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ARTICLES

Overcoming Impediments to Offshore CO₂ Storage: Legal Issues in the United States and Canada

by Romany M. Webb and
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Summary

Limiting future temperature increases and associated climate change requires immediate action to prevent additional carbon dioxide being released into the atmosphere and to lower the existing atmospheric carbon dioxide load. This could be advanced through carbon capture and storage (CCS), which involves collecting carbon dioxide that would otherwise be released by power plants or similar facilities and injecting it into underground geologic formations, where it will remain permanently sequestered. The techniques developed for CCS can also be used to sequester carbon dioxide that has been removed from the atmosphere using direct air capture or other negative emission technologies. Past CCS research has primarily focused on sequestering carbon dioxide onshore, for example, in depleted oil and gas reservoirs or deep saline aquifers. This Article explores the legal framework governing sub-seabed carbon dioxide injection (offshore CCS) in U.S. and Canadian waters, particularly the Cascadia Basin, where there is a large sub-seabed basalt rock formation with significant storage potential.

Human activities resulting in the emission of carbon dioxide have contributed to a marked rise in global temperatures. The Intergovernmental Panel on Climate Change (IPCC) estimates that, due to human activities, global average temperatures have risen by approximately 1 degree Celsius (°C) above pre-industrial levels.¹ According to the IPCC, increasing temperatures have already had “[i]mpacts on many natural and human systems,” which will come under even greater stress in the future as warming continues.² Recognizing this and seeking to avoid the worst impacts of global warming, the international community set a goal in the 2015 Paris Agreement of “[h]olding the increase in global average temperature to well below 2°C above pre-industrial levels,” and ideally “to limit the temperature increase to 1.5°C above pre-industrial levels.”³ This will require a dramatic reduction in carbon dioxide emissions, which must reach “net zero”⁴ between 2050 and 2075, and likely need to go “net negative”⁵ shortly thereafter.⁶

Research shows that emissions reductions of this magnitude are achievable but will likely require the use of carbon management techniques, such as carbon capture, utilization, and storage (CCUS).⁷ In broad terms, CCUS involves capturing carbon dioxide at its source, before it is released into the atmosphere, and then either using it in some way or injecting it into underground geologic formations, where it will be permanently sequestered.⁸ This process, particularly where it involves sequestration, can avoid further increases in the atmospheric concentration of carbon dioxide. It can also be combined with so-called

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1. Myles Allen et al., *Summary for Policymakers*, in GLOBAL WARMING OF 1.5°C 6 (Valérie Masson-Delmotte et al. eds., Intergovernmental Panel on Climate Change 2018), available at <https://perma.cc/8CTM-K66D>.
2. *Id.* at 7.
3. United Nations Paris Agreement, Dec. 12, 2015, art. 2, §1(a), 55 I.L.M. 743 (2016).
4. To achieve “net-zero” emissions, any release of carbon dioxide must be offset by the removal of an equivalent amount of carbon dioxide from the atmosphere.
5. To achieve “net-negative” emissions, more carbon dioxide must be removed from the atmosphere than is added to it.
6. Allen et al., *supra* note 1, at 14-15.
7. *Id.* at 19.
8. PETER FOLGER, CONGRESSIONAL RESEARCH SERVICE, R44902, CARBON CAPTURE AND SEQUESTRATION (CCS) IN THE UNITED STATES 1-2 (2018), available at <https://perma.cc/8SSN-5BCV>.

negative emission technologies, such as direct air capture, to reduce atmospheric carbon dioxide levels. During direct air capture, carbon dioxide is removed from the ambient air and can then be used in some way or injected underground using techniques developed for CCUS.⁹

CCUS injection sites must be carefully selected, not only to ensure permanent storage of the captured carbon dioxide, but also to minimize risks to public safety and the environment.¹⁰ To date, most carbon dioxide has been injected into active oil and gas wells, where it is used to maintain formation pressure and thus enhance hydrocarbon recovery.¹¹ However, this has limited climate benefits as the recovered hydrocarbons themselves emit carbon dioxide when burned, offsetting some or all of the emissions savings from the carbon capture process.¹² As such, there is growing interest in alternative injection sites that are unrelated to hydrocarbon recovery, where carbon dioxide can be permanently disposed of (a process often described simply as “carbon capture and storage” or CCS).

One option is to inject carbon dioxide into onshore sedimentary rock formations that hold, or previously held, fluids (e.g., depleted oil and gas reservoirs and deep saline aquifers).¹³ These formations are typically capped by a layer of relatively impermeable rock, which limits the movement of injected carbon dioxide, thereby reducing the potential for leakage.¹⁴ Nevertheless, the perceived risk of leakage and other adverse environmental impacts has, in the past, resulted in strong public opposition to injecting carbon dioxide into onshore formations.¹⁵

Seeking to avoid this, some researchers have suggested that carbon dioxide be injected into sub-seabed geologic formations comprised of basalt, a type of rock that has been shown to react with carbon dioxide to form carbonate minerals.¹⁶ During this process, the injected carbon dioxide is permanently converted into stone and thus becomes

immobile, greatly reducing the potential for leakage.¹⁷ Moreover, because sub-seabed basalts are located away from populated areas, injecting carbon dioxide therein poses fewer risks to public safety and may encounter less public opposition than onshore injection.¹⁸

Initial research suggests that offshore basalt formations have the capacity to store large amounts of carbon dioxide. Indeed, according to one recent study, sediment-covered basalt aquifers on the Juan de Fuca plate off western North America have the capacity to store more than 100 years’ worth of U.S. carbon dioxide emissions.¹⁹ The feasibility of storing carbon dioxide in one part of that area—known as the Cascadia Basin—was recently assessed in a study funded by the U.S. Department of Energy.²⁰ Building on that study, this Article discusses the legal framework for offshore CCS,²¹ using the Cascadia Basin as a case study to highlight issues that may arise in connection with future projects.

Located approximately 100 nautical miles from shore, the Cascadia Basin straddles areas under U.S. and Canadian jurisdiction. Thus, depending on precisely where in the basin an offshore CCS project occurs, it may be subject to regulation by the United States and/or Canada. Both countries’ regulations currently hinder offshore CCS and will likely need to be substantially revised to foster new project development.

The reasons for this are simple: neither the United States nor Canada has enacted comprehensive legislation specific to offshore CCS, resulting in projects being regulated under a patchwork of laws that were developed for other activities, and are often inappropriate for regulating offshore CCS. The laws currently prohibit some offshore CCS projects entirely and impose unnecessarily burdensome restrictions on others. These issues will need to be addressed, likely through legislative action, in order to realize the full potential of offshore CCS. Ideally, both the United States and Canada should enact legislation that deals specifically with offshore CCS, establishing a well-defined framework for the regulation of future projects.

This Article explores the current legal frameworks governing offshore CCS in the United States and Canada, highlighting issues that may hamper future project devel-

9. *Id.* at 11-12.

10. *Id.* at 8.

11. This is often referred to as enhanced oil recovery (EOR). During EOR, carbon dioxide is injected into oil wells, where it helps to maintain formation pressure by replacing oil and water that has already been pumped out of the well. Injecting carbon dioxide may also increase the viscosity of the oil and thus make it easier to pump from the well. *See id.* at 5, 8.

12. *See generally* David Biello, *Can Carbon Capture Technology Be Part of the Climate Solution?*, YALE ENV’T 360 (Sept. 8, 2014), <https://perma.cc/2GCP-W2XA>.

13. FOLGER, *supra* note 8, at 7.

14. *Id.*

15. *See, e.g.*, Terry Slavin & Alok Jha, *Not Under Our Backyard, Say Germans, in Blow to CO₂ Plans*, GUARDIAN (July 29, 2009), <https://perma.cc/CFV9-7VZV>.

16. David S. Goldberg et al., *Carbon Dioxide Sequestration in Deep-Sea Basalt*, 105 PROC. NAT’L ACAD. SCI. 9920 (2018). Basalt rock formations capable of storing carbon dioxide can also be found onshore. Carbon dioxide is currently being stored in one onshore basalt formation in Iceland. *See* Reykjavik Energy, *What Is CarbFix?*, <https://perma.cc/S3MY-DSG4> (last visited Mar. 15, 2019).

17. Sigurdur R. Gislason & Eric H. Oelkers, *Carbon Storage in Basalt*, 344 SCIENCE 373, 374 (2014).

18. David Goldberg et al., *Geological Storage of CO₂ in Sub-Seafloor Basalt: The CarbonSAFE Pre-Feasibility Study Offshore Washington State and British Columbia*, 146 ENERGY PROCEDIA 158, 163 (2018) [hereinafter *Geological Storage*].

19. Goldberg et al., *supra* note 16, at 9924.

20. *See generally Geological Storage, supra* note 18.

21. In this Article, the term “offshore CCS” is used to refer to the process by which carbon dioxide that has been collected at emissions sources (e.g., power plants) or removed from the atmosphere is injected into the sub-seabed, with the aim of permanently sequestering it there.

opment, particularly in the Cascadia Basin.²² The focus is on statutes and regulations affecting the injection of carbon dioxide in the Cascadia Basin and other sub-seabed geologic formations. However, it should be noted that future offshore CCS projects may also entail various other activities relating to the capture and transportation of carbon dioxide. For example, some projects may require the construction of new pipelines to transport carbon dioxide to the injection site, and/or other facilities to store carbon dioxide during transportation.²³ Depending on the type of facility and its location, construction may be subject to various permitting and other requirements at the federal, state/provincial, and/or local levels.²⁴ The requirements, which are generally similar to those imposed on other types of industrial development, are not discussed in this Article.

The Article is structured as follows: Part I discusses key principles of international law governing countries' exercise of regulatory authority over offshore CCS in the basin and elsewhere. Relevant international agreements prescribing the design of countries' regulations are explored in Part II. Part III focuses on the regulations currently in place in the United States and Canada, identifying ways in which they may prevent or restrict offshore CCS. Part IV concludes.

I. Jurisdiction Over Offshore CCS

Under international law, the United States and Canada have authority to regulate offshore CCS projects undertaken within 200 nautical miles of their respective coasts, and further in some circumstances. The countries share regulatory authority over projects in the Cascadia Basin, which straddles U.S. and Canadian waters, approximately 100 nautical miles from the coast. As a result, depending on precisely where in the basin a project occurs, it may be subject to regulation by the United States and/or Canada. This part discusses key legal principles governing the division of regulatory authority over projects in the basin and elsewhere.

A. International Legal Framework Governing Offshore Jurisdiction

International law, as set out in the United Nations Convention on the Law of the Sea (UNCLOS), divides offshore areas into several zones and assigns each a different legal status. The key zones, and their status, are shown in Figure 1.²⁵ As indicated there, under UNCLOS, each country has jurisdiction over areas within 200 nautical miles of the low water line along its coast (the baseline²⁶), and further in some circumstances.²⁷ This area is generally divided into three key parts, as follows:

1. The *territorial sea*, which includes the waters and sub-surface land extending 12 nautical miles from the baseline,²⁸ and forms part of the sovereign territory of the coastal state.²⁹
2. The *exclusive economic zone* (EEZ), which is the area of water adjacent to and beyond the territorial sea, extending 200 nautical miles from the baseline.³⁰ Within the EEZ, the coastal state has
 - sovereign rights to explore, exploit, conserve, and manage natural resources and undertake other activities for the economic exploitation of the zone; and
 - jurisdiction with regard to the establishment and use of artificial islands, installations, and structures, marine scientific research, and marine protection.³¹
3. The *continental shelf*, which is the submarine area extending beyond the territorial sea, to the farthest of 200 nautical miles from the baseline or the outer edge of the continental margin,³² up to 60 nautical miles from the continental slope or the point where sediment thickness is 1% of the distance thereto.³³ The continental shelf cannot, however, extend more than 100 nautical miles from the 2,500-meter isobath or 350 nautical miles from the baseline.³⁴ Within this area,

22. For additional information regarding the U.S. legal framework, see Romany Webb & Michael B. Gerrard, *Sequestering Carbon Dioxide Undersea in the Atlantic: Legal Problems and Solutions*, 36 UCLA J. ENVTL. L. & POL'Y 1, 36-38 (2018).

23. For a discussion of options for transporting carbon dioxide to an injection site in the Cascadia Basin, see *Geological Storage*, *supra* note 18, at 159-60.

24. For example, carbon dioxide pipelines in the United States are regulated by the states, some of which require pipeline construction to be permitted. Pipeline construction in the United States must also comply with any applicable local ordinances (e.g., zoning or land use plans). See generally Webb & Gerrard, *supra* note 22, at 36-38. In Canada, regulatory authority over carbon dioxide pipelines is shared among the federal government and the provinces. At the federal level, the National Energy Board regulates carbon dioxide pipelines crossing provincial boundaries (interprovincial pipelines), while other (intraprovincial) pipelines are regulated by provincial bodies. See generally ICF INTERNATIONAL, *DEVELOPING A PIPELINE INFRASTRUCTURE FOR CO₂ CAPTURE AND STORAGE: ISSUES AND CHALLENGES* 82-83 (2009), available at <https://perma.cc/A3SM-6Y89>.

25. United Nations Convention on the Law of the Sea, Dec. 10, 1982, 1833 U.N.T.S. 397 [hereinafter UNCLOS]. UNCLOS has been ratified by Canada. The United States has not ratified UNCLOS, but recognizes most of its provisions, including those discussed in this part, as forming part of customary international law.

26. In some circumstances, the baseline may differ from the low water line due to geological factors, such as the nature of the coastline and/or the presence of reefs thereon. See *id.* arts. 6-11. For example, on Canada's west coast, in the vicinity of Vancouver Island, straight baselines are used. Straight baselines are determined by drawing a straight line joining points along indented coastlines and/or the border of islands along the coast. See Fisheries and Oceans Canada, *Baselines of the Territorial Sea*, <https://perma.cc/Y9ST-PFLD> (last visited Sept. 14, 2018).

27. UNCLOS, *supra* note 25, arts. 2-3, 55-57.

28. *Id.* art. 3.

29. *Id.* art. 2.

30. *Id.* arts. 55, 57.

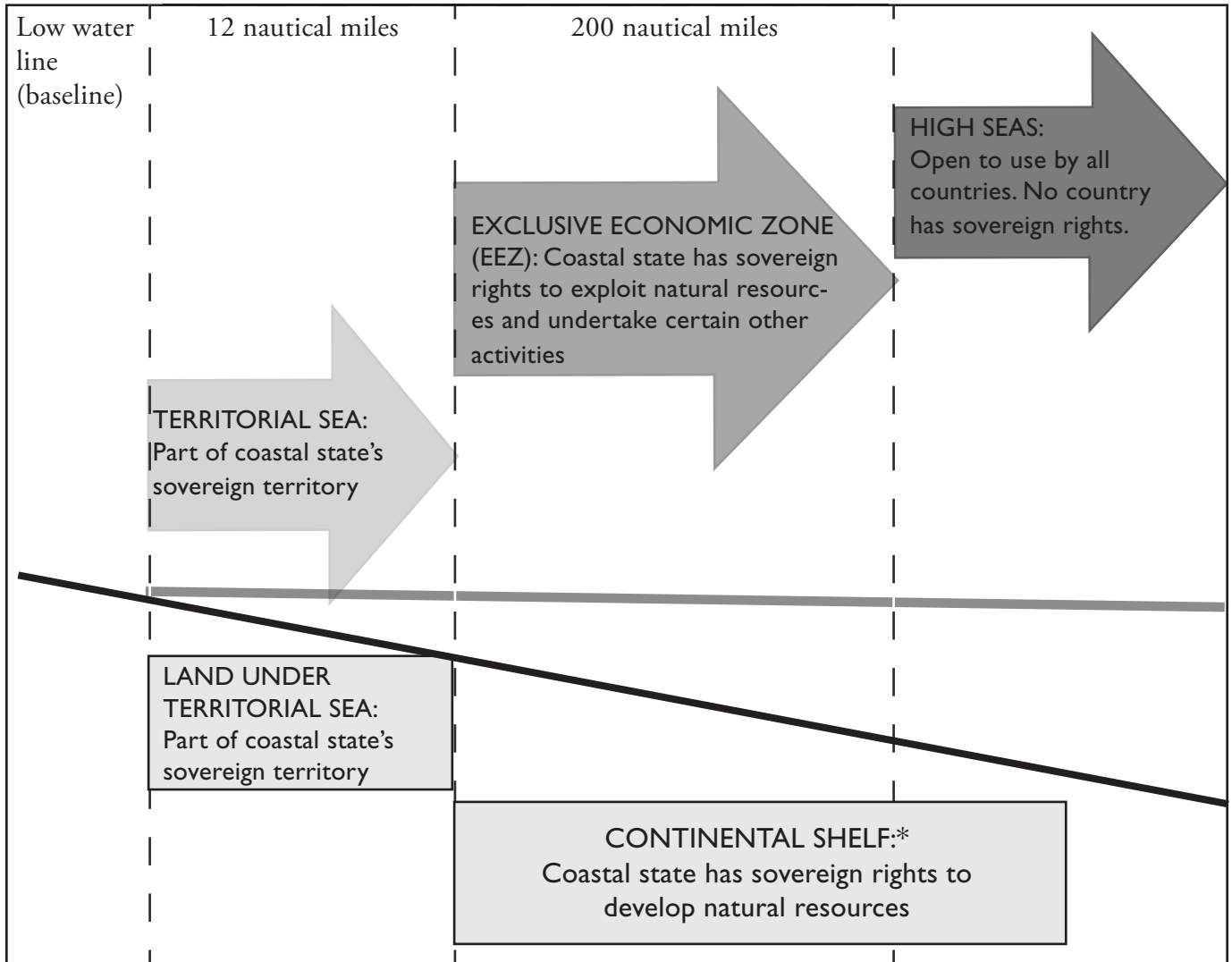
31. *Id.* art. 56.

32. The "continental margin" refers to the submerged prolongation of the land mass of the coastal state. *Id.* art. 76(1).

33. *Id.* art. 76(5).

34. *Id.*

Figure 1. Offshore Zones Identified in UNCLOS



* The continental shelf typically extends 200 nautical miles from shore. However, in some circumstances, it may extend beyond this point to the farthest of 100 nautical miles from the 2,500-meter isobath or 350 nautical miles from the baseline.

the coastal state has sovereign rights for the purpose of exploring and exploiting natural resources.³⁵

Except as noted above, countries generally do not have jurisdiction over areas more than 200 nautical miles from shore, which form part of the high seas and are open to use by all countries in accordance with international law.³⁶ UNCLOS provides for “freedom of the high seas,” which

comprises, inter alia, both for coastal and land-locked states: (a) freedom of navigation; (b) freedom of overflight; (c) freedom to lay submarine cables and pipelines . . . ; (d) freedom to construct artificial islands and other installations . . . ; (e) freedom of fishing . . . ; [and] (f) freedom of scientific research.³⁷

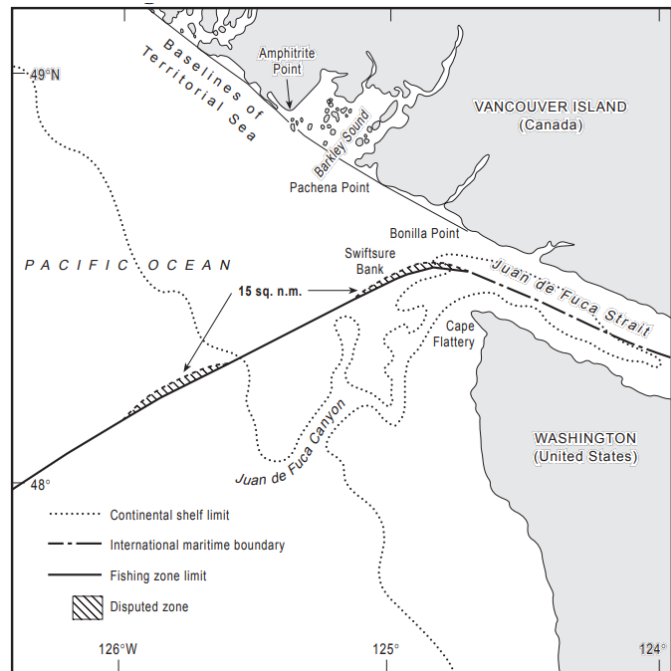
Countries must exercise these freedoms “with due regard to the interests of other[s].”³⁸

B. Division of Regulatory Jurisdiction in the Cascadia Basin

Consistent with UNCLOS, both the United States and Canada have claimed jurisdiction over offshore waters, extending 200 nautical miles from their respective coasts.³⁹ On the West Coast, the boundary line between the two countries’ waters passes through the center of the Juan de Fuca Strait, which runs between the Olympic Peninsula in Washington and Vancouver Island in British Columbia from Puget Sound to the Pacific Ocean.⁴⁰ West of the mouth of the strait, there is no agreed maritime boundary between the United States and Canada, with the countries disputing two areas totaling approximately 15 square miles in size (see Figure 2).⁴¹ The disputed areas fall outside the Cascadia Basin, which straddles U.S. and Canadian waters, approximately 100 nautical miles from shore.

The United States and Canada have authority, under international law, to regulate CCS and other projects undertaken in those parts of the Cascadia Basin located within their respective waters. This authority stems from the location of the Cascadia Basin within each country’s EEZ. As noted above, UNCLOS recognizes that countries have certain “sovereign rights” within their EEZs, includ-

Figure 2. U.S.-Canada Maritime Boundary



Source: David H. Gray, *Canada's Unresolved Maritime Boundaries*, IBRU BOUNDARY & SECURITY BULL., Autumn 1997, at 62.

ing “sovereign rights for the purpose of exploring and exploiting, conserving, and managing the natural resources . . . of the waters superjacent to the seabed and of the seabed and its subsoil, and with regard to other activities for the economic exploitation and exploration of the zone.”⁴² UNCLOS also recognizes countries’ exclusive jurisdiction, within their EEZs, over “(i) the establishment and use of artificial islands, installations and structures; (ii) marine scientific research; [and] (iii) the protection and preservation of the marine environment.”⁴³

I. U.S. Jurisdictional Areas

The U.S. portion of the Cascadia Basin falls under the jurisdiction of the federal government, which, on the West Coast, has exclusive authority over areas three to 200 nautical miles from shore (and further in some circumstances). Areas closer to shore fall under the authority of the relevant coastal state. Under the Submerged Lands Act, the boundary of each coastal state extends three nautical miles from its coastline,⁴⁴ except in Texas and the west coast of Florida, where state boundaries extend nine nautical miles from the coast.⁴⁵ Each coastal state has

35. *Id.* art. 77.

36. *Id.* arts. 86-87. The seabed underlying the high seas, and the resources therein, are considered “the common heritage of mankind.” Their development is overseen by the International Seabed Authority, which must act on behalf of, and for the benefit of, mankind as a whole. *See id.* arts. 136-37, 140, 150.

37. *Id.* art. 87(1).

38. *Id.* art. 87(2).

39. Proclamation No. 5030, 48 Fed. Reg. 10605 (Mar. 14, 1983); Oceans Act, S.C. 1996 c. 31, §13 (Can.).

40. David H. Gray, *Canada's Unresolved Maritime Boundaries*, IBRU BOUNDARY & SECURITY BULL., Autumn 1997, at 61.

41. The dispute arises because, while both the United States and Canada support establishing the boundary based on the principle of equidistance (i.e., the principle that neighboring countries’ offshore boundaries should conform to a median line that is equidistant from the nearest points on the baselines), they have used different baselines in applying the principle. This has resulted in small differences in the boundary lines in two areas. *See generally id.* at 62.

42. UNCLOS, *supra* note 25, art. 56(1)(a).

43. *Id.* art. 56(1)(b).

44. For the purposes of the Submerged Lands Act, a state’s “coastline” is defined as “the line of ordinary low water along that portion of the coast which is in direct contact with the open sea and the line marking the seaward limit of inland waters.” 43 U.S.C. §1301(c).

45. *Id.* §1312 (providing that “[t]he seaward boundary of each original coastal State is approved and confirmed as a line three geographic miles distant

title to, and ownership of, all submerged lands within its boundaries and all natural resources within those lands and the water above them.⁴⁶

Waters beyond state boundaries, up to 200 nautical miles from shore, fall under the exclusive authority of the federal government and are thus known as “federal waters.” The federal government has title to offshore land lying beneath federal waters and extending beyond them to the seaward limit of U.S. jurisdiction as defined in UNCLOS (the outer continental shelf or OCS).⁴⁷ As noted above, under UNCLOS, U.S. jurisdiction extends to the farthest of

- 200 nautical miles from the baseline (i.e., normally the low water line along the coast); or
- if the continental margin exceeds 200 nautical miles, a line
 - 60 nautical miles from the foot of the continental shelf; or
 - beyond the shelf foot where the sediment thickness is 1% of the distance thereto.⁴⁸

The OCS cannot, however, extend more than 350 nautical miles from the baseline or 100 nautical miles from the 2,500-meter isobath (i.e., a line connecting the depth of 2,500 meters).⁴⁹

2. Canadian Jurisdictional Areas

Canada has claimed jurisdiction over offshore waters extending up to 200 nautical miles from the baseline.⁵⁰ The Oceans Act defines the “baseline” as “the low-water line along the coast or on a low-tide elevation,” being “a naturally formed area of land that is surrounded by and above water at low tide but submerged at high tide.”⁵¹ Notably, however, the Act provides for the adoption of regulations specifying another baseline located further offshore.⁵² Such regulations have been adopted with respect to certain areas, including off the coast of British Columbia, where the coastline is heavily indented by bays and

harbors.⁵³ The regulations provide for the use of so-called straight baselines that are determined by drawing “closing lines” between points on either side of the indents.⁵⁴

Off the coast of British Columbia, waters situated landward of the straight baselines are considered part of Canada’s “internal waters,” and subject to the absolute sovereignty of the provincial government.⁵⁵ However, the government of British Columbia does not have any sovereign rights with respect to waters located seaward of the straight baselines, which fall under the exclusive authority of the federal government.⁵⁶ The federal government also exercises authority over offshore land, comprising the seabed and subsoil of the continental shelf, which extends to the farthest of 200 nautical miles from the baseline or the outer edge of the continental margin.⁵⁷ The Canadian portion of the Cascadia Basin forms part of the continental shelf and, as such, activities therein fall under the exclusive regulatory authority of the federal government.

II. International Agreements Respecting Offshore CCS

In both the United States and Canada, regulation of offshore CCS is informed by relevant international agreements, most notably the 1972 Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (London Convention)⁵⁸ and the 1996 Protocol to that Convention (London Protocol).⁵⁹ The key terms of those instruments and their application to offshore CCS are discussed in this part.

Both the London Convention and the London Protocol aim to prevent pollution of the marine environment as a result of “dumping.”⁶⁰ For the purposes of the London Convention, “dumping” is defined to include any “deliberate disposal at sea of wastes or other matter from ves-

from its coast line”). See also *id.* §1301(b) (defining the term “boundaries” and providing that “in no event shall the term boundaries . . . be interpreted as extending from the coast line more than three geographical miles in the Atlantic Ocean or the Pacific Ocean, or more than three marine leagues into the Gulf of Mexico”). A “marine league” is equivalent to three nautical miles. Thus, in the Gulf of Mexico, the boundaries of Florida and Texas extend nine nautical miles from the coastline. See generally *United States v. Louisiana*, 100 S. Ct. 1618 (1980), 420 U.S. 529 (1975), 394 U.S. 11 (1969), 389 U.S. 155 (1967), 363 U.S. 1 (1960), 339 U.S. 699 (1950).

46. 43 U.S.C. §1311(a)(1). The term “natural resources” is defined to include, without limitation, “oil, gas, and all other minerals, and fish, shrimp, oysters, clams, crabs, lobsters, sponges, kelp, and other marine animal and plant life but does not include water power, or the use of water for the production of power.” *Id.* §1301(e).

47. *Id.* §1331.

48. UNCLOS, *supra* note 25, art. 76.

49. *Id.* arts. 76(1), 76(4).

50. Oceans Act, S.C. 1996, c. 31, §13(1) (Can.).

51. *Id.* §5(1), (4).

52. *Id.* §5(2).

53. See Territorial Sea Geographical Coordinates Order, C.R.C., c. 1550 (Can.).

54. *Id.* §§3, 4. See also Oceans Act, §4(b).

55. Oceans Act, §§6, 9. Off the coast of British Columbia, the federal government has exclusive authority over the waters and submerged land west of Vancouver Island and the Queen Charlotte Islands. The courts have, however, held that the waters and submerged land between the mainland and Vancouver Island (including the Strait of Juan de Fuca, the Strait of Georgia, Johnstone Strait, and Queen Charlotte Strait) are internal waters under the exclusive authority of British Columbia. The government of British Columbia has also claimed authority over the waters and submerged land between the Queen Charlotte Islands and the mainland (i.e., the Hecate Strait). See Steve Rogers, *Offshore, in SURVEYS, PARCELS, AND TENURE ON CANADA LANDS* (Brian Ballantyne ed., Natural Resources Canada 2010), available at <https://perma.cc/AUX7-5DWR>; DAVID STRONG ET AL., BRITISH COLUMBIA OFFSHORE HYDROCARBON DEVELOPMENT: REPORT OF THE SCIENTIFIC REVIEW PANEL app. 3 (2002), available at <https://perma.cc/4NXS-CXZ3>.

56. Oceans Act, §14. See also Reference re: Offshore Mineral Rights, [1967] S.C.R. 792, 793 (Can.).

57. Oceans Act, §§17(1), 18.

58. Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter, Dec. 29, 1972, 26 U.S.T. 2403, 1046 U.N.T.S. 120 [hereinafter London Convention].

59. Protocol to the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter, Nov. 7, 1996, 36 I.L.M. 1 [hereinafter London Protocol].

60. London Convention, *supra* note 58, art. I; London Protocol, *supra* note 59, art. 2.

sels, aircraft, platforms, or other man-made structures.”⁶¹ There is some uncertainty as to whether this definition encompasses the sub-seabed injection of matter (i.e., as occurs during offshore CCS) or only its discharge into the water column.

The definition requires matter to be disposed of “at sea,” with that term defined to mean “marine waters,” which could be taken to suggest that matter must be discharged into the water column.⁶² Alternatively, the definition could be read as merely requiring the act of disposal to occur at sea, regardless of where the matter ends up.⁶³ Under this reading, the London Convention would apply to offshore CCS projects involving the sub-seabed injection of carbon dioxide.

Assuming the London Convention applies to sub-seabed injection, it may require contracting parties to prohibit offshore CCS altogether or without a permit. Under the London Convention, contracting parties are required to prohibit the dumping of certain materials listed in Annex I (prohibited materials), but may allow other materials to be dumped with a permit.⁶⁴ The prohibited materials include “industrial waste,” which is defined broadly to include “waste materials generated by manufacturing or processing operations.”⁶⁵ The London Convention’s scientific advisory group has concluded that this definition includes carbon dioxide derived from fossil fuels,⁶⁶ but no consensus has been reached on the issue by the contracting parties, leading to uncertainty as to how offshore CCS projects will be treated.

Much of this uncertainty has been resolved in the London Protocol, which was adopted in 1996, and would eventually replace the London Convention if it were to be ratified by all contracting parties. Compared to the London Convention, the London Protocol adopts a broader definition of “dumping,” which expressly includes the “storage of waste or other matter in the seabed.”⁶⁷ Under the London Protocol, contracting parties are required to “prohibit the dumping of any wastes or other matter with the exception of those listed in Annex 1,” which may be dumped with a permit.⁶⁸

When the London Protocol was first adopted in 1996, the list in Annex 1 did *not* include carbon dioxide, meaning that contracting parties were required to prohibit its sub-

seabed injection. However, this changed in 2006, when Annex 1 to the London Protocol was amended to list “[c]arbon dioxide streams from carbon dioxide capture processes for sequestration.”⁶⁹ Thus, the London Protocol now expressly allows the sub-seabed injection of carbon dioxide for the purposes of sequestration, provided the injection operation is permitted by the relevant national authority. Under the London Protocol, a national authority may only permit injection if three conditions are met, namely:

- (1) The carbon dioxide stream will be injected “into a sub-seabed geological formation”;
- (2) The stream “consists overwhelmingly of carbon dioxide”⁷⁰;
- (3) “[N]o wastes or other matter are added [to the stream] for the purpose of disposing of” them.⁷¹

The London Protocol entered into force in 2006. At that time, the Protocol became binding on Canada, which signed and ratified it in 2000.⁷² The United States signed the Protocol in 1998, but has not yet ratified it, and thus is not bound by its terms.⁷³ However, the United States is bound by the London Convention, which it ratified in 1974.⁷⁴ The United States and Canada have enacted domestic legislation implementing the London Convention and London Protocol, respectively. That legislation is discussed in Part III below, along with other statutes that may apply to offshore CCS in U.S. federal and Canadian waters.

III. Domestic Regulation of Offshore CCS

Neither the United States nor Canada has a comprehensive regulatory framework specifically addressing offshore CCS. While regulators in both countries have suggested that offshore CCS may be regulated under general environmental and other programs, little guidance has been provided on when and how those programs will apply, resulting in significant uncertainty as to the treatment of future projects.

Key regulatory issues that could arise in connection with offshore CCS projects undertaken in U.S. federal and Canadian waters are discussed in Sections III.A. and III.B. below. These sections focus exclusively on issues affecting the injection of carbon dioxide into sub-seabed geologic formations as part of an offshore CCS project. They do not address the regulation of other project-related activities performed in connection with the capture and trans-

61. London Convention, *supra* note 58, art. III(1).

62. *Id.* art. III(3). See also Webb & Gerrard, *supra* note 22, at 14.

63. Webb & Gerrard, *supra* note 22, at 14. See also Yvette Carr, *The International Legal Issues Relating to the Facilitation of Sub-Seabed CO₂ Sequestration Projects in Australia*, 14 AUSTL. INT’L L.J. 137, 144 (2007) (asserting that, for the purposes of the London Convention, “what matters is not the final resting place of the material, but the location of the act of [dumping] itself”); Ray Purdy & Richard Macrory, *Geological Carbon Sequestration: Critical Legal Issues 19* (Tyndall Centre, Working Paper No. 45, 2003) (noting that the London Convention was intended “to protect the sea” and thus should be interpreted as applying to “activities in the sea-bed that have the potential to harm the sea”), available at <https://perma.cc/6YK6-9HA7>.

64. London Convention, *supra* note 58, art. IV(1).

65. *Id.* Annex I.

66. Purdy & Macrory, *supra* note 63, at 21.

67. London Protocol, *supra* note 59, art. 1.4.1.3.

68. *Id.* art. 4.1.1.

69. *Id.* Annex 1(1.8).

70. The stream may, however, “contain incidental associated substances derived from the source material and the capture and sequestration processes used.” See *id.*

71. *Id.*

72. Environment and Climate Change Canada, *London Protocol on Prevention of Marine Pollution*, <https://perma.cc/3LGA-NQ9B> (last visited Jan. 8, 2019).

73. U.S. EPA, *Ocean Dumping: International Treaties*, <https://perma.cc/CMN6-KZWS> (last visited Jan. 8, 2019).

74. *Id.*

portation of carbon dioxide, such as the construction of new pipelines and/or storage facilities. Like other types of industrial development, those activities may be subject to various permitting and/or other regulatory requirements at the federal, state/provincial, and local levels.⁷⁵

A. Regulation of Offshore CCS Projects in U.S. Federal Waters

Uncertainty regarding the legal framework for offshore CCS in U.S. federal waters has long been recognized as a key barrier to project development, leading to calls from both government and independent bodies for the enactment of new federal legislation specifically addressing offshore CCS.⁷⁶ While no legislative action has been taken, multiple federal agencies—most notably the U.S. Environmental Protection Agency (EPA) and the U.S. Department of the Interior (DOI)—have asserted authority to regulate offshore CCS under existing environmental and other general statutes. In many cases, the statutes are poorly suited to dealing with offshore CCS, often granting agencies overlapping or conflicting regulatory authority with respect to projects. The result is a duplicative regulatory framework that is difficult for project developers to navigate and is, therefore, likely to hinder offshore CCS development.

I. EPA Regulation of Offshore CCS

EPA currently regulates a subset of offshore CCS projects through its Underground Injection Control (UIC) Program, which was established under the Safe Drinking Water Act (SDWA)⁷⁷ to prevent the contamination of drinking water by materials injected underground.⁷⁸ The UIC Program applies to, among other things, the underground injection of carbon dioxide for the purpose of “geological sequestration,” which is defined to mean the “long-term containment” of carbon dioxide in subsurface geological formations.⁷⁹ Notably, however, the UIC Program only applies where carbon dioxide is injected into formations located onshore or in state waters, within three (or, in some cases, nine) nautical miles of shore.⁸⁰ Injection operations occurring further offshore (e.g., in federal waters) are expressly exempt from regulation under the UIC Program.⁸¹

EPA has previously taken the view that it cannot regulate offshore CCS projects in federal waters through the

UIC Program because, under the SDWA, that program can only be used to “regulate the subsurface injection of fluids onshore and offshore under submerged lands within the territorial jurisdiction of States.”⁸² EPA has, however, suggested that it may regulate offshore CCS projects in federal waters under the ocean dumping program established in the Marine Protection, Research, and Sanctuaries Act (MPRSA).⁸³

The MPRSA, which was enacted to fulfill the United States’ obligations under the London Convention, regulates “the dumping of all types of materials into ocean waters.”⁸⁴ For the purposes of the MPRSA, the term “materials” is defined broadly to include “matter of any kind or description,” which would encompass carbon dioxide.⁸⁵ There is, however, some uncertainty as to whether the sub-seabed injection of carbon dioxide constitutes “dumping” under the MPRSA.⁸⁶

The MPRSA only applies to the dumping of materials “into ocean waters,” which are defined as “waters of the open seas lying seaward of the base line,” perhaps suggesting that the Act does not apply to the sub-seabed injection of material, but only to its discharge into the water column. That view is, however, contradicted by the MPRSA’s definition of “dumping,” which includes any “disposition of material” except (among other things):

the construction of any fixed structure or artificial island [] or the intentional placement of any device in ocean waters or *on or in the submerged lands beneath such waters*, for a purpose other than disposal, when such construction or such placement is otherwise regulated by Federal or State law or occurs pursuant to an authorized Federal or State program.⁸⁷

This exception would be unnecessary if the MPRSA did not apply to activities “on or in the submerged lands beneath ocean waters,” suggesting that seabed activities are subject to the Act (unless covered by the above exception).

Consistent with this view, EPA has suggested that “sub-seabed [carbon dioxide] injection . . . may, in certain circumstances, be defined as ocean dumping” under the MPRSA.⁸⁸ According to EPA officials, in determining whether a particular injection operation constitutes dumping, the Agency may consider the purpose for which carbon dioxide is to be injected.⁸⁹ This is relevant because, as noted above, the statutory definition of dumping excludes

75. See generally Webb & Gerrard, *supra* note 22, at 35-66.

76. See, e.g., REPORT OF THE INTERAGENCY TASK FORCE ON CARBON CAPTURE AND STORAGE 56, 66-67 (2010), available at <https://perma.cc/VLF7-VUF5>.

77. 42 U.S.C. §§300f to 300(j)-26, ELR STAT. SDWA §§1401-1465.

78. *Id.* §§300h et seq. See also U.S. EPA, *Underground Injection Control (UIC): General Information About Injection Wells*, <http://perma.cc/s7V2-PS4B> (last visited Jan. 15, 2017).

79. 40 C.F.R. §146.81 (2018). See also Federal Requirements Under the Underground Injection Control Program for Carbon Dioxide Geologic Sequestration Wells, 75 Fed. Reg. 77230, 77236 (Dec. 10, 2010) (codified at 40 C.F.R. pts. 124, 144, 145, et seq.).

80. 40 C.F.R. §144.1(g)(1) (2018).

81. *Id.* §144.1(g)(2)(i).

82. Federal Requirements Under the Underground Injection Control Program for Carbon Dioxide Geologic Sequestration Wells, 75 Fed. Reg. 77230, 77235 (Dec. 10, 2010) (codified at 40 C.F.R. pts. 124, 144, 145, et seq.).

83. 33 U.S.C. §§1401 et seq.

84. *Id.* §1401(b).

85. *Id.* §1402(c).

86. Webb & Gerrard, *supra* note 22, at 14-15.

87. 33 U.S.C. §1402(f) (emphasis added).

88. Federal Requirements Under the Underground Injection Control Program for Carbon Dioxide Geologic Sequestration Wells, 75 Fed. Reg. 77230, 77236 (Dec. 10, 2010) (codified at 40 C.F.R. pts. 124, 144, 145, et seq.).

89. EPA has not, however, made an official determination on this issue. See E-mail from David Redford, Freshwater and Marine Regulatory Branch, U.S. EPA, to Romany Webb, Sabin Center for Climate Change Law, Columbia Law School (Aug. 15, 2018) (on file with authors).

the placement of a device “in the [seabed] *for a purpose other than disposal*, when such . . . placement is otherwise regulated by Federal or State law.”⁹⁰ Thus, for example, the sub-seabed injection of carbon dioxide for the purposes of enhanced oil recovery may fall outside the MPRSA.⁹¹ The Act would, however, likely apply to injection operations aimed at permanently storing carbon dioxide in the sub-seabed because that is arguably a form of disposal.

If subject to the MPRSA, offshore CCS projects would need to be permitted by EPA, where

the carbon dioxide is transported from the United States (regardless of where injection occurs); or

- the carbon dioxide is transported from outside the United States, and
 - transportation occurs on a vessel registered in the United States (regardless of where injection occurs); or
 - injection occurs within 12 nautical miles of the U.S. coast (regardless of how the carbon dioxide is transported).⁹²

Under the MPRSA, EPA cannot permit the sub-seabed injection of “industrial waste,” defined as “any solid, semi-solid, or liquid waste generated by a manufacturing or processing plant.”⁹³ Whether this definition encompasses carbon dioxide is an open question.⁹⁴

The answer may depend on the source of the carbon dioxide, with some commentators arguing that carbon dioxide collected at power plants and similar facilities is more likely to be considered industrial waste than that sourced in other ways, such as through direct air capture.⁹⁵ This is an important issue to resolve because, if carbon dioxide from some or all sources is considered industrial waste, the MPRSA would prohibit its sub-seabed injection for the purpose of offshore CCS. This possibility, as well as the broader uncertainty (discussed above) regarding application of the MPRSA to sub-seabed injection, is likely to discourage investment in offshore CCS.

As noted above, if carbon dioxide is found not to be an industrial waste for the purposes of the MPRSA, offshore CCS in U.S. federal waters will generally be permissible with a permit from EPA.⁹⁶ Under the MPRSA, EPA may permit offshore dumping if satisfied that it “will not unreasonably degrade or endanger human health, welfare, or amenities, or the marine environment, ecological sys-

tems, or economic potentialities.”⁹⁷ Dumping can only occur in EPA-designated “dump sites,” which are selected to “mitigate adverse impact[s] on the environment,” as well as “the interference of [dumping] with other activities.”⁹⁸ To date, EPA has designated 99 dump sites, none of which are located in the Cascadia Basin.⁹⁹ Thus, before offshore CCS can occur in the basin, EPA must designate the area as a dump site.

Any person wishing to engage in offshore dumping may request designation of a new dump site.¹⁰⁰ In determining whether to grant a request, EPA evaluates the physical, chemical, and biological characteristics of the site and the impacts of past dumping in areas with similar characteristics.¹⁰¹ EPA also conducts various environmental and other reviews, including under the National Environmental Policy Act (NEPA),¹⁰² which requires an environmental impact statement to be prepared for any major federal action that “significantly affect[s] the quality of the human environment.”¹⁰³ While this requirement has been held not to apply to actions taken under the MPRSA,¹⁰⁴ EPA voluntarily complies with NEPA when making site designations pursuant to the Act.¹⁰⁵

EPA also complies with other procedural requirements, including those arising under the following:

- *Endangered Species Act (ESA)*¹⁰⁶: Section 7 of the ESA requires each federal agency to “insure that any action authorized, funded or carried out by [it] is not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of habitat of such species.”¹⁰⁷ To that end, if a federal agency

97. 33 U.S.C. §1412(a).

98. *Id.* §1412(c); 40 C.F.R. §228.5 (2018).

99. U.S. EPA, *Ocean Disposal Map*, <https://www.epa.gov/ocean-dumping/ocean-disposal-map> (last visited May 13, 2019).

100. Designation requests must be submitted as part of the person’s application for a permit to engage in offshore dumping. *See generally* 40 C.F.R. §221.1(f) (2018) (requiring permit applications to include, among other things, details of the “[p]roposed dump site, and in the event such proposed dump site is not . . . designated . . . , detailed physical, chemical, and biological information relating to the proposed dump site and sufficient to support its designation”).

101. *Id.* §228.4. For a full list of the criteria applied by EPA when designating sites, *see id.* §228.6.

102. 42 U.S.C. §§4321-4370h, ELR STAT. NEPA §§2-209.

103. *Id.* §4332(2)(C).

104. *Maryland v. Train*, 415 F. Supp. 116, 6 ELR 20496 (D. Md. 1976) (holding that EPA is not required to prepare an environmental impact statement for actions taken under the MPRSA because, “[w]here federal regulatory action is circumscribed by extensive procedures, including public participation, for evaluating environmental issues and is taken by an agency with recognized environmental expertise, formal adherence to the NEPA requirements is not required unless Congress has specifically so directed”).

105. Policy and Procedures for Voluntary Preparation of National Environmental Policy Act (NEPA) Documents, 63 Fed. Reg. 58045, 58046 (Oct. 29, 1998) (indicating that “EPA voluntarily will follow NEPA procedures in ocean disposal site designations under MPRSA”).

106. 16 U.S.C. §§1531-1544, ELR STAT. ESA §§2-18.

107. 16 U.S.C. §1536(a)(2). An “endangered” species is one that “is in danger of extinction throughout all or a significant portion of its range.” *See id.* §1532(6). A “threatened” species is one that “is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.” *See id.* §1532(20).

90. 33 U.S.C. §1402(f) (emphasis added).

91. E-mail from David Redford, *supra* note 89.

92. 33 U.S.C. §1411; 40 C.F.R. §220.1 (2018).

93. 33 U.S.C. §1414(b).

94. Webb & Gerrard, *supra* note 22, at 67-68.

95. *Id.*

96. An EPA permit will be required if the carbon dioxide is to be (1) injected into the sub-seabed within 12 nautical miles of the U.S. coast; or (2) transported from the United States or on a U.S.-registered vessel (regardless of where injection occurs). 33 U.S.C. §1411; 40 C.F.R. §220.1 (2018).

action could affect endangered or threatened marine species, it must consult with the National Marine Fisheries Service (NMFS).¹⁰⁸

- *Magnuson-Stevens Fishery Conservation and Management Act (MSA)*: Under §305 of the MSA, federal agencies must also consult with NMFS before undertaking, authorizing, or funding any action that may adversely affect waters or submerged land designated as “essential fish habitat.”¹⁰⁹
- *Coastal Zone Management Act (CZMA)*¹¹⁰: Under the CZMA, before undertaking an action that will affect land or water use or natural resources within the boundaries of a state (i.e., typically extending three nautical miles from shore), a federal agency must consult with the relevant coastal state.¹¹¹ Consultation is intended to ensure that the federal agency action is, to the maximum extent possible, consistent with any state coastal management plan.¹¹² The federal agency must provide the state with a consistency determination, describing the action, its expected effects, and how it is consistent with the management plan.¹¹³ If the state objects to the determination, the federal agency must work with it to address the objection.¹¹⁴

If an area is designated as a dump site, EPA may permit the dumping of materials therein. Applications for permits must be filed with the relevant EPA regional office and include, among other things, details of the material to be dumped and the method of dumping, an assessment of the environmental impacts of dumping, and an evaluation of the need for dumping and alternative methods of disposing of the material.¹¹⁵ Based on that information, and the views expressed at any public hearing held on the application, EPA may issue or refuse to issue a permit.¹¹⁶ EPA must base its decision on an assessment of “the environmental effect of the proposed dumping operation,” as well as its effect on “esthetic, recreational and economic values and on other uses of the ocean,” and the need for dumping and availability of alternatives.¹¹⁷

108. See generally National Oceanic and Atmospheric Administration Fisheries, *Consultations: Endangered Species Act Consultations*, <https://www.fisheries.noaa.gov/topic/consultations#endangered-species-act-consultations> (last visited May 13, 2019). Note that EPA would likely be required to engage in such consultation before designating a dump site in the Cascadia Basin as waters in that area have been identified as providing critical habitat for the endangered leatherback sea turtle. See National Oceanic and Atmospheric Administration Fisheries West Coast Region, *Sea Turtles*, https://www.west-coast.fisheries.noaa.gov/protected_species/sea_turtles/marine_turtles.html (last visited May 13, 2019).

109. 16 U.S.C. §1855(b)(2). See also *id.* §1802(10).

110. 16 U.S.C. §§1451-1466, ELR STAT. CZMA §§302-319.

111. *Id.* §1456(c).

112. *Id.* §1456(c)(1)(A).

113. *Id.* §1456(c)(1)(C); 15 C.F.R. §930.39 (2019).

114. 15 C.F.R. §930.43 (2019).

115. 40 C.F.R. §221.1 (2018).

116. Any person may request that EPA hold a public hearing on a permit application. *Id.* §§222.3-4. See also *id.* §§222.5-7 (outlining the hearing procedures).

117. *Id.* §227.1.

2. DOI Regulation of Offshore CCS

As well as a permit from EPA, offshore CCS projects in U.S. federal waters also require a lease from DOI’s Bureau of Ocean Energy Management (BOEM) under the Outer Continental Shelf Lands Act (OCSLA). OCSLA does not specifically address offshore CCS, creating some uncertainty as to how projects should be treated by BOEM, and the circumstances in which it may issue leases therefor. Generally, under §8(p)(1) of OCSLA, leases can only be issued for activities that

- (a) support exploration, development, production, or storage of oil or natural gas . . . ;
- (b) support transportation of oil or natural gas, excluding shipping activities;
- (c) produce or support production, transportation, or transmission of energy from sources other than oil and gas; or
- (d) use, for energy-related purposes or for other authorized marine-related purposes, facilities currently or previously used for activities [relating to oil, gas, and other mineral development on the OCS].¹¹⁸

This section was intended to enable the leasing of offshore land for energy development, and gives BOEM little scope to issue leases for other purposes, including offshore CCS.

BOEM has concluded that it can, under paragraph (C) above, issue leases for offshore CCS projects involving the storage of carbon dioxide “generated as a by-product of . . . coal-fired power plants” (coal CCS projects).¹¹⁹ In BOEM’s view, coal CCS projects support energy production from coal (i.e., a source other than oil and gas), and thus fall within paragraph (C).¹²⁰ That paragraph would not, however, apply to projects involving the storage of carbon dioxide from non-coal sources (e.g., natural gas power plants) (non-coal CCS projects). Where non-coal CCS projects are undertaken using existing facilities previously used in oil and gas drilling, they may fall within the terms of paragraph (D) above, enabling the issuance of leases by BOEM.¹²¹ In all other cases, however, BOEM could not issue leases for non-coal CCS projects.

This differential treatment of coal and non-coal CCS projects appears to be an accidental consequence of attempting to fit offshore CCS within a statutory framework developed for other activities. It is not driven by any rational policy choice, nor could it be as there is no valid basis for distinguishing between coal and non-coal CCS projects, both of which are conducted in the same way and involve the same risks. The distinction serves only to cre-

118. 43 U.S.C. §1337(p)(1).

119. Webb & Gerrard, *supra* note 22, at 18.

120. *Id.*

121. *Id.* BOEM has not taken an official position on whether offshore CCS projects using existing facilities previously used for oil and gas development fall within §8(p)(1)(D) of the OCSLA.

ate uncertainty for project developers and thus discourage investment in offshore CCS.

Adding to the uncertainty faced by project developers, BOEM does not have an established process for issuing leases for coal CCS projects. Generally, under OCSLA, §8(p)(1) leases must be issued “on a competitive basis unless [BOEM] determines . . . that there is no competitive interest” in the lease area.¹²² BOEM regulations establish a detailed process for competitive and noncompetitive leasing under §8(p)(1)(C) of OCSLA.¹²³ Notably, however, those regulations only apply to the issuance of leases for renewable energy projects, and not for other activities.¹²⁴

It is, therefore, unclear how BOEM will approach the leasing of land for coal CCS projects. Assuming it adopts the same process as is currently used for renewable energy projects, it could propose areas for leasing on its own motion or accept requests from interested parties.¹²⁵ In both cases, prior to leasing, BOEM would be required to publish a notice seeking expressions of interest in the lease area from third parties.¹²⁶ If expressions of interest are received, BOEM will issue leases through a competitive auction.¹²⁷ Otherwise, leases will be issued noncompetitively on a first-come, first-served basis.¹²⁸ Prior to issuing any lease, BOEM must conduct various environmental and other reviews, including under NEPA and the ESA.¹²⁹ As part of those reviews, BOEM must consider how leasing will affect the local environment and develop measures to mitigate any adverse effects.¹³⁰

B. Regulation of Offshore CCS Projects in Canadian Waters

As in the United States, currently in Canada there is no comprehensive regulatory framework specifically addressing offshore CCS. Despite this, however, greater certainty exists as to the regulation of offshore CCS because it falls

squarely within the terms of an existing, general program governing “disposal at sea.” That program, which is administered by Environment and Climate Change Canada (ECCC), currently prohibits offshore CCS in Canadian waters, with very limited exceptions. While ECCC has proposed removing the prohibition, even if that were to occur, offshore CCS development in Canadian waters is likely to be hindered by other regulatory programs.

I. ECCC Regulation of Offshore CCS

The Disposal at Sea Program is established in Division 3 of Part 7 of the Canadian Environmental Protection Act (CEPA), which was adopted to fulfill Canada’s obligations under the London Protocol.¹³¹ Consistent with that instrument, the division aims to “protect the marine environment” by regulating offshore “disposal,” which is defined broadly to include (among other things):

- (a) the disposal of a substance at sea from a ship, an aircraft, a platform, or another structure,
- (b) the disposal of dredged material into the sea from any source not mentioned in paragraph (a), [and]
- (c) the storage on the seabed, in the subsoil of the seabed, or on the ice in any area of the sea of a substance that comes from a ship, an aircraft, a platform, or another structure.¹³²

Offshore CCS projects involve injecting carbon dioxide into sub-seabed geologic formations (i.e., effectively the “subsoil of the seabed”) and thus would ordinarily fall within paragraph (c) above. It should be noted, however, that paragraph (c) only covers the sub-seabed injection of materials “that come[] from a ship, an aircraft, a platform or another structure.”¹³³

It appears, then, that offshore CCS projects will only constitute disposal under the CEPA if a structure is used to transport and/or inject carbon dioxide. The CEPA provides little guidance on the meaning of the term “structure,” defining it merely as a “structure that is made by a person.”¹³⁴ Additional guidance has been provided by ECCC, which, when applying paragraph (a) above, has concluded that the term “structure” excludes pipelines.¹³⁵ Applying the same exclusion to paragraph (c), offshore CCS would not involve disposal if a pipeline system were used to transport carbon dioxide offshore and deposit it into the sub-seabed, without the use of any platform or similar structures. It is, however, unclear whether that is technically feasible. Past offshore CCS proposals have typically anticipated the use of platforms, at least initially,

122. 43 U.S.C. §1337(p)(3).

123. 30 C.F.R. §§585.100 et seq. (2018).

124. *Id.* §585.101(a) (providing that the regulations “establish procedures for issuance and administration of leases . . . for renewable energy production on the Outer Continental Shelf”). See also *id.* §585.112 (defining “renewable energy” to mean “energy resources other than oil and gas and minerals”). Coal CCS projects are unlikely to be considered “renewable energy projects” for the purposes of the regulations. Under the regulations, the term “renewable energy” excludes “minerals,” which is defined broadly to include “oil, gas, sulphur, geopressured-geothermal and associated resources, and all other minerals which are authorized by an Act of Congress to be produced from ‘public lands.’” *Id.* §585.112; 43 U.S.C. §1331(q). Thus, while scientists typically only refer to naturally occurring inorganic substances as “minerals,” the regulations appear to use that term more broadly to encompass any substance obtained by mining (i.e., since oil and gas are defined as “minerals” but are not inorganic substances). As coal is a substance obtained by mining, and is authorized to be produced from public lands (i.e., under the Mineral Leasing Act), it is arguably a mineral for the purposes of the regulations. It would not, therefore, fall within the regulatory definition of “renewable energy.”

125. 30 C.F.R. §§585.210, 585.230 (2018).

126. *Id.* §§585.210(a), 585.231(b).

127. *Id.* §§585.220, 585.231(c).

128. *Id.* §§585.201, 585.231(d), 585.232.

129. For a discussion of the requirements under NEPA and the ESA, see *supra* Section III.A.1. See also Webb & Gerrard, *supra* note 22, at 19-21.

130. 30 C.F.R. §§585.211(b), 585.231(e)-(f) (2018).

131. CEPA, S.C. 1999, c. 33, pt. 7, div. 3 (Can.).

132. *Id.* §122(1).

133. *Id.*

134. *Id.*

135. Interview with David Taillefer, Head, Antarctic and Marine Project Development, Environmental Protection Branch, ECCC, in N.Y., N.Y. (Apr. 20, 2018).

which would result in a project being classified as disposal under the CEPA.¹³⁶

Section 125 of the CEPA prohibits, with limited exceptions, the disposal of a substance in specified offshore areas, including Canada's territorial sea and EEZ. In those areas, a substance may only be disposed of if two conditions are met, namely

- (1) "the substance is waste or other matter" of a kind listed in Schedule 5 of the Act¹³⁷; and
- (2) "the disposal is done in accordance with a Canadian permit" issued by the minister of environment and climate change (ECC).¹³⁸ Under the CEPA, the minister of ECC has broad power to issue permits, authorizing the disposal of waste or other matter listed in Schedule 5.¹³⁹

The list in Schedule 5 of the CEPA is based on the original 1996 version of Annex 1 to the London Protocol, and thus does *not* include carbon dioxide.¹⁴⁰ As such, carbon dioxide does not qualify as "waste or other matter" under the CEPA, and its offshore disposal is therefore prohibited by the Act. The minister of ECC cannot issue permits authorizing the offshore disposal of carbon dioxide.

Recognizing that the prohibition on offshore disposal of carbon dioxide is inconsistent with the current version of the London Protocol, in 2016 ECCC recommended that the CEPA "be amended to expressly authorize the Minister of ECC to issue permits for the storage of [carbon dioxide] in sub-seabed geological formations."¹⁴¹ According to ECCC staff, the amendments would not require an act of Parliament, but could be achieved through an order in council, which allows certain legislative action to be taken by the governor-general, with the advice and consent of the cabinet.¹⁴²

As a result, the amendments could be made relatively quickly, with previous orders in council being finalized within six to 12 months.¹⁴³ It is, however, not yet known when the amendment process will begin. While the minister of ECC has previously expressed support for amending the CEPA, this is not currently a priority for the cabinet, with ECCC staff indicating that legislative action may not be taken unless and until a specific offshore CCS project is

proposed.¹⁴⁴ However, in the absence of legislative action, offshore CCS developers may be reluctant to propose projects, creating a "Catch-22" situation.

It should be noted that, even if the CEPA is amended to authorize the issuance of permits for offshore CCS, developers may face delays and other challenges in the permitting process. Under Schedule 6 of the CEPA, before permitting the disposal of materials at sea, ECCC must assess the likely impact thereof, taking into account the nature of the material to be disposed of, the characteristics of the disposal site, and the availability of alternative methods of disposal.¹⁴⁵ ECCC bases its assessment on information provided, and studies conducted, by the permit applicant.¹⁴⁶ ECCC has issued detailed rules governing the application process,¹⁴⁷ but those rules deal solely with applications for permits to dispose of dredged¹⁴⁸ and excavated materials¹⁴⁹ and fish waste,¹⁵⁰ and cannot be readily applied to offshore CCS.¹⁵¹

According to ECCC staff, new CCS-specific rules will need to be developed, which could take several months because the agency will have to consult with other federal and state bodies.¹⁵² Even after the rules are finalized, securing permits for offshore CCS projects could take significant time, including because additional project-specific consultations will need to be undertaken.¹⁵³ Moreover, as part of the permitting process, each project must undergo environmental review in accordance with the Canadian Environmental Assessment Act (CEAA).¹⁵⁴ The CEAA review must include an assessment of, among other things, the environmental impacts of the project and "technically and economically feasible [measures] that would mitigate [those impacts]."¹⁵⁵ Project developers may be required to implement the identified mitigation measures as a condition of any disposal permit issued by ECCC.¹⁵⁶

Offshore CCS developers may have to undergo the above permitting process multiple times because, under the CEPA, disposal permits only remain valid for one

136. Equinor ASA, in partnership with Royal Dutch Shell and Total SA, recently proposed an offshore CCS project that may not require the use of platforms. Under the proposal, carbon dioxide would be captured onshore and transported to a receiving plant on the coast. At the plant, the carbon dioxide would be pumped into storage tanks before being sent through pipelines to offshore injection wells. See *Equinor, Shell, and Total Get Nod for Offshore CO₂ Storage in Norway*, OFFSHORE ENERGY TODAY, Jan. 14, 2019, <https://perma.cc/DN3H-YNT2>.

137. CEPA §125(1)(a). See also *id.* §122(1) (defining "waste or other matter" to mean the "waste or other matter listed in Schedule 5").

138. *Id.* §125(1)(b).

139. *Id.* §§122(1), 127(1).

140. *Id.* sched. 5. See also *supra* Part II, discussing Annex 1 to the London Protocol.

141. ECCC, CANADIAN ENVIRONMENTAL PROTECTION ACT, 1999: ISSUES AND POSSIBLE APPROACHES 22 (2016), <https://perma.cc/E4CN-5VER>.

142. Interview with David Taillefer, *supra* note 135.

143. *Id.*

144. *Id.*

145. CEPA sched. 6.

146. Interview with David Taillefer, *supra* note 135.

147. ECCC, *Disposal at Sea Permit Application Guide*, <https://perma.cc/LG5U-KMRT> (last visited Feb. 25, 2019).

148. ECCC, *Disposal at Sea Permit Application Guide for Dredged Material*, <https://perma.cc/MK5H-PL9M> (last visited Feb. 25, 2019).

149. ECCC, *Disposal at Sea Permit Application Guide for Excavated Material*, <https://perma.cc/3LHV-GAKL> (last visited Feb. 25, 2019).

150. ECCC, *Disposal at Sea Permit Application Guide for Fish Waste*, <https://perma.cc/4RPB-CSHP> (last visited Feb. 25, 2019).

151. Interview with David Taillefer, *supra* note 135.

152. *Id.*

153. Notice of the filing of a permit application must be published in a newspaper circulating in the vicinity of the proposed project area. See CEPA §128(3)(d). Members of the public are encouraged to comment as part of the permit review process. See generally ECCC, FACT SHEET: DISPOSAL AT SEA IN BRITISH COLUMBIA (2009), <https://perma.cc/P5Q9-YT8Q>.

154. Under the CEPA, an environmental assessment must be conducted for any project involving a physical activity that is prescribed by regulations, or designated by the minister of the environment. See CEAA, S.C. 2012, c. 19, §§2, 13, 14. The minister has designated disposal at sea as an activity requiring assessment under the Act. See ECCC, *supra* note 150, at 2.

155. CEAA §19(1).

156. *Id.* §129(1).

year¹⁵⁷ and can be renewed no more than four times.¹⁵⁸ Thus, permits have a maximum term of five years, but many offshore CCS projects will operate over longer periods, forcing developers to obtain multiple permits. The costs and uncertainty associated with undergoing multiple permitting processes may discourage developers from investing in offshore CCS.

2. Other Regulatory Programs Applicable to Offshore CCS

Even if the above issues are addressed, offshore CCS development in Canadian waters may be hindered by other factors, including uncertainty regarding the treatment of projects under other laws. For example, significant uncertainty exists as to whether project developers are legally required to hold an interest in the sub-seabed, where carbon dioxide will be stored. Such a requirement could be inferred from the Oceans Act, which declares that the federal government has exclusive “rights over the continental shelf of Canada,”¹⁵⁹ including the “seabed and subsoil of the submarine areas” below the EEZ (and further in some circumstances).¹⁶⁰

The Canada Petroleum Resources Act (CPRA) authorizes the federal minister of natural resources to grant interests in the continental shelf to third parties.¹⁶¹ However, those interests only permit the development of oil and gas resources in the continental shelf and do not deal with its use for other purposes, including offshore CCS.¹⁶² Neither the CPRA nor any other statute expressly provides for the grant of interests to use the continental shelf for offshore CCS, leading to uncertainty as to whether and how offshore CCS project developers can obtain such an interest.¹⁶³

157. *Id.* §129(2).

158. *Id.* §127(1).

159. Oceans Act, §18 (declaring that the federal government has “sovereign rights over the continental shelf of Canada for the purpose of exploring it and exploiting the mineral and other non-living natural resources of the seabed and the subsoil of the continental shelf of Canada, together with living organisms belonging to sedimentary species”).

160. *Id.* §17 (defining the “continental shelf of Canada” as “the seabed and subsoil of the submarine areas, including those of the exclusive economic zone of Canada, that extend beyond the territorial sea of Canada throughout the natural prolongation of the land territory of Canada” to the farthest of “the outer edge of the continental margin” or “a distance of 200 nautical miles from the baseline” used for determining the limit of Canada’s offshore jurisdiction).

161. CPRA, R.S.C. 1995, c. 36 (2d Supp.), §13(1) (authorizing the minister to “issue interests in respect of any frontier lands”). *See also id.* §2 (defining “frontier lands” to include “the continental shelf of Canada”).

162. *Id.* §2 (defining the term “interest” to mean any “exploration license, production license, or significant discovery license” or former versions of those instruments). *See also id.* §§22, 29, 37 (specifying the rights conferred by an exploration license, significant discovery license, and production license, respectively).

163. Natural Resources Canada (NRCan) staff indicated that, based on an initial review of the CPRA, it appears that interests issued under the Act do not permit use of the sub-seabed for offshore CCS. NRCan has not, however, reached an official conclusion on this issue. Interview with Candace Newman, Senior Policy Advisor, Energy Sector, NRCan, in N.Y., N.Y. (Apr. 20, 2018).

Developers wanting to engage in offshore CCS in the Cascadia Basin face additional challenges, because part of the basin and surrounding areas have been proposed for designation as a “marine protected area” under the Oceans Act.¹⁶⁴ Section 35 of the Oceans Act authorizes the governor in council, on the recommendation of the minister of fisheries and oceans, to designate offshore areas requiring special protection due to their ecological or biological significance.¹⁶⁵ Once an area is designated, regulations may be adopted prohibiting or restricting activities therein.¹⁶⁶

The minister of fisheries and oceans is currently assessing whether to recommend designation of an area—known as the “Offshore Pacific Area of Interest”—covering approximately 139,700 square kilometers west of Vancouver Island.¹⁶⁷ The Offshore Pacific Area of Interest is considered ecologically significant due to the presence of unique seafloor features, including seamounts¹⁶⁸ and hydrothermal vents,¹⁶⁹ which help to support biodiversity.¹⁷⁰ Those features would, if the Offshore Pacific Area of Interest is designated, be protected through regulations that may limit activities in the area.

Regulations applying to other designated areas have, for example, included a general prohibition on activities that disturb living marine organisms and their habitats.¹⁷¹ However, the regulations typically exempt activities under-

164. Fisheries and Oceans Canada, *Offshore Pacific Area of Interest (AOI)*, <https://perma.cc/PP5Q-4WAM> (last visited Aug. 1, 2018).

165. Oceans Act, §35(3)(a) (authorizing “[t]he Governor in Council, on the recommendation of the Minister, [to] make regulations . . . designating marine protected areas” (among other things)). *See also id.* §35(1), providing that an area may be

designated under this section for special protection for one or more of the following reasons: (a) the conservation and protection of commercial and non-commercial fishery resources, include marine mammals, and their habitats; (b) the conservation and protection of endangered or threatened marine species, and their habitats; (c) the conservation and protection of unique habitats; (d) the conservation and protection of marine areas of high biodiversity or biological productivity; and (e) the conservation and protection of any marine resource or habitat as is necessary to fulfil the mandate of the Minister [of Fisheries and Oceans].

166. *Id.* §35(3)(b), authorizing

[t]he Governor in Council, on the recommendation of the Minister, [to] make regulations . . . prescribing measures that may include but not be limited to (i) the zoning of marine protected areas, (ii) the prohibition of classes of activities within marine protected areas, and (iii) any other matter consistent with the purpose of the designation.

167. Fisheries and Oceans Canada, *supra* note 164.

168. A seamount is an underwater mountain that has an elevation of more than 1,000 meters above the seafloor. *See* CANADIAN SCIENCE ADVISORY SECRETARIAT, FISHERIES AND OCEANS CANADA, IDENTIFICATION OF ECOLOGICALLY AND BIOLOGICALLY SIGNIFICANT AREAS (EBSAS) IN THE OFFSHORE PACIFIC BIOREGION 8 (2016), <https://perma.cc/LB87-H94T>.

169. Hydrothermal vents are a geological feature caused by the spreading of tectonic plates, which results in cracks in the oceanic crust, through which hydrothermal fluid is released. *See* STEPHEN BAN ET AL., FISHERIES AND OCEANS CANADA, IDENTIFICATION OF ECOLOGICALLY AND BIOLOGICALLY SIGNIFICANT AREAS (EBSAS) IN CANADA’S OFFSHORE PACIFIC BIOREGION (2016), <https://perma.cc/3BRQ-V2PT>.

170. *Id.*

171. *See, e.g.*, Anguniaqvia Niqiqy Marine Protected Areas Regulations, SOR/2016-280, §3 (Can.) (stating “[i]t is prohibited in the Marine Protected Areas to carry out any activity that disturbs, damages, destroys or removes from the Marine Protected Areas any living marine organism or any part of its habitat or is likely to do so”).

taken in connection with scientific research and certain commercial activities.¹⁷² According to government representatives, it may be possible to secure an exemption for offshore CCS projects in the Offshore Pacific Area of Interest (if designated), but this would need to be included in the regulations adopted for that area. Thus, until the regulations are finalized or a decision is made not to designate the Offshore Pacific Area of Interest, uncertainty regarding the permissibility of offshore CCS is likely to hamper new project development.

IV. Conclusion

Offshore CCS (i.e., the process by which carbon dioxide is stored in geologic formations beneath the seabed) can play an important role in mitigating climate change by limiting or even reducing the atmospheric concentration of carbon dioxide. During offshore CCS, carbon dioxide that has been captured at its source or removed from the atmosphere is permanently disposed of by injecting it into the sub-seabed.¹⁷³ There is typically little risk of carbon dioxide leaking from the injection site, at least where it consists of basalt rock, which has been shown to react with carbon dioxide and convert it into an immovable solid.¹⁷⁴ One large sub-seabed basalt rock formation, capable of storing significant carbon dioxide, is located off the West Coast of North America in an area known as the Cascadia Basin.¹⁷⁵

Storing carbon dioxide in the Cascadia Basin and other sub-seabed basalt rock formations is thought to be technically feasible. However, storage projects may be hindered by various nontechnical issues, including legal and regulatory issues. As an example, while projects in the Cascadia Basin are subject to regulation by the United States and/or Canada (i.e., depending on precisely where they occur), neither country has a comprehensive regulatory framework specific to offshore CCS. This creates significant uncertainty as to the treatment of future projects, which will likely be regulated under general programs that were developed for other activities, and are often inappropriate for regulating offshore CCS.

In both the United States and Canada, offshore CCS is likely to be regulated under programs established to fulfill the countries' obligations under the London Convention and London Protocol, respectively.¹⁷⁶ The relevant U.S. program, which is administered by EPA under the MPRSA, regulates the dumping of materials at sea.¹⁷⁷ The MPRSA adopts a broad definition of "dumping," which is likely to include the sub-seabed injection of materials, including carbon dioxide.¹⁷⁸

Assuming this is the case, most carbon dioxide injection operations would need to be permitted by EPA,¹⁷⁹ but permits cannot be issued for the dumping of "industrial waste . . . generated by manufacturing or processing plants," which would encompass some and perhaps all sources of carbon dioxide.¹⁸⁰ Thus, the MPRSA would effectively prohibit some, if not all, carbon dioxide injection operations in U.S. federal waters. Similarly, offshore carbon dioxide injection is also prohibited in Canadian waters under the CEPA.¹⁸¹

Amending the MPRSA and CEPA to remove the prohibition on sub-seabed carbon dioxide injection is a necessary first step to enable offshore CCS in U.S. federal and Canadian waters. It is not sufficient by itself, however. Action will also be needed to address a raft of other legal issues that have the potential to restrict, or completely prevent, offshore CCS.

A good example is BOEM's limited authority to issue leases for offshore CCS projects in U.S. federal waters. Under the OCSLA, leases can currently only be issued for projects involving the sub-seabed injection of carbon dioxide sourced from coal-fired power plants, an artificial restriction that is likely to hinder offshore CCS development.¹⁸² To maximize development, this and other similar restrictions will need to be removed, which would require legislative action. Ideally, legislation should be enacted in both the United States and Canada that deals specifically with offshore CCS, establishing a well-defined framework for the regulation of future projects.

172. Interview with Candace Newman, *supra* note 163. See, e.g., Anguniaqvia Niqiqyuam Marine Protected Areas Regulations, SOR/2016-280, §3 (Can.) (indicating that "a scientific research or monitoring activity, educational activity or commercial marine tourism activity may be carried out in the Marine Protected Areas" in certain circumstances).

173. See generally Global CCS Institute, *Understanding CCS*, <https://perma.cc/4SZQ-PV48> (last visited May 28, 2019).

174. Gislason & Oelkers, *supra* note 17.

175. Goldberg et al., *supra* note 16.

176. See *supra* Sections III.A. and III.B.

177. 33 U.S.C. §1401(b).

178. *Id.* §1402(f). See also *supra* Section III.A.1.

179. 33 U.S.C. §1411. A permit is required to transport material from the United States or on a U.S.-registered vessel for the purpose of dumping it at sea and to dump material transported from outside the United States within 12 nautical miles of the U.S. coast.

180. *Id.* §1414b. See also *supra* Section III.A.1.

181. CEPA §§122, 125, 127.

182. 43 U.S.C. §1337(p)(1). See also *supra* Section III.A.2.