission to the House of Representatives Standing Committee on Science and Innovation Inquiry into Geosequestration Technology* (2006) at 17.

The impacts of leakage depend in part upon the magnitude and rate of release.[24] According to the Intergovernmental Panel on Climate Change ('IPCC'), the risks of all stages of the sub-seabed sequestration process (capture, transport and storage) fall into two broad categories: local impacts and global impacts arising from the release of stored CO_2 into the atmosphere.[25] Local impacts include lethal effects on plants and subsoil animals near the storage site (eg, zooplankton) and contamination of groundwater (with associated risks to human health).[26] At the extreme, substantial and abrupt leakage could lead to high local CO_2 concentrations in the air that could interfere with other legitimate uses of the sea, including fishing and maritime transport, and pose a threat to the health and safety of offshore platform workers.[27]

The global risks relate to the long term adverse climate change consequences of the gradual, unintended release of CO_2 through undetected faults or fractures in the storage reservoir — a result of incorrect site selection.[28] According to Holloway, little is known about the environmental damage that could be caused by gradual but persistent leaking.[29] De Figuereido says that, because of the remoteness of offshore storage sites from human settlements, sub-seabed sequestration 'eliminates the human health risks that onshore CO_2 storage faces from emissions of CO_2 from the geological storage reservoir to the surface'.[30] However, the IPCC states that it is 'possible, though improbable', that gradual releases of CO_2 from both onshore *and* offshore storage reservoirs will pose a threat to humans,[31] but of course the effects of leakage on human health depend on the concentration and duration of exposure.[32]

Interestingly, the International Maritime Organization's ('IMO') Intersessional Technical Working Group on CO_2 Sequestration ('Technical Working Group') disputes the contention that leakage risks would range from local to global levels. In its opinion, leakage risks might, 'in the worst case, only range from local to regional levels'.[33] It is possible that CO_2 could leak far from its storage area to cross jurisdictional boundaries.[34] Obviously, the risk of causing transboundary environmental harm increases as the proximity of the activity to other States becomes greater. But given Australia's

24 OSPAR Commission, *Placement of CO_2 in Subsea Geological Structures: A report prepared by Norway and the United Kingdom and reviewed by the OSPAR Offshore Industry Committee and the OSPAR Biodiversity Committee* (2006) 8 <www.ospar.org/eng/doc/Placement%20of%20CO2%20in%20subsea%20geological%20structures.doc> accessed 7 September 2007.

25 IPCC, above n3 at 242.

26 IPCC, above n3 at 13, 243; IMO, *Risk Assessment and Management Framework for CO_2 Sequestration in Sub-Seabed Geological Structures*, Doc LC/SG-CO2 1/7 Annex 3 (2006) at 7.

27 Ibid.

28 IPCC, above n3 at 242; House of Representatives Standing Committee on Science and Innovation, above n17 at 61.

29 Sam Holloway, 'Carbon dioxide capture and geological storage' (2007) 365 *Philosophical Transactions of the Royal Society A* 1095 at 1103.

30 Mark de Figuereido, *The Liability of Carbon Dioxide Storage* (D Phil Thesis, Massachusetts Institute of Technology, 2007) at 138.

31 IPCC, above n3 at 247.

32 IPCC, above n3 at 391; de Figuereido, above n30 at 184.

33 IMO, *Report of the Second Meeting of the Intersessional Technical Working Group on CO_2 Sequestration*, Doc LC/SG-CO2 2/4 (30 April 2007) at 3.

geographical remoteness, it is not clear how likely CO_2 leaked into waters within Australia's jurisdiction and control would travel to the atmosphere and waters within the jurisdiction and control of nearby States (for example, Papua New Guinea, Indonesia, New Zealand and the South-Pacific islands). For the purposes of this article, this is considered a possibility, necessitating the implementation of an international and domestic liability regime for transboundary environmental damage.

The IMO's Technical Working Group considers the above concerns to be outweighed by the global benefits of sub-seabed sequestration.[35] While sub-seabed sequestration is only 'one possibility in a suite of options'[36] to reduce global CO_2 emissions, it may nevertheless be seen as an attractive one, considering the statistics. According to the IPCC, available technology can capture about 85-95 per cent of CO_2 produced from power plants, with the net result being an 80-90 per cent reduction in CO_2 emissions to the atmosphere.[37] Some commentators consider this net figure to be too low for sub-seabed sequestration to be classed as an effective response to climate change. They point out that all transport processes of CO_2 involve some energy consumption that will be provided by fossil fuels, thereby reducing the overall effectiveness of sequestration as an emissions reduction strategy.[38] However, proponents of this technology have never claimed that sub-seabed sequestration is the cure-all to climate change. The parties to the *1996 Protocol* have acknowledged that it is but one in a suite of options to address the problems.[39]

3. International Convention Regime

A. *Law of the Sea Convention*

The 1982 *United Nations Convention on the Law of the Sea*[40] (*'LOSC'*) is a framework convention containing fundamental rules of ocean governance. It codifies the rule under customary international law that States have the sovereign right to exploit their natural resources, but they must do so in accordance with their obligation to protect and preserve the marine environment.[41]

---

34 National Energy Technology Laboratory ('NETL'), Department of Energy, United States Government, *International Carbon Capture and Storage Projects: Overcoming Legal Barriers* (2006) 13 <www.netl.doe.gov/energy-analyses/pubs/CCSregulatorypaperFinalReport.pdf> accessed 31 August 2007.

35 IMO, *Report of the Second Meeting of the Intersessional Technical Working Group on CO_2 Sequestration*, Doc LC/SG-CO2 2/4 Annex 3 (30 April 2007) at 1.

36 House of Representatives Standing Committee on Science and Innovation, above n17 at 21.

37 IPCC, above n3 at 4.

38 Energy Research Centre of the Netherlands ('ECN'), *Acceptability of CO_2 Capture and Storage: A Review of Legal, Regulatory, Economic and Social Aspects of CO_2 Capture and Storage* (2006) at 31 <www.ecn.nl/publicaties/PdfFetch.aspx?nr=ECN-C--06-026> accessed 24 August 2007.

39 IMO, *CO_2 Sequestration in Sub-Seabed Formations: Consideration of Proposals to Amend Annex 1 to the London Protocol*, Doc LP 1/6 (28 April 2006) at 1.

40 *United Nations Convention on the Law of the Sea*, opened for signature 10 December 1982, 1833 UNTS 3 (entered into force 16 November 1994) (*'LOSC'*).

While the *LOSC* does not explicitly prohibit sub-seabed sequestration, a number of provisions are relevant. Parties to the *LOSC* must ensure that activities under their jurisdiction or control are conducted so as not to cause damage by pollution to other States and their environment.[42] They must take all measures that are necessary to prevent, reduce and control pollution of the marine environment from any source[43] and to adopt laws and regulations to prevent, reduce and control pollution of the marine environment from land-based sources, including pipelines.[44] Furthermore, parties must also take all necessary measures to prevent, reduce and control pollution of the marine environment resulting from the use of technologies under their jurisdiction or control.[45] Article 1.1(4) of the *LOSC* defines 'pollution of the marine environment' as:

> [T]he introduction by man, directly or indirectly, of substances or energy into the marine environment, including estuaries, which results or is likely to result in such deleterious effects as harm to living resources and marine life, hazards to human health, hindrance to marine activities, including fishing and other legitimate uses of the sea, impairment of quality for use of sea water and reduction of amenities.

In the author's view, sub-seabed sequestration is not, of itself, 'pollution of the marine environment'. While it involves 'the introduction by man, directly…of substances…into the marine environment', it does not *necessarily* result in the adverse consequences contained in the definition and the IPCC's statistics presented above suggest that it is not likely to, either. However, *leakage* from a storage reservoir would amount to 'the introduction by man … indirectly, of substances … into the marine environment' and result in harm to living marine resources, thereby falling within the definition of 'pollution of the marine environment'.[46] But the latter interpretation does not amount to a prohibition on sub-seabed sequestration, because it prohibits the consequences, not the activity itself.

While the articles discussed above arguably do not prohibit sub-seabed sequestration, art 195 probably does. Under art 195, States, in carrying out their obligations to protect and preserve the marine environment, are to act 'so as not to transfer, directly or indirectly, damage or hazards from one area to another or transform one type of pollution into another'.[47] The *LOSC* does not define 'pollution' (as a term separate to 'pollution of the marine environment'), 'damage' or 'hazards', but art 195 could be interpreted in a way that would prohibit sub-seabed sequestration under the *LOSC*. First, sequestration may involve the transformation of gaseous CO_2 to liquid CO_2. Gaseous CO_2 produced from power plants is undoubtedly 'pollution'; if CO_2 introduced into the

41 *LOSC*, arts 192 and 193. See also International Energy Agency and Carbon Sequestration Leadership Forum, *Discussion Paper for 2nd IEA/CSLF Workshop on Legal Aspects of Carbon Capture and Storage* (2006) 62 <www.iea.org/textbase/work/2006/carbon/2.pdf> accessed 31 August 2007.

42 *LOSC*, art 194(2).

43 *LOSC*, art 194(1).

44 *LOSC*, art 207.

45 *LOSC,* art 196.

46 Ian Havercroft and Ray Purdy, *Carbon Capture and Storage — A Legal Perspective* (2007) 18 United Nations <www.un.org/esa/sustdev/sdissues/energy/op/ccs_egm/presentations_papers/havercroft_ paper_legal.pdf> accessed 30 September 2007.

47 *LOSC*, art 195.

marine environment was also so classified, sub-seabed sequestration would involve transforming one 'type' of pollution (gaseous CO_2) into another (liquid CO_2). Secondly, sequestration involves transferring CO_2 from land-based sources to the sub-seabed, which could be interpreted as transferring 'damage or hazards' from one place to another. Accordingly, sub-seabed sequestration is arguably prohibited under the *LOSC* by reason of art 195.

Article 210 of the *LOSC* requires States to adopt laws and take other necessary measures to prevent, reduce and control pollution of the marine environment by dumping, ensuring that dumping is not carried out without the permission of the States.[48]

Article 210 also requires States to establish global and regional rules to control pollution of the marine environment by dumping.[49] These global rules are considered to be the *Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter*[50] ('*London Convention*') and the *1996 Protocol* thereto.

B. London Convention and 1996 Protocol

The *London Convention* and *1996 Protocol* are the most relevant international treaties to sub-seabed sequestration, although neither was drafted with it in mind. The *1996 Protocol* supersedes the *London Convention* for States (like Australia) that are parties to both treaties.[51] However, Australia continues to be bound by the *London Convention* in relation to States that are party to the *London Convention* and not the *1996 Protocol*.[52]

(i) London Convention

There is no clear consensus on whether the *London Convention* governs sub-seabed sequestration. However, the Secretariat of the *London Convention*, René Coenen, is on record as stating that sub-seabed sequestration is not covered under the *London Convention*.[53] That view is of course, not a binding one.

The *London Convention* regulates the intentional dumping and incineration of wastes at sea. It prohibits the dumping of all 'wastes or other matter' listed in annex I and requires a special permit for the dumping of wastes listed in annex II.[54] CO_2 is not listed in either annex, but would fall within the 'industrial waste' category in annex I if it derived from a 'manufacturing or processing operation'. The Scientific Group of the *London Convention* has concluded that CO_2 derived from fossil fuels is an industrial waste.[55]

---

48 *LOSC*, arts 210(1) to (3).

49 *LOSC*, art 210(4).

50 *Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter*, opened for signature 29 December 1972 (entered into force 30 August 1975) ('*London Convention*').

51 *1996 Protocol*, art 23.

52 *Vienna Convention on the Law of Treaties*, opened for signature 23 May 1969, 1155 UNTS 331, art 30.4 (entered into force 27 January 1980) ('*Vienna Convention on the Law of Treaties*').

53 de Figuereido, above n30 at 113.

54 *London Convention*, art IV(1).

55 Ray Purdy and Richard Macrory, *Geological Carbon Sequestration: Critical Legal Issues* (2004) at 25 Tyndall Centre for Climate Change Research <www.tyndall.ac.uk/publications/working_papers/ wp45.pdf> accessed 31 August 2007.

The definition of 'dumping' is important. 'Dumping' includes the deliberate disposal of wastes or other matter from ships, aircraft or platforms 'at sea'.[56] Dumping does not include the disposal of wastes 'at sea' via pipelines from land-based sources. 'Sea' is defined as 'all marine waters other than the internal waters of States'.[57] The definition of 'sea' makes no mention of the seabed or subsoil. On one reading, because sub-seabed sequestration involves the storage of CO_2 into the sub-seabed and not disposal into the water column, it is not the disposal of wastes or other matter 'at sea'.

However, some commentators argue that sub-seabed sequestration falls within the definition of 'dumping', because what matters is not the final resting place of the material, but the location of the act of disposal itself.[58] Others argue that sub-seabed sequestration could fall within the definition of dumping if a purposive approach was adopted to its interpretation;[59] that is, the purpose of the *London Convention* is not just to protect the sea but also activities in the sub-seabed that have the potential to harm the sea itself.[60] In the author's view, these interpretations are persuasive.

Another issue arising under the definition of 'dumping' is the meaning of the word 'disposal', which is not defined. An argument could be made that there is a distinction between 'disposal' and 'storage' (the former being prohibited, the latter not) and that sub-seabed sequestration does not constitute 'disposal' under the *London Convention*. However, 'disposal' has been interpreted as the action of permanently getting rid of a substance[61] and arguably that is exactly what sub-seabed sequestration involves.

Interestingly, it has been argued that the permissibility of sub-seabed sequestration under the *London Convention* depends on the purpose of the storage activity and not on the potential environmental impacts of the storage on the marine environment.[62] That argument is based on the definition of 'dumping'. 'Dumping' excludes the 'placement of matter for a purpose other than the mere disposal thereof, provided that such placement is not contrary to the aims of this Convention'.[63] Since the purpose of sub-seabed sequestration is to mitigate the impacts of climate change and ocean acidification on the marine environment, arguably it is not done for the purpose of 'mere disposal' and thus does not constitute 'dumping' (and is thus a legitimate activity under the *London Convention*). However, sub-seabed sequestration probably does not constitute 'placement' (and therefore does not fall within the exception), because 'placement' implies temporary

56 *London Convention*, art III(1).

57 *London Convention*, art III(3).

58 Minter Ellison, *Carbon Capture and Storage: Report to the Australian Greenhouse Office on Property Rights and Associated Liability Issues* (2005) at 111 Australian Greenhouse Office, Department of the Environment and Heritage, Australian Government <www.greenhouse.gov.au/ccs/publications/ pubs/ccs.pdf> accessed 4 September 2007.

59 *Vienna Convention on the Law of Treaties*, art 31.

60 Purdy and Macrory, above n55 at 19.

61 ECN, above n38 at 9.

62 Caroline Wall, Christian Bernstone and Marie-Louise Olvstam, *International and European Legal Aspects on Underground Geological Storage of CO2* (2005) at 5 Vattenfall <www.vatenfall.com/www/co2_en/ co2_en/ Gemeinsame_Inhalte/DOCUMENT/388963co2x/578173repo/603971vatt/P0270590.pdf> at 24 August 2007.

63 *London Convention*, art III(1)(b)(ii).

disposal, whereas sequestration operations are not planned with the intent of later recovering the CO_2.[64] Storage of CO_2 for the purpose of enhanced oil and gas recovery ('EOGR'), on the other hand, is conducted for a purpose other than mere disposal (i.e., for oil or gas production) and falls within the exception.

For the reasons stated above, sub-seabed sequestration is considered a prohibited activity under the *London Convention*, except if the CO_2 is transported via pipeline from land-based sources and disposed of into the sub-seabed from the pipeline. In the author's view, this exception does not adequately give effect to the objective of the *London Convention* of preventing the pollution of the sea by dumping. There are no present plans to amend the *London Convention* to expressly permit sub-seabed sequestration, because there is an expectation that more parties will gradually accede to the Protocol over time.[65]

(ii) 1996 Protocol

The objective of the *1996 Protocol* is to 'protect and preserve the marine environment from all sources of pollution and take effective measures… to prevent, reduce and where practicable eliminate pollution caused by dumping or incineration at sea of wastes or other matter'.[66]

Like the *London Convention*, the *1996 Protocol* only applies to dumping activities that involve ships or offshore platforms. It does not control pipeline discharges of substances from land-based sources. Unlike the *London Convention*, the *1996 Protocol's* geographical application includes the seabed and subsoil of marine waters (other than the internal waters of States).[67] The 'sea' does not include sub-seabed repositories accessed only from land.[68] The *1996 Protocol* also inserts an additional definition of 'dumping', which is 'any *storage* of wastes or other matter *in the seabed and the subsoil thereof* from vessels, aircraft, platforms or other man-made structures at sea' (changes italicised).[69] This removes any doubt about the meaning of 'dumping' as it now clearly includes storage beneath the ocean floor.

The *1996 Protocol* prohibits the dumping of wastes or other matter unless they are listed in annex 1, in which case a permit is required.[70] The parties are required to develop legislative or administrative procedures for the issuance of permits complying with annex 2.[71] In the issuance of permits, the parties are required to consider opportunities to avoid dumping in favour of 'environmentally preferable alternatives'.[72] Relevant considerations include the types, amounts and relative hazard of the particular wastes

64 Ray Purdy, 'The Legal Implications of Carbon Capture and Storage Under the Sea' (2006) *Sustainable Development Law and Policy* 22 at 25; de Figuereido, above n30 at 114.

65 Havercroft and Purdy, above n46 at 5.

66 *1996 Protocol*, art 2.

67 *1996 Protocol*, art 1.7.

68 *1996 Protocol*, art 1.7.

69 *1996 Protocol*, art 1.4.1.3.

70 *1996 Protocol*, arts 4.1 and 4.2.

71 *1996 Protocol*, art 4.2.

72 *1996 Protocol*, art 4.2.

and the feasibility of waste reduction/prevention techniques including clean production technologies.[73] Other relevant considerations under annex 2 include the choice of dumping site, an assessment of the potential effects of dumping on 'human health, living resources, amenities and other legitimate uses of the sea'.[74]

Like the *LOSC*, the *1996 Protocol* prohibits parties from transferring 'directly or indirectly, damage or likelihood of damage from one part of the environment to another' or transforming 'one type of pollution into another'.[75] This could also be interpreted as prohibiting sub-seabed sequestration, but that is irrelevant now that sub-seabed sequestration is expressly permitted by the *1996 Protocol* (see the next section).

Importantly, the parties to the *1996 Protocol* are required to apply a 'precautionary approach' to environmental protection from dumping of wastes, whereby:

> [A]ppropriate preventative measures are taken when there is reason to believe that wastes or other matter introduced into the marine environment are likely to cause harm even when there is no conclusive evidence to prove a causal relation between inputs and their effects.[76]

While the introduction of CO_2 into the sub-seabed is not 'likely' to cause harm to the marine environment, the introduction of *leaked* CO_2 into the marine environment *from* a sub-seabed storage site is. Either way, the precautionary approach requires caution in going ahead with sub-seabed sequestration unless convinced that it is safe. Arguably, that approach is diametrically opposed to art 3.3 of the *UNFCCC*, which requires the parties to 'take precautionary measures to anticipate, prevent or minimise the causes of climate change and mitigate its adverse effects'. It states that lack of full scientific certainty about climate change should not be used as a reason for postponing such measures, which should 'cover all relevant sources, sinks and reservoirs of greenhouse gases'. In other words, there is a 'clash of precaution': the *UNFCCC* promotes sub-seabed sequestration as a precautionary measure to reduce climate change, whereas the *1996 Protocol* — notwithstanding that it now permits sub-seabed sequestration — promotes restraint as a precautionary measure to protect the marine environment.[77]

Finally, the *1996 Protocol* adopts a 'polluter pays' approach by requiring each party to promote practices whereby those it has authorised to engage in dumping activities (the 'operators') bear the cost of meeting relevant pollution prevention and control requirements.[78] This indicates that any future liability regime developed under the *1996 Protocol* is likely to impose primary liability on the operator.

---

73 *1996 Protocol*, annex 2 art 2.

74 *1996 Protocol*, annex 2 arts 11–13.

75 *1996 Protocol*, art 3.3.

76 *1996 Protocol*, art 3.1.

77 Interview with Associate Professor Rosemary Rayfuse (Faculty of Law, University of New South Wales, Sydney, 1 November 2007).

78 *1996 Protocol*, art 3.2.

C. *Amendments to the 1996 Protocol*

Following the *1996 Protocol's* entering into force, Australia, co-sponsored by France, Norway and the United Kingdom, submitted a proposal to amend annex 1 to permit the storage of CO_2 in sub-seabed geological formations.[79] On 2 November 2006, the amendments were adopted. Now, 'CO_2 streams from CO_2 capture processes for sequestration' may be considered for dumping, providing that disposal is into a sub-seabed geological formation, the CO_2 streams consist 'overwhelmingly' of CO_2 and no wastes or other matter are added to the CO_2 streams for the purpose of dumping.[80] These amendments entered into force on 10 February 2007.

In resolving to adopt the amendments, the parties recognised the role that sub-seabed sequestration could play in addressing the implications for the marine environment of climate change and ocean acidification.[81] The parties who were not in favour of amendment argued that there were still too many scientific uncertainties regarding site selection, acceptable leakage rate, long-term monitoring and issues regarding the purity of the captured CO_2.[82] For those parties, the precautionary approach dictated against amending the *1996 Protocol* for the time being.

Vanuatu (a party to both the *London Convention* and *1996 Protocol*) supported the amendment in principle, but said that sub-seabed sequestration should only be viewed as a temporary solution 'while awaiting the advent of low-carbon forms of energy'.[83] It advocated additional amendments to annex 1 to reflect that position, on the proviso that such amendments were not interpreted as a means for failing to reduce CO_2 emissions at source.[84] In the author's view, that sensible position is more in line with the precautionary approach than the position that was ultimately adopted.

There remain some outstanding issues following the amendments.[85] Firstly, it is unclear what is precisely meant by the requirement that the CO_2 streams shall consist 'overwhelmingly' of CO_2. That requirement was added to the amendments because captured CO_2 streams have the potential to contain substantial gaseous impurities, which could have direct consequences for the integrity and capacity of the storage reservoir as well as chemical hazards.[86] Accordingly, Greenpeace International submitted that the qualitative condition would not place sufficient control over the quality of the sequestered stream. Having reviewed the technologies available to purify CO_2 streams,

79 IMO, above n39.

80 IMO, *Notification of Amendments to Annex 1 to the London Protocol 1996*, Doc LC-LP.1/Circ.5 (27 November 2006) at 3.

81 IMO, above n39 at 1 and annex 2.

82 IMO, *Report of the Twenty-Eighth Consultative Meeting of Contracting Parties to the London Convention and The First Meeting of Contracting Parties to the 1996 Protocol*, Doc LC 28/15 (6 December 2006) at 23.

83 Id at 24.

84 Ibid.

85 IMO, *Provisional Agenda for the Twenty-Ninth Consultative Meeting of Contracting Parties to the London Convention and the Second Meeting of Contracting Parties to the London Protocol*, Doc LC 29/1 (11 January 2007).

86 IMO, *CO_2 Sequestration in Sub-Seabed Geological Formations: Consideration of Proposals to Amend Annex 1 to the London Protocol, Composition of CO_2 Streams for Sequestration in Sub-Seabed Geological Formations: The Feasibility and Necessity for a Quantitative Limit on Purity*, Doc LP 1/6/2 (8 September 2006) at 3.

it considered a quantitative value of 'greater than 99.9 per cent by volume CO_2' would be justified and readily achievable.[87]

That approach was rejected. The reason was that significant impurities would be undesirable from an operational perspective in any event. Higher operating pressures would be required to inject CO_2 containing significant levels of impurities, which would be more difficult and costly in practice.[88] Nonetheless, there remains some uncertainty as to what 'overwhelmingly' means from a best practice perspective and this needs to be resolved by the parties.

Secondly, the Parties are yet to develop procedures concerning State responsibility and liability. At the meeting in November 2007, the parties considered, under Article 15 of the 1996 Protocol, the creation of procedures concerning liability arising from dumping.[89] However, there was reluctance to start developing a general liability regime at this stage, in part because it would be a "long process with many legal, political and administrative implications".[90] Further, "no interest" was expressed in developing a separate liability regime in relation to sub-seabed sequestration.[91] It is submitted that the Parties should consider developing a specific liability regime. International responsibility and liability issues are examined in the following section.

4. State Responsibility and Civil Liability for Transboundary Environmental Damage Caused by Sub-Seabed Sequestration

The legal consequences of the occurrence of a leakage of CO_2 into the marine environment and the atmosphere are not clear cut. The rules of State responsibility for internationally wrongful acts and liability for transboundary environmental harm have long been a matter of contentious debate. It is only relatively recently that these issues were put at the forefront of the international agenda.[92]

According to Handl, this is partly because of the international community's overriding initial concern with the development of States' primary obligations to protect and preserve natural resources, rather than with the development of secondary rules relating to the consequences of environmental damage, which were relegated to future consideration.[93]

87 Ibid.

88 IMO, *CO_2 Sequestration in Sub-Seabed Geological Formations: Consideration of Proposals to Amend Annex 1 to the London Protocol, Information on the Composition of CO_2 Streams from Capture Plants*, Doc LC 27/INF (25 October 2006).

89 IMO, above n85.

90 IMO, *Report of the Twenty-Ninth Consultative Meeting and the Second Meeting of Contracting Parties*, Doc LC 29/17 (14 December 2007) at 47.

91 Ibid.

92 Gunther Handl, 'Transboundary Impacts' in Daniel Bodansky, Jutta Brunnée & Ellen Hey (eds), *The Oxford Handbook of International Environmental Law* (2007) 531 at 544.

93 Ibid.

This certainly seems to be the case with the *London Convention*. Article X of the *London Convention* relates to State responsibility and liability arising from dumping. While steps were taken in the late 1980s to develop a liability and compensation regime under art X, ultimately it was viewed as premature to embark upon the establishment of such a regime and the process was abandoned.[94] Given the expectation that more States will become parties to the *1996 Protocol* over time, it is unlikely that a liability regime will be developed under the *London Convention*.

Article 15 of the *1996 Protocol*, which is framed in similar terms to article X of the *London Convention*, provides as follows:

> In accordance with the principles of international law regarding State responsibility for damage to the environment of other States or to any other area of the environment, the Contracting Parties undertake to develop procedures regarding liability arising from the dumping or incineration at sea of wastes or other matter.[95]

This part of the article addresses international responsibility and liability issues as they apply to sub-seabed sequestration. The first section examines States' primary obligations in relation to transboundary environmental damage. The second section considers the rules of State responsibility for breaches of treaty and non-treaty obligations and the work of the International Law Commission ('ILC'). The third section looks at the procedures taken under the *1996 Protocol* so far to establish a liability regime relating to sub-seabed sequestration and how the principles of international liability should be incorporated into the liability regime.

A. *Obligation Not to Cause Transboundary Environmental Damage and the Duty of Prevention*

The starting point for developing a liability regime is recognising the fundamental principle of international environmental law: the obligation of a State not to cause harm to the environment of another State. This principle was recognised as early as 1941 in the *Trail Smelter Arbitration,*[96] in which the US-Canada International Joint Commission held that under the principles of international law, no State has the right to use or permit the use of its territory in such a manner as to cause injury to the territory of another or the properties or persons therein.[97]

---

94 George C Kasoulides, 'State Responsibility and Assessment of Liability for Damage Resulting from Dumping Operations' (1989) 26 *San Diego Law Review* 497 at 500; IMO, *Development of Procedures Regarding Liability Arising from Dumping: Overview of Liability Issues under Multilateral Environmental Agreements Relevant for the Purpose of the London Protocol*, Doc LC 29/9 (21 September 2007).

95 Article X of the *London Convention* provides: 'In accordance with the principles of international law regarding State responsibility for damage to the environment of other States or to any other area of the environment, caused by dumping of wastes and other matter of all kinds, the Contracting Parties undertake to develop procedures for the assessment of liability and the settlement of disputes regarding dumping'.

96 *Trail Smelter Arbitration (United States of America v Canada)* (Award) (1941) 3 UNRIAA 1905 ('*Trail Smelter*').

97 *Trail Smelter* (1941) 3 UNRIAA 1905 at 1965.

The obligation not to cause environmental harm to another State has gained customary international law status.[98] Since the *Trail Smelter Arbitration*, it has been recognised by the International Court of Justice ('ICJ')[99] and has been codified in a number of treaties including the *LOSC*.[100]

Closely related to the obligation not to cause environmental harm is the principle of prevention. The principle of prevention and the obligation not to cause transboundary environmental harm may in effect be the same thing when involving relationships between two or more States.[101] Handl describes the obligation of prevention as an 'essential aspect' of the obligation not to cause transboundary harm.[102] Accordingly, the author accepts their interrelatedness and for conciseness the principle of prevention will be treated as the relevant obligation.

The ILC's Articles on Prevention of Transboundary Harm from Hazardous Activities[103] ('Prevention Articles') deal with the principle of prevention in the context of hazardous activities not prohibited by international law, which involve a risk of causing significant transboundary harm.[104] Such activities include those involving a high probability of causing significant transboundary harm or a low probability of causing disastrous transboundary harm ('ultrahazardous activity').[105] The ILC does not define 'ultrahazardous activity' but, in its later work it names nuclear and outer space activities as examples.[106]

The principle of prevention requires a State to 'take all appropriate measures to prevent significant transboundary harm or at any event to minimise the risk thereof'.[107] That obligation is one of due diligence.[108] The duty of due diligence does not require

98 Hunter, Salzman & Zaelke, above n2 at 502.

99 For example, *Corfu Channel (United Kingdom of Great Britain and Northern Ireland v People's Republic of Albania) (Merits)* [1949] ICJ Rep 4 at 22 ('*Corfu Channel*'); *Lac Lanoux Arbitration (Spain v France)* (1957) XII UNRIAA 281; *Legality of the Threat or Use of Nuclear Weapons (Advisory Opinion)* (1996) ICJ Rep 29 at [226]; *Gabčíkovo-Nagymaros Project (Hungary v Slovakia)* (1997) ICJ Rep 92 at 41 ('*Gabčíkovo-Nagymaros*').

100 *LOSC*, art 194(2).

101 Hunter, Salzman & Zaelke, above n2 at 507. See also Kasoulides, above n92 at 501–2; Malgosia Fitzmaurice, 'International Responsibility and Liability' in Daniel Bodansky, Jutta Brunnée and Ellen Hey (eds), *The Oxford Handbook of International Environmental Law* (2007) 1010 at 1013.

102 Handl, above n92 at 539.

103 International Law Commission ('ILC'), 'Draft Articles on the Prevention of Transboundary Harm from Hazardous Activities with commentaries' in *Report of the International Law Commission on the Work of its Fifty-Third Session*, UN GAOR, 56th Session, Supp. No. 10, UN Doc A/56/10 (2001) ('Prevention Articles').

104 ILC, Prevention Articles, above n101 at art 1. The Prevention Articles are regarded as a codification of existing international law: see Patricia Birnie and Alan Boyle, *International Law and the Environment* (2nd ed, 2002) at 113.

105 ILC, Prevention Articles, above n101 at art 2.

106 ILC, 'Draft Principles on the Allocation of Loss in the Case of Transboundary Harm Arising out of Hazardous Activities with commentaries' in *Report of the International Law Commission on the Work of its Fifty-Eighth Session*, UN GAOR, 61st Session, Supp. No. 10, UN Doc A/61/10 (2006) ('Liability Principles') at 117. Arguably, sub-seabed sequestration qualifies as an 'ultra-hazardous activity' because of the low probability of it causing disastrous transboundary consequences such as loss of human life, serious harm to the marine environment and dangerous anthropogenic interference with the climate system, in the event of a substantial leakage or earthquake.

107 ILC, Prevention Articles, above n103 at art 3.

that significant harm be totally prevented, if it is not possible to do so. Rather, it requires a State to exert its best possible efforts to minimise the risk.[109] In the present context, due diligence is 'manifested in reasonable efforts by a State to inform itself of factual and legal consequences that relate foreseeably to a contemplated procedure and to take appropriate measures in [a] timely fashion, to address them'.[110]

Appropriate measures to discharge a State's obligation of due diligence broadly include formulating, implementing and enforcing legislative or administrative policies designed to prevent significant transboundary harm or to minimise its risk.[111] The standard of due diligence required is what is considered to be 'appropriate and proportional to the degree of risk of transboundary harm in the particular instance'.[112] In the case of ultrahazardous activities, a much higher standard of care is required in the formulation and enforcement of policies. According to the ILC, the factors to be considered in determining the due diligence requirement in each instance include the size of the operation, its location, climate conditions and the materials used in the activity.[113]

B. State Responsibility for a Breach of International Obligations

The customary laws of State responsibility are codified in the ILC's Articles on the Responsibility of States for Internationally Wrongful Acts ('Responsibility Articles').[114] The central concept of the rules of State responsibility is that every internationally wrongful act of a State entails the international responsibility of that State.[115] An 'internationally wrongful act' consists of an act or omission that is attributable to the State under international law and constitutes a breach of an international obligation.[116]

In the case of sub-seabed sequestration, a party to the *LOSC* and/or the *London Convention* that is not a party to the *1996 Protocol* would be in breach of its international obligations if it stored CO_2 into a sub-seabed geological formation (except for the purpose of EOGR). Such activities would not need to result in any transboundary harm or harm to the marine environment to engage the State's responsibility; merely conducting the activity would amount to an 'internationally wrongful act'.[117]

---

108 Id at 391; Fitzmaurice, above n99 at 1014.

109 ILC, Prevention Articles, above n103 at 391–2.

110 Id at 393.

111 Ibid. For an elaboration of the procedural duties involved in discharging a State's obligation of due diligence, see Xue Hanqin, *Transboundary Damage in International Law* (2003) at 165–75.

112 ILC, Prevention Articles, above n103 at 394.

113 Ibid.

114 ILC, 'Draft Articles on Responsibility of States for Internationally Wrongful Acts with commentaries', *Report of the International Law Commission on Its Work of Its Fifty-Third Session*, UN GAOR, 56th Session, Supp. No. 10, UN Doc A/56/10 (2001) ('Responsibility Articles'). The Responsibility Articles are not, of themselves, binding law, but they are largely consistent with decisions of the International Court of Justice and are persuasive evidence of the state of customary international law: Jaye Ellis, 'Has International Law Outgrown Trail Smelter?', in Rebecca Bratspies and Russell Miller (eds), *Transboundary Harm in International Law: Lessons from the Trail Smelter Arbitration* (2006) 60. There is a divergence between some articles and customary law, which will be pointed out as the case arises.

115 ILC, Responsibility Articles, above n114 at art 1.

116 Id, art 2. International obligations may be established by a treaty, a customary rule of international law or a general principle of international law (art 12).

For parties to the *1996 Protocol*, the non-fulfilment of the duty of prevention would engage State responsibility notwithstanding that the sub-seabed sequestration activity is not itself prohibited.[118] Where sub-seabed sequestration caused transboundary environmental harm or pollution of the high seas or atmosphere, a State would not be responsible merely because the damage occurred. Rather, the State would be responsible for the non-fulfilment of its duty of prevention where its conduct involved a failure to exercise due diligence. The State would also be in breach of its obligations under the *1996 Protocol* and *UNFCCC*.

Where a State is responsible for an internationally wrongful act, new legal obligations arise *vis-à-vis* the injured State. The core legal obligations of the responsible State are to cease the wrongful conduct[119] and to make full reparation for the injury caused by the wrongful act.[120] Cessation would require a State not a party to the *1996 Protocol* to discontinue the act of storing CO_2 into a sub-seabed geological formation. The situation is less straightforward for party States like Australia. How would Australia cease its non-fulfilment of the duty of prevention years after a storage site has closed and once a leakage event has occurred? That is where obligations of reparation come into play.

In the *Factory at Chorzów* case, the Permanent Court of International Justice held that 'reparation must, as far as possible, wipe out all the consequences of the illegal act and re-establish the situation which would, in all probability, have existed if that act had not been committed'.[121] Forms of reparation include restitution, compensation and satisfaction. Restitution in the case of a CO_2 leakage may be impossible, in which case the 'injured State is entitled to obtain compensation from the State which has committed an internationally wrongful act for the damage caused by it'.[122] Compensation must correspond to the financially assessable damage suffered by the injured State,[123] which can include the costs incurred in responding to the pollution incident.[124]

An interesting consideration in the context of sub-seabed sequestration is the character of a State's obligations to the international community of States as a whole (*erga omnes*). In *Barcelona Traction, Light and Power Co., Ltd.*[125] the ICJ recognised that a State may owe a duty to obey a norm to the international community as a whole, and when a State violates an *erga omnes* obligation any State — regardless of injury — may invoke the source State's responsibility. An example of a breach of an *erga omnes* obligation is pollution of the high seas in violation of article 194 of the *LOSC*.[126] It is less clear what obligations are owed to the international community as a whole in respect of the climate

117 Id at 226.
118 ILC, Liability Principles, above n106 at 118.
119 ILC, Responsibility Articles, above n114 at art 30.
120 Id at art 31. See also *Factory at Chorzów (Jurisdiction)* (1927) PCIJ, Series A, No. 9 at 21.
121 *Factory at Chorzów (Merits)* (1928) PCIJ, Series A, No. 17 at 47.
122 *Gabčíkovo-Nagymaros* (1997) ICJ Rep 7 at 81. See also ILC, Responsibility Articles, above n114 at art 36.1.
123 ILC, Responsibility Articles, above n114 at art 36.2.
124 Id at 251.
125 *Barcelona Traction, Light and Power Co., Ltd. (New Application)* (*Belgium v Spain*) (1962), ICJ Rep 3.
126 Roda Verheyen, *Climate Change Damage and International Law: Prevention Duties and State Responsibility* (2005) at 237.

system. Verheyen argues that it would be difficult to deny the applicability of the law of State responsibility to the climate system on the ground that protection of the global climate is not an obligation that is 'owed' to one State in particular.[127] Indeed, the global climate is explicitly recognised in the *UNFCCC* as a common concern of humankind.[128] However, that does not yet imply specific legal obligations beyond cooperation.[129]

Article 48 of the Responsibility Articles explicitly covers *erga omnes* obligations. It enables any State (whether directly injured or not) to invoke the responsibility of another when the obligation breached is a) owed to a group of States and is established for the protection of a collective interest of the group, or b) the obligation breached is owed to the international community as a whole. Each State, as a member of the international community as a whole can demand cessation, guarantees of non-repetition and performance of reparation where a State breaches its climate protection duties.[130] Article 48.2 is progressive (as opposed to a codification of existing law) in that it enables reparation regardless of the existence of an injured State.[131]

C. *Development of a Liability Regime for Sub-Seabed Sequestration*

State responsibility for environmental damage has played a fairly limited role in international environmental law, partly because it does not cover the liability of private actors, who are primarily responsible for pollution.[132] Over the last 30 years or so, the international community has moved towards the development of civil liability regimes for specific hazardous activities and has even begun to codify the regimes within binding multilateral environmental agreements ('MEAs').[133]

In 2006, the ILC adopted its Draft Principles on the Allocation of Loss in the Case of Transboundary Harm Arising out of Hazardous Activities ('Liability Principles').[134] While the Liability Principles are a 'non-binding declaration of draft principles' rather than a codification of customary international law,[135] they appear to reflect the recent trends towards the development of civil liability regimes relating to transboundary environmental damage caused by hazardous activities not prohibited by international law.

In December 2006, the parties to the *1996 Protocol* agreed that liability issues should be considered at the Second Meeting of the parties in November 2007.[136] It appeared that a liability regime would be developed to apply specifically to sub-seabed sequestration, because the Secretariat invited the Parties to consider 'Draft

127 Ibid.

128 *UNFCCC*, preamble.

129 Hunter, Salzman & Zaelke, above n2 at 490.

130 ILC, Responsibility Articles, above n114 at art 48.2. See also Verheyen, above n126 at 267.

131 Verheyen, above n126 at 268.

132 Fitzmaurice, above n101 at 1011.

133 Anne Daniel, 'Civil Liability Regimes as a Complement to Multilateral Agreements: Sound International Policy or False Comfort?' (2003) 12 *RECIEL* 225 at 225; Id at 1012.

134 ILC, Liability Principles, above n106.

135 Id at 113.

136 IMO, *Report of the Twenty-Eighth Consultative Meeting of Contracting Parties to the London Convention and the First Meeting of Contracting Parties to the 1996 Protocol*, Doc LC 28/15 (6 December 2006).

Guidelines'[137] on liability and compensation prepared under the *Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean* ('*Barcelona Convention*')[138] specifically for that purpose.[139] However, as indicated, the parties in November 2007 expressed no interest in taking that course.

(i) Application and Form of Liability Instrument

The crucial first step is to define the activities that would be covered by a liability and compensation regime. Given that specific issues concerning the risks and long-term permanence of CO_2 storage are unique to sub-seabed sequestration compared with other legal dumping activities in annex 1 to the *1996 Protocol*, a liability regime should be developed that focuses specifically on that activity rather than all legal dumping activities. Daniel observes that civil liability regimes have been successful when they have focused on specific hazardous activities and have failed when they are too broad in focus.[140]

Another important issue is the form that a liability and compensation regime should take. In the present case, it could take the form of a new protocol or an annexure to the existing *1996 Protocol*, or a soft law instrument such as guidelines or recommendations. The present trend is for the development of protocols. However, that process is complex, lengthy and resource-intensive and most of the liability protocols developed in recent years have not yet come into force.[141] The middle ground is to develop interim guidelines on liability issues until a protocol has been negotiated (although that could just further delay progress in the development of a protocol). That was the course taken by the parties to the *Barcelona Convention*.

(ii) Allocation of Liability

Some commentators doubt whether the 'polluter pays' principle has achieved customary status,[142] but it is an essential component underpinning recent liability regimes for transboundary environmental harm caused by hazardous activities not prohibited by international law.[143] The central premise of the 'polluter pays' principle is that liability for

137 Open-Ended Working Group of Legal and Technical Experts under the Barcelona Convention, *Draft Guidelines on liability and compensation for damage resulting from pollution of the marine environment in the Mediterranean Sea area*, Doc UNEP(DEPI)/MED WG.319/3 (2007).

138 *Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean*, opened for signature 16 February 1976, 1102 UNTS 27 (entered into force 12 February 1978) ('*Barcelona Convention*').

139 IMO, above n94; IMO, *Development of Procedures Regarding Liability Arising from Dumping: Overview of Liability Issues under a Selection of Multilateral Environmental Agreements*, Doc LC 29/INF.5 (21 September 2007).

140 Daniel, above n133 at 236.

141 Id at 225, 236; Open-Ended Working Group of Legal and Technical Experts under the Barcelona Convention, *Report of the Open-Ended Working Group of Legal and Technical Experts to propose Appropriate Rules and Procedures for the Determination of Liability and Compensation for Damage Resulting From Pollution of the Marine Environment in the Mediterranean Sea Area*, Doc UNEP(DEPI)/MED WG.285/4 (2006) at 10–11; Fitzmaurice, above n99 at 1012.

142 ILC, Liability Principles, above n106 at 147.

143 For example, *Basel Protocol on Liability and Compensation for Damage Resulting from the Transboundary Movement of Hazardous Wastes and Their Disposal*, Doc UNEP-CHW.5/29 ('*Basel Protocol*').

hazardous activities primarily attaches to the operator.[144] That is the approach adopted in the Draft Guidelines[145] and by the ILC in the Liability Principles.[146]

But that should not absolve a State from discharging its own duties of prevention. State responsibility should be engaged to implement not only the obligations of the State itself but also the civil obligations of the operator.[147] Even if a State fully complies with its prevention obligations, accidents may nonetheless occur and have transboundary consequences that cause harm and serious loss to other States.[148] A liability regime for sub-seabed sequestration, while imposing primary liability on the operator, should be without prejudice to the rules of State responsibility for internationally wrongful acts. In other words, ideally a liability regime for sub-seabed sequestration would be a 'residual State liability' regime.

Opponents to residual State liability assert that it takes 'all the meaning out of the polluter pays principle'.[149] For that reason the Draft Guidelines do not provide for any State subsidiary liability (compare that to the Liability Principles, which do).[150] However, allocating residual liability to the State is not inconsistent with the 'polluter pays' principle as long as the operator is *primarily* responsible for pollution. Also, residual liability is appropriate particularly when the State has failed to perform its treaty obligations by, for example, failing to enact substantive and procedural legislation to ensure adequate compensation.[151] It is also appropriate when the operator's financial resources are inadequate to pay the requisite amount of compensation to the victims of transboundary harm. Another key advantage is that State responsibility requires cessation of the harmful activity, which is not required by civil liability regimes.[152]

A final reason why allocation of subsidiary liability to the State is appropriate in relation to sub-seabed sequestration is that CO_2 is intended to be stored on a long-term basis. Since storage sites could be operative for thousands of years, liability for the management of the stored CO_2 should, after a certain amount of time, be allocated to State agencies, which would legally exist in the longer term.[153] Whether or not a specific time limit should be prescribed in a liability regime, and what that time limit should be, should be given serious thought by the parties to the *1996 Protocol*. Perhaps it is an issue best left to individual States to consider and adopt in national legislation.

144 ILC, Liability Principles, above n106 at 112.

145 Open-Ended Working Group of Legal and Technical Experts under the Barcelona Convention, above n135 at 5.

146 ILC, Liability Principles, above n106 at 115.

147 Id at 118.

148 Id at 111.

149 Open-Ended Working Group of Legal and Technical Experts under the Barcelona Convention, above n141 at 17.

150 Id at 3.

151 Kasoulides, above n94 at 515.

152 Daniel, above n133 at 238.

153 Nicola Durrant, 'Emissions Trading, Offsets and Other Mitigation Options for the Australian Coal Industry' (2007) 24 *EPLJ* 361 at 378.

(iii) Standard of Liability

The imposition of liability on the operator should ordinarily not require proof of fault.[154] Strict liability is justified because it alleviates the burden on victims to prove fault of the operator (although it does not eliminate the need to prove a causal connection of the damage to the source of the activity).[155] Again, that is the approach adopted in the Draft Guidelines[156] and the Liability Principles.[157]

The liability of operators for transboundary environmental damage in the case of sub-seabed sequestration should also be limited. The benefits of limited liability are, first, that it would encourage operators to continue to be engaged in an environmentally beneficial (albeit hazardous) activity.[158] Secondly, limited liability takes into account practical problems of individual solvency or financial capacity.[159] Having said that, the limits of liability should not be set too low because there should still be sufficient incentive for the operator to take strict measures of prevention.[160] Also, limited liability should be excluded in case of fault; that is, where the operator is made liable for the damage caused by his or her wrongful intentional, reckless or negligent conduct.[161]

(iv) Compensation

The primary purpose of imposing liability is to ensure prompt and adequate compensation to victims of transboundary damage.[162] The importance of this was reflected in the *Trail Smelter Arbitration*[163] and the *Corfu Channel* case[164] and in principle 22 of the *Stockholm Declaration*[165] and principle 13 of the *Rio Declaration.*[166] Some commentators regard the provision of prompt and adequate compensation as a customary law obligation.[167]

The Draft Guidelines and the Liability Principles encourage contracting parties to develop legislation requiring compensation for environmental damage resulting from pollution of the marine environment. Compensation that includes the costs of preventive measures and costs of measures undertaken to clean up, restore and reinstate the impaired environment, should be borne by the operator. States should also take

154 ILC, Liability Principles, above n106, principle 4.2.
155 Kasoulides, above n94 at 519; Id at 157.
156 Open-Ended Working Group of Legal and Technical Experts under the Barcelona Convention, above n141 at 6.
157 ILC, Liability Principles, above n106 at principle 4.2.
158 Id at 158.
159 Kasoulides, above n94 at 520.
160 ILC, Liability Principles, above n106 at 159.
161 Id at 160.
162 ILC, Liability Principles, above n106, principle 3.
163 *Trail Smelter* (1941) 3 UNRIAA 1905 at 1965.
164 *Corfu Channel* [1949] ICJ Rep 4 at 22.
165 *Stockholm Declaration on the Human Environment*, UN Doc A/CONF.48/14 (1972) 11 ILM 1416.
166 *Rio Declaration on Environment and Development*, UN Doc A/CONF.151/26Rev. 1, Vol 1 (1992).
167 ILC, Liability Principles, above n 104, 153. See Peter Tobias-Stoll, 'Transboundary Pollution' in Fred L. Morrison and Rudiger Wolfrum (eds), *International, Regional and National Environmental Law* (2003) 169 at 169–174.

measures to require the operator to establish and maintain financial security such as insurance to cover claims of compensation and, where appropriate, establish industry-wide funds at the national level. In the event that those measures are inadequate to compensate the victims of transboundary damage, the State of origin should also ensure that additional financial resources are made available.[168]

(v) Response Measures

The final key element of a liability regime is requiring States to ensure that appropriate measures are in place to respond to an incident arising from sub-seabed sequestration.[169] In this regard, the State's obligation of due diligence extends beyond the prevention stage to the monitoring stage and to the point at which an incident actually occurs. In *Gabčíkovo-Nagymaros Project*, the ICJ recognised that environmental risks have to be assessed on a continuous basis.[170]

5. Implementation of Australia's International Obligations in Respect of Sub-Seabed Sequestration

The *London Convention* and the *1996 Protocol* are implemented in Australia by the *Environment Protection (Sea Dumping) Act* 1981 (Cth) (*'Sea Dumping Act'*). The *Sea Dumping Act* prohibits the dumping of 'controlled material' into 'Australian waters' from any vessel, aircraft or platform, and into any part of the sea from any Australian vessel or Australian aircraft, otherwise than in accordance with a permit.[171] Dumping without a permit is a criminal offence.[172]

The *Sea Dumping Act* enables the relevant Minister to issue permits for the dumping of 'controlled material' that is within annex 1 to the *1996 Protocol*.[173] However, it does not provide a suitable framework to deal with the complex issues that arise in the authorisation and monitoring of sub-seabed sequestration and associated liability issues.

Accordingly, a Bill to amend the *Offshore Petroleum Act* 2006 (Cth) to provide access and property rights for sub-seabed sequestration is currently being drafted. The *Offshore Petroleum Act* was identified as the most appropriate vehicle to implement an access regime due to the co-existence of the industries and the similarities in the technologies used.[174]

---

168 ILC, Liability Principles, above n106 at principle 4.

169 Id at 166.

170 *Gabčíkovo-Nagymaros* (1997) ICJ Rep 92 at 7.

171 *Environment Protection (Sea Dumping) Act* 1981 (Cth), s10A(1).

172 *Environment Protection (Sea Dumping) Act* 1981 (Cth), s10A(2). If it is proved that the offending material is 'seriously harmful material', it attracts a term of imprisonment for up to 10 years or a fine of up to $220,000.

173 *Environment Protection (Sea Dumping) Act* 1981 (Cth) at s19(5). 'Controlled material' means wastes or other matter within the meaning of the 1996 Protocol: s4.

174 Australian Government, Department of Industry, Tourism and Resources, *Carbon Dioxide Capture and Geological Storage (CCS) Development of Regulatory Framework* (2007) <www.industry.gov.au/> accessed 12 November 2007.

The Bill will provide industry with the necessary access rights, establish methods for selecting storage sites and regulate and monitor storage activity.[175] It will introduce new permits to allow for access and property rights and define the rights and conditions for operators to inject, store and transport CO_2. The Bill will incorporate a licensing framework broadly similar to the existing regime for petroleum activities including exploration permits, holding leases and injection licences.[176]

A key issue will obviously be post-closure and long-term liability for sequestered CO_2. According to the website of the Commonwealth Department of Industry Tourism and Resources, the Bill has been developed consistent with the Ministerial Council on Mineral and Petroleum Resources' ('MCMPR') Regulatory Guiding Principles for CCS.[177] Strangely, in respect of post-closure liability, the Regulatory Guiding Principles state that there could be liability to pay monetary compensation under the common law of negligence and nuisance 'for injury to a person or persons…or for damage to property';[178] they make no provision for liability for environmental damage. Any future liability regime adopted by the Commonwealth Government would need to provide procedures to compensate other States in the event of transboundary environmental damage in order to discharge Australia's international obligations.

The Regulatory Guiding Principles provide for a scheme of subsidiary State liability after the closure and decommissioning of a storage site. Once the operator has discharged all of its obligations under its permit/lease/license, the relevant regulator would accept a surrender of that permit/lease/license in respect of the site, at which point the responsibility of the operator would cease (except where it has been negligent) and responsibility and any future liability would be assumed by the regulator (government).[179] That approach is consistent with the approaches taken at the international level, as explained above.

Another key issue will be establishing appropriate funds from which to provide compensation to injured States in the event of transboundary environmental damage. The Bill to amend the *Offshore Petroleum Act* is not likely to cover that issue since it has not yet been negotiated at the international level. The Regulatory Guiding Principles are vague on this issue and simply recommend that government and industry address the issue of post-closure financial liabilities for which additional legislation may be required.[180]

175 The Hon Ian Macfarlane MP, 'Budget Boost for Carbon Capture and Storage' (Press Release, 8 May 2007) <http://minister.industry.gov.au/index.cfm?event=object.showContent&objectID=6B0268B5-95B7-1A75-D5647F383802911A> accessed 31 July 2007.

176 Australian Government, Department of Industry, Tourism and Resources, above n174.

177 Ministerial Council on Mineral and Petroleum Resources, *Australian Regulatory Guiding Principles for Carbon Dioxide Capture and Geological Storage* (2005) Australian Government Department of Industry, Tourism and Resources <www.industry.gov.au> accessed 29 August 2007.

178 Id at 41.

179 Id at 42–6.

180 Id at 50.

Conclusion

This article examined the potential of sub-seabed sequestration to reduce the adverse consequences of climate change and ocean acidification on the marine environment and analysed the international legal regime relevant to the permissibility of sub-seabed sequestration. It concluded that only parties to the *1996 Protocol* may (in accordance with the provisions of that Protocol) lawfully carry out sub-seabed sequestration activities.

This article also looked at how international law would respond to environmental damage caused by a CO_2 leakage event. At the time of writing, the parties to the *1996 Protocol* had expressed no interest in developing a separate liability and compensation regime for transboundary environmental damage caused by sub-seabed sequestration. On the basis of the work of the ILC, the Legal and Technical Working Group of the Barcelona Convention and recent State practice, it was submitted that the States to the *1996 Protocol* should develop a liability regime that is specific to sub-seabed sequestration given the unique liability issues that arise from that activity.

A liability regime for sub-seabed sequestration should ensure the provision of prompt and adequate compensation to victims of transboundary environmental damage. That liability regime should provide for strict but limited liability of the operator and subsidiary State liability. To discharge its obligations of prevention under international law, Australia needs to develop a detailed regulatory regime encompassing appropriate environmental impact assessment and authorisation procedures and appropriate methods of post-closure monitoring. It also needs to develop a long-term liability regime whereby the government becomes liable for environmental harm after the post-closure phase and beyond, so that the victims of any future transboundary environmental liability are promptly and adequately compensated. The duty of compensation is now a customary rule of international law and is the primary purpose of imposing liability in international environmental law.