10-2024

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ARTICLES

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SUMMARY

A number of facilities intended for permanent sequestration of carbon dioxide are being developed in the United States. Several will be located on or near the coast of the Gulf of Mexico, making them easily accessible to ships. Meanwhile, in Europe there is substantial interest in capturing carbon dioxide from industrial operations, but currently inadequate sequestration facilities, and growing interest in shipping carbon dioxide for sequestration in the United States. This Article reviews the main U.S. federal laws applicable to transportation and geologic storage of carbon dioxide, including laws enacted to implement relevant international treaties. The Article also contextualizes its main findings in light of the National Environmental Policy Act's application to projects involving transportation and related storage of carbon dioxide. Finally, it considers paradigmatic state laws on the topic, namely those from Louisiana, North Dakota, Wyoming, and Texas.

A number of large facilities intended for permanent sequestration of carbon dioxide are being developed in the United States.[1] Several of these will be located in Texas and Louisiana on or near the coast of the Gulf of Mexico, making them easily accessible to ships.[2] At the same time, there is substantial interest in Europe in installing equipment to capture carbon dioxide from certain industrial operations before it is emitted into the atmosphere,[3] but currently there are inadequate facilities

Authors' Note: The authors are grateful to Pria Deanna Mahadevan for her excellent edits on earlier drafts of this Article. They appreciate Prof. Romany Webb's thoughtful comments throughout their writing. The authors also appreciate the excellent work of Hunter Jones and fellow ELR *editors. This Article is based on Chapters 5 and 6 of their report titled "Legal Issues in Oceanic Transport of Carbon Dioxide for Sequestration." The research was funded by Peter G. Livanos, chairman of EcoLog Ltd. The views presented here are those of the authors alone.*

1. These developments benefited from recently enacted federal legislation, chief among them being the Infrastructure and Investment Jobs Act of 2021, which allocates $12 billion for new investment in carbon capture, use, and storage (*see* Infrastructure and Investment Jobs Act, Pub. L. No. 117-58, 135 Stat. 1467 (2021)), the Inflation Reduction Act of 2022, earmarking $369 billion to climate and energy funding over the next decade and creating additional tax incentives through enhancements to Internal Revenue Code §45Q for direct air capture and carbon capture and storage (CCS) (*see* Inflation Reduction Act, Pub. L. No. 117-169, 136 Stat. 1818 (2022), including funding for new programs and previously approved demonstrations of programs under the Energy Act of 2020), and related boost for CCS research and monitoring capabilities for storage under the U.S. Department of Energy (DOE) (*see* Creating Helpful Incentives to Produce Seminconductors (CHIPS) Act, Pub. L. No. 117-167, §10102, 136 Stat. 1366 (2022)). Meanwhile, additional federal funding for the transportation stages of the CCS chain, including shipping of carbon dioxide for storage in the United States, made headlines lately. *See, e.g.*, Press Release, DOE Office of Energy and Carbon Management, DOE Announces $500 Million to Build a Safe and Reliable Carbon Dioxide Transportation System (May 2, 2024).
2. Global CCS Institute, Global Status of CCS 2023, at 29-32 (2023), https://www.globalccsinstitute.com/wp-content/uploads/2023/11/GSR23-Executive-Summary_PDF.pdf (The United States is leading the global CCS landscape, with 73 CCS facilities operating, in construction, and in development. In Louisiana, the report notes the recent decision to build a Central Louisiana Regional Carbon Storage Hub (CENLA Hub); in Texas, the report highlights the construction of the Bayou Bend CCS project and the Costal Bend CCS project, the latter in Corpus Christi.).
3. This interest is poised to increase as carbon pricing within the European Union (EU) and, more broadly, within the European Economic Area rises under the European Union Emissions Trading System (EU ETS). The EU

existing in Europe to sequester much of this carbon dioxide.[4] Moreover, pressure is increasing for countries—and developed countries, in particular—to curb their emissions under international treaties,[5] with the Intergovernmental Panel on Climate Change (IPCC) having long established carbon capture and storage (CCS) as "an option in the portfolio of mitigation actions for stabilization of atmospheric greenhouse gas concentrations."[6] Therefore, there is interest in the possibility of using ships to transport carbon dioxide that has been captured in Europe to the United States for sequestration.

In that context, this Article reviews the main U.S. federal laws applicable to the transportation and geologic storage of carbon dioxide, including laws enacted to implement relevant international treaties to which the United States is a Party or treaties with which the United States must comply under customary international law, despite not being a Party.[7] It also considers paradigmatic state laws on the topic, namely those from Louisiana, North Dakota, Texas, and Wyoming. This review is based on activities related to geological carbon sequestration, specifically the storage of carbon dioxide in underground geologic formations.[8] It does not address the subsurface injection of carbon dioxide for enhanced oil recovery.

The Article builds on our previous research on the existing requirements imposed under international law.[9] As it focuses exclusively on U.S. federal and subnational laws that may be relevant to international transport of carbon dioxide for permanent storage (i.e., sequestration), a detailed analysis of U.S. law concerning reservoirs, pipelines, and the like is outside the scope of this research. That said, the Article analyzes eventual requirements that current pipeline regulations may impose regarding purity standards and specifications for carbon dioxide streams.

The Article is divided into three parts. Part I focuses on federal legislation that may potentially apply to the cross-border shipping of carbon dioxide for permanent storage in the United States. It is further divided into two subsections that address carbon dioxide transportation and carbon dioxide storage, respectively. Part II outlines current state experiences in handling the transportation for permanent storage of carbon dioxide. It centers on how states have handled provisions under the Safe Drinking Water Act (SDWA),[10] one of the federal statutes outlined in the first part. Four states present paradigmatic experiences relevant to this research: Louisiana, North Dakota, Wyoming (all three with SDWA primacy), and Texas (due to its location). Finally, Part III concludes with our main findings.

ETS is regulated under Directive 2003/87/EC of the European Parliament and of the Council of 13 October 2003 Establishing a Scheme for Greenhouse Gas Emission Allowance Trading Within the Community and Amending Council Directive 96/81/EC, 2003 O.J. (L 275) 32. This ETS is considered the basis of the EU's climate policies. *See* Lorenzo Squintani et al., *Regulating Greenhouse Gas Emissions From EU ETS Installations: What Room Is Left for Member States?*, *in* Climate Law in EU Member States: Towards National Legislation for Climate Protection 67, 67-70 (Marjan Peeters et al. eds., Edward Elgar 2012).

Related to the EU ETS is the Carbon Border Adjustment Mechanism of the European Union, more commonly known as the CBAM. The EU ETS and the CBAM share a common objective of pricing greenhouse gas (GHG) emissions from the same sectors and goods by using specific allowances or certificates. Both systems are regulatory in nature and are based on the need to curb GHG emissions, as is required by the binding environmental target under EU law. Regulation 2023/956 of the European Parliament and of the Council of 10 May 2023 Establishing a Carbon Border Adjustment Mechanism, 2023 O.J. (L 130) 52, item 20, https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv%3AOJ.L_.2023.130.01.0052.01.ENG&toc=OJ%3AL%3A2023%3A130%3ATOC [https://perma.cc/Z993-UPND].

4. Stephen Rassenfoss, *Europe Wants to Export Its CO_2; The Question Is: Who Wants It?*, J. Petroleum Tech. (Jan. 15, 2023), https://jpt.spe.org/europe-wants-to-export-its-co2-the-question-is-who-wants-it (highlighting that Europe overall lacks vast storage capacity, except for a few countries such as Denmark, Iceland, and Norway).
5. *See, e.g.*, United Nations Framework Convention on Climate Change art. 2, May 9, 1992, S. Treaty Doc. No. 102-38, 1771 U.N.T.S. 107 (aiming at stabilizing GHG emissions "at a level that would prevent dangerous anthropogenic interference with the climate system," while providing that the Parties "should protect the climate system for the benefit of present and future generations of humankind, on the basis of equity and in accordance with their common but differentiated responsibilities and respective capabilities," *id*. art. 3(1)). See also Paris Agreement to the United Nations Framework Convention on Climate Change art. 2, Dec. 12, 2015, T.I.A.S. No. 16-1104, which has as its main goal to keep the rise in global average temperature "well below" 2° Celsius (°C) (3.6° Fahrenheit (°F)) above pre-industrial levels, while advancing efforts to cap the temperature increase to 1.5°C (2.7°F) above pre-industrial levels.
6. IPCC, IPCC Special Report on Carbon Dioxide Capture and Storage Prepared by Working Group III of the Intergovernmental Panel on Climate Change 3 (Bert Metz et al. eds., 2005) (This was the first report from the IPCC exclusively on CCS. From the outset, the report established that widespread application of CCS was contingent on technical maturity, costs, overall potential, diffusion, and transfer of the technology to developing countries and their capacity to apply the technology, regulatory aspects, environmental issues, and public perception). According to this seminal report, which predicted the economic attractiveness of carbon dioxide transported by ships, CCS could potentially reduce the overall mitigation costs while increasing flexibility regarding achieving GHG emission reductions. *Id*. at 21-30.
7. Statute of the International Court of Justice art. 38(1), Apr. 18, 1946, 33 U.N.T.S. 993. Article 38(1) reads in part as follows:

> The Court, whose function is to decide in accordance with international law such disputes as are submitted to it, shall apply:
>
> a. international conventions, whether general or particular, establishing rules expressly recognized by the contesting states;
>
> b. international custom, as evidence of a general practice accepted as law[.]

Customary international law is a set of legal rules that restrict the activities of States and are not written down or codified in a specific source; it arises when a significant number of States consistently engage in a pattern of behavior and the conviction has developed among States that this behavior is required by international law. University of South Carolina Law Library, *Guide to International and Foreign Law Research*, https://guides.law.sc.edu/c.php?g=315476&p=2108171 (last updated June 28, 2018) [https://perma.cc/G4L2-RYTK] (noting that the conviction developed among States that this behavior is required by international law is often called *opinio juris* and is understood as the general belief that the observed State practice is legally obligatory).

8. U.S. Geological Survey, *Frequently Asked Questions: What's the Difference Between Geologic and Biologic Carbon Sequestration*, https://www.usgs.gov/faqs/whats-difference-between-geologic-and-biologic-carbon-sequestration (last visited Aug. 5, 2024) [https://perma.cc/3ZU2-K4DM] (differentiating geologic storage from biological storage; the latter is the removal from atmospheric carbon dioxide for storage in vegetation, soil, woody products, and aquatic environments).
9. *See* Carolina Arlota et al., Sabin Center for Climate Change Law, Legal Issues in Oceanic Transport of Carbon Dioxide for Sequestration 43-91 (2024); *see also* Carolina Arlota & Michael B. Gerrard, *The International Legal Framework of Oceanic Shipping of Carbon Dioxide for Permanent Storage*, 47 Fordham Int'l L.J. 377 (2024).
10. 42 U.S.C. §§300f to 300j-26, ELR Stat. SDWA §§1401-1465.

I. Current Federal Laws

There is no comprehensive domestic legal framework regulating the cross-border transportation of carbon dioxide from a foreign country for permanent storage in the United States. Even exclusively domestic transportation faces challenges. In 2010, an interagency report assessed the then-existing elements of a multi-regulatory framework with the goal of determining whether these disparate regulations could be integrated into a single framework for governing CCS.[11] Ultimately, the task force found that a range of barriers, including differences in scope, implementation approaches, administrative procedures, compliance assurance, and enforcement mechanisms, present challenges for creating a unified framework.[12]

In the United States, authority over carbon dioxide imports for permanent storage, to the extent it exists, is generally at the federal level. Despite recent developments in U.S. federal policy, importing carbon dioxide for permanent storage remains subject to different provisions that were not designed with this kind of activity in mind. Importantly, the 2021 Infrastructure Investment and Jobs Act (IIJA)[13] provided a boost for carbon dioxide use and permanent storage.

The specific domestic regulatory requirements for carbon capture, transportation, usage, and storage, and the related implementing agencies, differ depending on several factors, including the location of the project, type of project (experimental or commercial), source of funding (government or private), land ownership (public or private), location of injection wells (onshore or offshore), purity of the carbon dioxide stream, and source of the stream (power generation, industrial processes, or other sources).[14]

The remainder of this part analyzes the extent to which current federal laws may impact the import of carbon dioxide into the United States for permanent storage.[15] This analysis is divided in two sections. Section A discusses the potentially applicable federal statutes regarding the cross-border transportation of carbon dioxide, and Section B focuses on carbon dioxide for storage purposes. This part concludes with a summary of our main findings contextualized in light of the National Environmental Policy Act's (NEPA's)[16] application to projects involving the transportation and related storage of carbon dioxide.

A. Carbon Dioxide Transportation

This section discusses the main federal statutes regulating the cross-border transportation of carbon dioxide for storage, focusing specifically on the Marine Protection, Research, and Sanctuaries Act (MPRSA), the Hazardous Materials Transportation Act (HMTA), and the Act to Prevent Pollution From Ships (APPS).

1. MPRSA

Titles I and II of MPRSA,[17] also referred to as the Ocean Dumping Act,[18] essentially transposes the London Convention into the domestic law of the United States.[19] This subsection focuses exclusively on domestic issues that may impact the cross-border transportation of carbon dioxide for permanent storage in the United States.

MPRSA prohibits (1) transportation of "material" from the United States for the purpose of ocean "dumping"; (2) "transportation" of material from anywhere for the purpose of ocean dumping by U.S. agencies or U.S.-flagged vessels; and (3) dumping of material transported from outside the United States into ocean waters.[20] However, a permit may authorize any of those activities.[21] Implementation of MPRSA is overseen by the U.S. Environmental Protection Agency (EPA).

MPRSA broadly defines "material" as

> matter of any kind or description, including, but not limited to, dredged material, solid waste, incinerator residue, garbage, sewage, sewage sludge, munitions, radiological, chemical, and biological warfare agents, radioactive materials, chemicals, biological and laboratory waste, wreck or discarded equipment, rock, sand, excavation debris, and industrial, municipal, agricultural, and other waste.[22]

Likewise, "dumping" is also broadly defined as "the disposition of any material."[23] Finally, "transportation" is defined as the "carriage and related handling of any material by a vessel, or by any other vehicle, including aircraft."[24]

11. Interagency Task Force on Carbon Capture and Storage, Report of the Interagency Task Force on Carbon Capture and Storage 66 (2010), https://www.energy.gov/fecm/articles/ccstf-final-report [https://perma.cc/FSF7-X9N6].
12. *Id.*
13. IIJA, Pub. L. No. 117-58, §§40306, 40307, 135 Stat. 429, 1002-03 (2021) (amending, for example, the SDWA and including §40307, Geologic carbon sequestration on the outer continental shelf).
14. Interagency Task Force on Carbon Capture and Storage, *supra* note 11, at 66.
15. The U.S. Environmental Protection Agency's (EPA's) Greenhouse Gas Reporting Program, which gathers information on GHG emissions in injection and storage sites, is excluded from our analysis. *See* 40 C.F.R. §98 subpts. RR (for geologic sequestration), UU (for injection).
16. 42 U.S.C. §§4321-4370h, ELR Stat. NEPA §§2-209.
17. 33 U.S.C. §1401.
18. U.S. EPA, *Summary of the Marine Protection, Research, and Sanctuaries Act*, https://www.epa.gov/laws-regulations/summary-marine-protection-research-and-sanctuaries-act (last updated Dec. 14, 2023) [https://perma.cc/4BHH-MKNH].
19. 33 U.S.C. §1402(m).
20. *Id.* §1411 (providing that "Ocean waters," under 33 U.S.C. §1402(b), means "those waters of the open seas lying seaward of the baseline from which the territorial sea is measured").
21. *Id.* §§1411-1412.
22. *Id.* §1402(c).
23. *Id.* §1402(f). There are several exceptions for dumping, but none are likely to apply for permanent storage of carbon dioxide. *But cf.* 33 U.S.C. §1402(f)(1) (It is worth clarifying that one of the exclusions of "dumping" refers to activities regulated within the Federal Water Pollution Control Act (FWPCA), which nowadays—and after numerous amendments—is commonly known as the Clean Water Act, 33 U.S.C. §§1251-1387, ELR Stat. FWPCA §§101-607).
24. *Id.* §1402(l).

Incidentally, EPA can only issue permits authorizing such dumping if the Agency concludes that it "will not unreasonably degrade or endanger human health, welfare, or amenities or the marine environment, ecological systems, or economic potentialities."[25] EPA will also need to analyze these environmental requirements under the Class VI rule permits as delegated by the SDWA.[26] While the same activity can be regulated by two statutes, the SDWA ultimately applies more directly to storage than transportation considerations. The SDWA and its Class VI rule are discussed in further detail in Section I.B.1 of this Article.

Given the broad definition of "dumping" under MPRSA,[27] sub-seabed carbon dioxide injection for geologic storage may be considered "dumping" and fall within the scope of MPRSA regulation, subject to the IIJA amendment discussed below.[28]

In the past, federal authority supported an interpretation that MPRSA would apply to sub-seabed carbon dioxide injection and storage. As recently as 2017, federal agencies underscored that MPRSA, much like the London Convention, aims to prevent the dumping of waste streams into the sea and, as such, "[i]njection of CO_2 [carbon dioxide] into deep (> 3,000 m [meters]) ocean waters or near-surface seabed sediments may be considered ocean dumping."[29] Likewise, EPA has previously considered that MPRSA may be applicable to offshore permanent storage of carbon dioxide streams, stating that "[s]ub-seabed [carbon dioxide (CO_2)] injection for [geological storage] may, in certain circumstances, be defined as ocean dumping and subject to regulation under the MPRSA."[30]

More recently, it has been pointed out that the definition of "dumping" under MPRSA[31] "excludes 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.'"[32] Therefore, the permanent storage of sub-seabed carbon dioxide could qualify as "dumping" under MPRSA, as this storage is arguably a type of disposal.

Importantly, the IIJA recently clarified that a carbon dioxide stream injected for permanent sequestration into the outer continental shelf (OCS) is not considered to be "material" under MPRSA.[33] Therefore, no permits under MPRSA are required for storage in the OCS.[34] While the IIJA clarified the lack of any MPRSA-triggered permits for storage in the OCS, the Act does not clarify how MPRSA might regulate sub-seabed carbon dioxide injection and storage outside of the OCS.

Here, it helps to shift attention away from the definition of "dumping" into the definition of "transportation" under MPRSA, given its broad definition of "transportation."[35] The analysis is complex. MPRSA requires a permit for the transportation of material from outside the United States if the transportation occurs on a vessel or aircraft registered in the United States or flying the U.S. flag and the material is to be dumped into U.S. ocean waters.[36] The IIJA,

25. *Id.* §1412(a) (listing several factors that EPA may consider in its assessment, including the need for such dumping activities and their impact on recreation, ocean life, and ecosystems, among others). *See also* 40 C.F.R. §227.
26. Section I.B details the discussion of Class VI rules.
27. 33 U.S.C. §1402(f).
28. MPRSA, as amended by the IIJA, specifically says that MPRSA permits are not required for offshore carbon storage. However, were this not the case, permanent storage occurring within 12 nautical miles from the United States' coast would require a permit. If permanent storage occurred outside these 12 nautical miles and the discharge originated from a U.S. registered vessel (or a foreign vessel loaded in the United States), a permit would also be required. *See* 33 U.S.C. §1411. That said, there is reciprocity for international vessels carrying substances (including carbon dioxide), so permits issued by other Member States of the convention are recognized outside the 12 nautical miles from the United States. *See id.* §1412(e).
29. Bureau of Ocean Energy Management, U.S. Department of the Interior, Best Management Practices for Offshore Transportation and Sub-Seabed Geologic Storage of Carbon Dioxide 19 (Rebecca C. Smyth & Susan D. Hovorka eds., 2017), https://espis.boem.gov/final%20reports/5663.pdf [https://perma.cc/7TEH-UMAS]. The Bureau of Ocean Energy Management's (BOEM's) careful language is probably based on the international law controversy about the inclusion of carbon capture for offshore storage in the list of prohibited substances in Annex I of the London Convention. The key contention is that the convention aims only to control dumping "at sea" (in other words, in the water) and thus would not cover carbon dioxide storage, as that would occur in geological formations below the sea column. *See, e.g.*, Ian Havercroft & Ray Purdy, U.N. Sustainable Development, Carbon Capture and Storage—A Legal Perspective 3 (2007), https://sustainabledevelopment.un.org/content/documents/1486havercroft_paper_legal.pdf [https://perma.cc/R5PL-AW4P].

    A contrary school of thought interprets the term "dumping at sea" to include anything that occurs at sea, whether it involves discharges into the water column or injection into the seabed. *Cf.* Yvette Carr, *The International Legal Issues Relating to the Facilitation of Sub-Seabed CO_2 Sequestration Projects in Australia*, 2007 Australian Int'l L.J. 137, 143-45 (2007) (noting that carbon dioxide storage would be considered prohibited under the London Convention).
30. Federal Requirements Under the Underground Injection Control (UIC) Program for Carbon Dioxide (CO_2) Geologic Sequestration (GS) Wells, 75 Fed. Reg. 77230, 77236 (Dec. 10, 2010) [hereinafter Class VI Rule], https://www.govinfo.gov/content/pkg/FR-2010-12-10/pdf/2010-29954.pdf [https://perma.cc/G56E-3RGM] (This is in the context of the Class VI rule, which will be analyzed later in this Article.).
31. 33 U.S.C. §1402(f). According to MPRSA, the definition of "dumping" includes the disposition of "any material" except, among others,

    > 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.
32. Romany M. Webb & Michael B. Gerrard, Sabin Center for Climate Change Law, Overcoming Impediments to Offshore Carbon Dioxide Storage: Legal Issues in the U.S. and Canada 17 (2019).
33. IIJA §40307(c) states:

    > A carbon dioxide stream injected for the purpose of carbon sequestration under subparagraph (E) of section 8(p)(1) of the Outer Continental Shelf Lands Act (43 U.S.C. 1337(p)(1)) shall not be considered to be material (as defined in section 3 of the Marine Protection, Research, and Sanctuaries Act of 1972 (33 U.S.C. 1402)) for purposes of that Act (33 U.S.C. 1401 et seq.).
34. The OCS includes the Gulf of Mexico. *See* U.S. Department of the Interior (DOI) BOEM, *Gulf of Mexico OCS Region*, https://www.boem.gov/regions/gulf-mexico-ocs-region (last visited Aug. 5, 2024) [https://perma.cc/N5VR-WYD9].
35. 33 U.S.C. §1402(l) provides as follows: "'Transport' or 'transportation' refers to the carriage and related handling of any material by a vessel, or by any other vehicle, including aircraft."
36. 33 U.S.C. §1412(a) states:

    > [T]he Administrator may issue permits, after notice and opportunity for public hearings, for the transportation from the United States or, in the case of an agency or instrumentality of the United States or in the case of a vessel or aircraft registered in the United States or flying the United States flag, for the transportation from a location outside the United States, of material for the purpose of dumping it into ocean waters, or for the dumping of material into the waters described in section 1411(b) of this title, where the Administrator determines that such dumping will not unreasonably degrade or

however, says that carbon dioxide to be stored in the subseabed of the OCS does not qualify as "material."[37]

Considering such statutes, an MPRSA permit will only be required for transportation from overseas if the transportation is done using a U.S. vessel and the dumping will occur in an area other than the OCS. Assuming that no carbon dioxide will be dumped in the water column, that leaves the seabed underlying state waters. In practice, it can be inferred that MPRSA does not apply to the carbon dioxide injection into the seabed underlying state waters. This injection is deemed controlled by the SDWA,[38] because EPA requires SDWA permits for sub-seabed injected in state waters.[39] Because MPRSA has a quite broad preemption clause,[40] if MPRSA were to apply, SDWA permits would not be required.[41]

Both the SDWA and MPRSA contain substantive environmental protection requirements that would need to be satisfied prior to the start of geologic storage.[42] EPA has already considered the need for coordination between these two regulations.[43] Importantly, these laws do not appear to impose additional restrictions on the source and overall purity of the carbon dioxide streams for permanent storage in the United States.

Finally, it is worth clarifying MPRSA's scope regarding industrial waste. MPRSA does not authorize the issuance of permits for "industrial waste,"[44] which is defined as "any solid, semisolid, or liquid waste generated by a manufacturing or processing plant."[45] Nonetheless, federal agencies have highlighted that if carbon dioxide qualifies as "industrial waste," MPRSA can be interpreted to ban permanent offshore storage of carbon dioxide *outside* the OCS.[46] (As noted above, the IIJA exempts offshore storage from MPRSA *within* the OCS.)

It has been contended that carbon dioxide streams captured from power plants or other industrial processes are more likely to qualify as "industrial waste," whereas carbon dioxide streams captured from carbon dioxide removal processes may be less likely to qualify as "industrial waste."[47] The classification of carbon dioxide for permanent storage as "industrial waste" could mean that MPRSA would conflict with the offshore storage of carbon dioxide. In practice, this issue is not consequential, as MPRSA would only apply to state waters, which are deemed under the SDWA's purview (instead of MPRSA), under EPA's interpretation, as discussed above.

2. The HMTA

The HMTA aims to protect against the risks to life, property, and the environment inherent in the transportation of hazardous material in intrastate, interstate, and foreign commerce.[48] It also sets detailed requirements for carriers of "hazardous materials," as defined by the Secretary of Transportation.[49] Our analysis of the HMTA is divided in two subsections: the first focuses on HMTA requirements for transportation of carbon dioxide by ship, while the second focuses on HMTA requirements for transportation by pipelines.

☐ *Ship-based transport.* The U.S. Coast Guard, which lies within the Department of Homeland Security,[50] is responsible for enforcing the HMTA requirements with respect to the transportation of hazardous materials via ship.[51] The HMTA establishes shipping documentation and disclosure requirements applicable to the transport of hazardous waste,[52] as well as general requirements for bulk and non-bulk packaging of hazardous materials.[53]

Regulations adopted under the HMTA establish general requirements for the shipment of compressed gases and other hazardous materials in cylinders, pressure receptacles, and spherical pressure vessels.[54] More specifically, compressed gases must be in United Nations (U.N.) pressure receptacles built in accordance with the U.N. standards or in metal cylinders and containers built in accordance with U.S. Department of Transportation (DOT) regulations.[55]

endanger human health, welfare, or amenities, or the marine environment, ecological systems, or economic potentialities.

Ocean waters are defined under 33 U.S.C. §1402(b) as "those waters of the open seas lying seaward of the base line from which the territorial sea is measured." In practice, within 12 nautical miles of the United States coast, as further explained.

37. IIJA §40307(c).
38. SDWA, 42 U.S.C. §§300h et seq. Part II details the discussion of the SDWA and Class VI rules for injection and storage of carbon dioxide.
39. *See* 40 C.F.R. §144.l (e). *See also* Class VI Rule, *supra* note 30, at 77235.
40. 33 U.S.C. §1416.
41. Special thanks to Romany Webb for highlighting this possibility.
42. Class VI Rule, *supra* note 30, at 77236; 33 U.S.C. §1402 (for MPRSA).
43. Class VI Rule, *supra* note 30, at 77236-37.
44. 33 U.S.C. §1412a (regulating emergency dumping of industrial waste).
45. *Id.* §1412a(b) (defining "industrial waste").
46. Bureau of Ocean Energy Management, U.S. Department of the Interior, *supra* note 29, at 212.
47. Webb & Gerrard, *supra* note 32, at 17-18.
48. HMTA, 49 U.S.C. §5101 (codified at 49 C.F.R. §171).
49. 49 U.S.C. §5102(2) (defining "hazardous material" as "a substance or material the Secretary designates under [49 U.S.C. §5103(a)]").
50. The U.S. Coast Guard, which was established in 1915 (14 U.S.C. §1), became a part of the U.S. Department of Transportation (DOT) in 1967, pursuant to the Department of Transportation Act of October 15, 1966. Upon the enactment of the Homeland Security Act of 2022, Pub. L. No. 107-296, 116 Stat. 2135, the Coast Guard was transferred from DOT to the Department of Homeland Security on March 1, 2023. *See* Federal Register, *Coast Guard*, https://www.federalregister.gov/agencies/coast-guard (last visited Aug. 5, 2024) [https://perma.cc/2SFL-L8N7].
51. 49 U.S.C. §5121(c) (authorizing the Secretary of Transportation to delegate such enforcement authority).
52. *Id.* §5110.
53. *Id.* §5110(a). *See* 49 C.F.R. §§171, 173, 178-80 (highlighting that the regulations are applicable to bulk and non-bulk packaging; the effectiveness of packaging is not reduced during transportation; and that effectiveness of packaging cannot be reduced from the mixture of gases or vapors).
54. 49 C.F.R. §173.301(a) provides as follows:

    General qualifications for use of cylinders. Unless otherwise stated, as used in this section, the term "cylinder" includes a UN pressure receptacle. As used in this subpart, filled or charged means an introduction or presence of a hazardous material in a cylinder. A cylinder filled with a Class 2 hazardous material (gas) and offered for transportation must meet the requirements in this section and §§173.301a through 173.305, as applicable.
55. *Id.* §173.301(a)(1) (And as specified, "and [Interstate Commerce Commission] specifications and part 178 of this subchapter in effect at the time of manufacture or [Canadian Railway Commission], [Board of Transport Commissioners for Canada], [Canadian Transport Commission] or [Transport Canada] specification, and requalified and marked as prescribed in subpart C in part 180 of this subchapter, if applicable.").

A pressure relief device is not required for carbon dioxide cylinders that meet these dimensions.[56]

Carbon dioxide is listed as a Class 2.2 (nonflammable gas) hazardous material under DOT regulations.[57] According to the table in §172.101 of the HMTA as well as the related vessel stowage requirements in §172.101(k)(2), carbon dioxide refrigerated liquid falls into stowage category "B." This means that carbon dioxide must be stowed "on deck" or "under deck" on either a cargo vessel or a passenger vessel. If stowed on a passenger vessel, the HMTA provides additional limitations on the number and density of passengers on the ship. The Act provides that the number of passengers either cannot (1) exceed 25 people, or (2) exceed one passenger per three meters of vessel length; whichever number of passengers is larger is considered the limit. If a passenger vessel exceeds both of these numbers, the transport of carbon dioxide is prohibited.[58]

☐ *Pipeline-based transport.* The HMTA delegates regulatory authority over pipeline safety to the Pipeline and Hazardous Materials Safety Administration (PHMSA), an agency within DOT.[59]

PHMSA issues and enforces regulations on the construction, operation, maintenance, and spill response planning for certain carbon dioxide pipelines.[60] Although several agencies are involved in the regulation of interstate pipelines in the United States, only PHMSA has federal safety regulatory authority over pipelines carrying carbon dioxide.[61] PHMSA regulations specify the scope of application of the HMTA regarding carbon dioxide in federal and state waters and related exclusions.[62] States regulate intrastate pipeline safety[63] and are subject to minimum federal law requirements.[64]

The scope of PHMSA regulation covers "pipeline facilities and the transportation of hazardous liquids or carbon dioxide associated with those facilities in or affecting interstate or foreign commerce, including pipeline facilities on the Outer Continental Shelf (OCS)."[65] Under PHMSA's regulations, the OCS is defined as "submerged lands lying seaward and outside the area of lands beneath navigable waters as defined in Section 2 of the Submerged Lands Act (43 U.S.C. 1301) and of which the subsoil and seabed appertain to the United States and are subject to its jurisdiction and control."[66] In practice, the OCS generally extends between three to 200 nautical miles (NM) from the U.S. coast.[67] This includes the relevant portions of the Gulf of Mexico.

PHMSA regulations define "carbon dioxide" as "a fluid consisting of more than 90 percent carbon dioxide molecules compressed to a supercritical state."[68] While PHMSA regulations apply to pipelines transporting carbon dioxide in a supercritical liquid state,[69] they do not regulate pipelines transporting carbon dioxide in a subcritical fluid or gaseous state.[70] PHMSA could, under its existing authority, also adopt regulations applying to the transport of gaseous carbon dioxide,[71] but arguably lacks authority to regulate interstate and intrastate pipelines transporting liquid carbon dioxide.[72]

PHMSA regulations also specifically exclude transportation of carbon dioxide "through onshore production (including flow lines), refining, or manufacturing facilities or storage or in-plant piping systems associated with such facilities."[73] Likewise, it excludes from its scope of application the transportation of carbon dioxide by ships and other non-pipeline modes of transportation.[74]

56. *Id.* §173.301(f)(7)(i).
57. *Id.* §172.101. According to the table in §172.101, and related vessel stowage requirements in §172.101(k)(2), carbon dioxide refrigerated liquid has a stowage category "B," meaning:
    > (i) The material may be stowed "on deck" or "under deck" on a cargo vessel and on a passenger vessel carrying a number of passengers limited to not more than the larger of 25 passengers, or one passenger per each 3 [meter] of overall vessel length; and (ii) "On deck only" on passenger vessels in which the number of passengers specified in paragraph (k)(2)(i) of this section is exceeded.
58. *Id.* (table in §172.101, and related vessel stowage requirements in §172.101(k)(2)).
59. HMTA, 49 U.S.C. §§5101-5127 (codified at 40 C.F.R. §§171-180); 49 U.S.C. §60102(a).
60. 49 C.F.R. §190, §§195-199 (Importantly, PHMSA regulations apply to carbon dioxide pipelines carrying carbon dioxide as a supercritical liquid. *See* 49 C.F.R. §195.2: "*Carbon dioxide* means a fluid consisting of more than 90 percent carbon dioxide molecules compressed to a supercritical state.").
61. Michael B. Gerrard & Justin Gundlach, *CCS in US Climate Change Policy*, *in* Carbon Capture and Storage: Emerging Legal and Regulatory Issues 101, 108-09 (Ian Havercroft et al. eds., Bloomsbury Publishing 2019) (explaining that the Federal Energy Regulatory Commission, the Surface Transportation Board, and the Office of Pipeline Safety in DOT's PHMSA regulate the siting, economics, and safety of several interstate pipelines in the country).
62. 49 C.F.R. §195.1(b)(5), (6), (7). These regulations apply to the "transportation of hazardous liquids or carbon dioxide."
63. Gerrard & Gundlach, *supra* note 61, at 109. For a website with links to state performance, including incidents and accidents across the country, see DOT PHMSA, *State Pages*, https://primis.phmsa.dot.gov/comm/States.htm?nocache=8261 (last visited Aug. 5, 2024) [https://perma.cc/2PA3-RMDM].
64. *See, e.g.*, DOT PHMSA, *Federal Effort*, https://www.phmsa.dot.gov/pipeline/effort-allocation/federal-effort (last updated Mar. 11, 2024) [https://perma.cc/9H9U-DAW7].
65. 49 C.F.R. §195.1(a).
66. *Id.* §195.2.
67. 43 U.S.C. §§1301, 1301(b). The definition of "OCS" is detailed in the Outer Continental Shelf Lands Act (OCSLA) analysis (Section I.B.3 of this Article).
68. 49 C.F.R. §195.2.
69. *Id.* §195.1(a).
70. Seth Kerschner & Taylor Pullins, *How US Environmental Laws and Regulations Affect Carbon Capture and Storage*, White & Case (Jan. 29, 2021), https://www.whitecase.com/insight-our-thinking/how-us-environmental-laws-and-regulations-affect-carbon-capture-and-storage [https://perma.cc/D7BP-X3A8].
71. 49 C.F.R. §60102(i).
72. California Natural Resources Agency, Proposal to the Legislature for Establishing a State Framework and Standards for Intrastate Pipelines Transporting Carbon Dioxide 4 (2023). *See also* Martin Lockman, Sabin Center for Climate Change Law, Permitting CO_2 Pipelines: Assessing the Landscape of Federal and State Regulations (2023).
73. 49 C.F.R. §195.1(b)(8).
74. 49 C.F.R. §195.1(b)(9)-(10) states:
    > (9) Transportation of hazardous liquid or carbon dioxide:

Carbon dioxide is classified as a "highly volatile and non-flammable/non-toxic" fluid under PHMSA regulations.[75] Despite carbon dioxide being listed as a Class 2.2 (nonflammable gas) hazardous material under DOT regulations,[76] PHMSA currently applies similar safety requirements to carbon dioxide pipelines as it does to pipelines carrying hazardous liquids, such as crude oil and anhydrous ammonia.[77]

However, PHMSA regulations do not specifically include carbon dioxide within its definition of "hazardous liquids."[78] In other words, while PHMSA regulations do not identify carbon dioxide as a "hazardous liquid," they impose requirements for carbon dioxide pipelines similar to those imposed on other pipelines carrying hazardous liquids. This approach has been justified based on the fact that the pipelines carry highly pressurized carbon dioxide in a supercritical phase much like pipelines carrying other hazardous material.[79]

Under PHMSA regulations, pipeline owners and operators are required to ensure that carbon dioxide streams are chemically compatible with the pipeline and related commodities within the pipeline, and will not corrode the pipeline and pipeline systems.[80] Therefore, owners and operators are incentivized to comply with the purity levels and overall regulatory requirements for the composition of the stream due to the risks posed by deviating from these requirements, including pipeline corrosion and eventual liability. Operators of pipelines transporting carbon dioxide have additional obligations to investigate the corrosive effect of the carbon dioxide on the pipeline and take adequate steps to mitigate internal corrosion.[81] Moreover, operators of pipelines in the OCS must fulfill specific notification requirements[82] and comply with construction and design requirements for pipelines transporting carbon dioxide.[83]

Considering the analysis above, current PHMSA regulations do not require specific levels of purity of the carbon dioxide stream (except for requiring a substance to be at least 90% pure to qualify as carbon dioxide), and do not impose extra requirements depending on the source of the carbon dioxide.[84] That said, these regulations are in flux. In 2019, PHMSA amended its regulations for pipelines carrying hazardous liquids, providing for additional reporting requirements, inspections, and periodic assessments, among others.[85] In the aftermath of a 2020 accident in Satartia, Mississippi, in which a carbon dioxide pipeline ruptured, prompting the evacuation of several hundred people, in 2022,[86] PHMSA announced a new rule updating the safety regulations for carbon dioxide pipelines.[87]

(i) By vessel, aircraft, tank truck, tank car, or other non-pipeline mode of transportation; or

(ii) Through facilities located on the grounds of a materials transportation terminal if the facilities are used exclusively to transfer hazardous liquid or carbon dioxide between non-pipeline modes of transportation or between a non-pipeline mode and a pipeline. These facilities do not include any device and associated piping that are necessary to control pressure in the pipeline under §195.406(b); or

(10) Transportation of carbon dioxide downstream from the applicable following point:

(i) The inlet of a compressor used in the injection of carbon dioxide for oil recovery operations, or the point where recycled carbon dioxide enters the injection system, whichever is farther upstream; or

(ii) The connection of the first branch pipeline in the production field where the pipeline transports carbon dioxide to an injection well or to a header or manifold from which a pipeline branches to an injection well.

75. *Id.* pt. 195, app. B, tbl.4.
76. *Id.* §172.101.
77. Paul W. Parfomak, Congressional Research Service, IN11944, Carbon Dioxide Pipelines: Safety Issues (2022), https://crsreports.congress.gov/product/pdf/IN/IN11944 [https://perma.cc/F34E-B37Z].
78. 49 C.F.R. §195.2.
79. Matthew Wallace et al., DOE, A Review of the CO_2 Pipeline Infrastructure in the U.S. 32 (2015) (underscoring that, overall, smaller carbon dioxide distribution lines, which transport the carbon dioxide from the trunkline to individual wells, are not subject to these PHMSA safety standards).
80. 49 C.F.R. §195.4 determines: "No person may transport any hazardous liquid or carbon dioxide unless the hazardous liquid or carbon dioxide is chemically compatible with both the pipeline, including all components, and any other commodity that it may come into contact with while in the pipeline."
81. *Id.* §195.579(a).
82. 49 C.F.R. §195.9 establishes:

> Operators of transportation pipelines on the Outer Continental Shelf must identify on all their respective pipelines the specific points at which operating responsibility transfers to a producing operator. For those instances in which the transfer points are not identifiable by a durable marking, each operator will have until September 15, 1998, to identify the transfer points. If it is not practicable to durably mark a transfer point and the transfer point is located above water, the operator must depict the transfer point on a schematic maintained near the transfer point. If a transfer point is located subsea, the operator must identify the transfer point on a schematic which must be maintained at the nearest upstream facility and provided to PHMSA upon request. For those cases in which adjoining operators have not agreed on a transfer point by September 15, 1998, the Regional Director and the [Minerals Management Service] Regional Supervisor will make a joint determination of the transfer point.

83. *Id.* §195 (providing for construction and design requirements). Specific requirements include, for instance, that a carbon dioxide pipeline system must be designed to mitigate the effects of fracture propagation.
84. 49 C.F.R. §195.2 states: "*Carbon dioxide* means a fluid consisting of more than 90 percent carbon dioxide molecules compressed to a supercritical state."
85. *Id.* §195, as amended by Pipeline Safety: Safety of Hazardous Liquid Pipelines, 84 Fed. Reg. 52260 (PHMSA Oct. 1, 2019), https://www.govinfo.gov/content/pkg/FR-2019-10-01/pdf/2019-20458.pdf [https://perma.cc/PXV6-57LH] (These changes were incorporated throughout our analysis.).
86. Press Release, PHMSA, PHMSA Announces New Safety Measures to Protect Americans From Carbon Dioxide Pipeline Failures After Satartia, MS Leak (May 26, 2022), https://www.phmsa.dot.gov/news/phmsa-announces-new-safety-measures-protect-americans-carbon-dioxide-pipeline-failures [https://perma.cc/S9EV-QPFE] ("The carbon dioxide pipeline failure in Satartia, Mississippi in 2020 resulted in local evacuations and caused almost 50 people to seek medical attention.").
87. Pipeline Safety: Requirement of Valve Installation and Minimum Rupture Detection Standards, 87 Fed. Reg. 20940 (PHMSA Apr. 8, 2022).

3. The APPS

The APPS transposes the MARPOL Convention into U.S. domestic law,[88] particularly the convention's Annex VI requirements.[89] MARPOL's focus is on operational discharges, whereas intentional dumping of waste[90] is regulated under the London Convention and Protocol.[91] Under the APPS, "discharge" has the same meaning as it has in the MARPOL Convention,[92] which specifies that "[*d*]*ischarge*, in relation to harmful substances or effluents containing such substances, means any release howsoever caused from a ship and includes any escape, disposal, spilling, leaking, pumping, emitting or emptying."[93]

The APPS[94] subjects U.S.-flagged vessels to inspection regarding compliance with MARPOL's Annex VI requirements. Non-U.S.-flagged vessels are subject to examination under the port State control when operating in U.S. waters.[95] Port State control is "the inspection of foreign ships in national ports to verify that the condition of the ship and its equipment comply with the requirements of international regulations and that the ship is manned and operated in compliance with these rules."[96]

The APPS does not regulate the transportation of carbon dioxide for permanent storage in the United States (though of course if a ship carrying carbon dioxide experienced a spill of its fuel, the APPS would apply to that spill). A recent comprehensive report on carbon capture, utilization, and sequestration by the White House Council on Environmental Quality (CEQ) did not even include the APPS in its analysis.[97] Accordingly, this Article merely mentions the APPS here for the purpose of completeness, as the subject matter the Act regulates does not cover the international shipping of carbon dioxide streams for storage.

B. Carbon Dioxide Storage

This section analyzes the main federal statutes regulating the permanent storage of carbon dioxide, focusing specifically on the SDWA, the Resource Conservation and Recovery Act (RCRA),[98] and the Outer Continental Shelf Lands Act (OCSLA).

1. The SDWA

The SDWA is the main federal statute regulating underground injection activities in the United States, including activities related to the geologic sequestration of carbon dioxide.[99] This subsection starts with a survey of the key definitions in the SDWA and EPA's authority to issue regulations under the Act. It proceeds to introduce the Class VI rule, which governs the underground injection of carbon dioxide for geologic sequestration. Finally, the subsection provides an analysis of the standards for carbon dioxide injection and sequestration under the Class VI rule.

☐ *SDWA overview.* The SDWA imposes federal requirements, administered by EPA, with the possibility of delegation to states of the regulation of underground injection control (UIC) programs to protect underground sources of drinking water. The state regulations must, among other requirements, prohibit any underground injection activity unless authorized by a permit or rule.[100] Injections by federal agencies or on property owned or leased by the federal government are subject to the state's UIC requirements.[101] State UIC regulations shall "contain minimum requirements for effective programs to prevent underground injection which endangers drinking water sources."[102]

EPA regulations issued under the SDWA define an "underground source of drinking water" as an "aquifer or its portion which supplies any public water system or which contains a sufficient quantity of ground water to supply a public water system; and currently supplies drinking water for human consumption; or contains fewer than 10,000 [milligrams/liter] total dissolved solids; and which is not an exempted aquifer."[103]

"Underground injection" is defined as "the subsurface emplacement of fluids by well injection,"[104] excluding "(i) the underground injection of natural gas for purposes of storage; and (ii) the underground injection of fluids or propping agents (other than diesel fuels) pursuant to hydraulic fracturing operations related to oil, gas, or geothermal production activities."[105] Underground injection is considered to endanger drinking water sources if the injection:

88. 33 U.S.C. §1901(5) (determining that "Convention" in the APPS refers to the MARPOL Convention).
89. *Id.* §§1901-1905.
90. International Convention for the Prevention of Pollution From Ships art. 2, Nov. 2, 1973, 1340 U.N.T.S. 61, 12 I.L.M. 319 [hereinafter MARPOL].
91. David Hunter et al., International Environmental Law and Policy 786 (2022).
92. 33 U.S.C. §1901(6) (establishing that "discharge," "emission," "garbage," "harmful substance," and "incident" shall have the meanings provided in the MARPOL Convention).
93. MARPOL, *supra* note 90, art. 2 (3)(a). The definition of "discharge" in MARPOL Article 2(3)(b) excludes, among others, any dumping regulated under the London Convention and release of harmful substances directly arising from the exploration, exploitation, and associated offshore processing of seabed mineral resources.
94. 33 U.S.C. §1902.
95. The U.S. Coast Guard or EPA may bring enforcement action for a violation. *See* APPS §§1903-1907.
96. International Maritime Organization, *Port State Control*, https://www.imo.org/en/ourwork/msas/pages/portstatecontrol.aspx (last visited Aug. 5, 2024) [https://perma.cc/68WQ-UWQY].
97. CEQ, Council on Environmental Quality Report to Congress on Carbon Capture, Utilization, and Sequestration (2021), https://www.whitehouse.gov/wp-content/uploads/2021/06/CEQ-CCUS-Permitting-Report.pdf [https://perma.cc/VMW4-YEUP].
98. 42 U.S.C. §§6901-6992k, ELR Stat. RCRA §§1001-11011.
99. Angela C. Jones, Congressional Research Service, R46192, Injection and Geologic Sequestration of Carbon Dioxide: Federal Role and Issues for Congress 9 (2022), https://sgp.fas.org/crs/misc/R46192.pdf [https://perma.cc/BT8G-R8SZ].
100. SDWA, 42 U.S.C. §300h.
101. *Id.* §300h(b)(1)(D).
102. *Id.* §300h(b)(1).
103. 40 C.F.R. §146.3.
104. 42 U.S.C. §300h(d)(1)(A).
105. *Id.* §300h(d)(1)(B).

> may result in the presence in underground water which supplies or can reasonably be expected to supply any public water system of any contaminant, and if the presence of such contaminant may result in such system's not complying with any national primary drinking water regulation or may otherwise adversely affect the health of persons.[106]

EPA acknowledged that risks to underground sources of drinking water could be posed by the large injection volumes typically present in geologic carbon storage projects, the buoyant and mobile nature of carbon dioxide, the potential existence of impurities in the carbon dioxide stream, and carbon dioxide's corrosivity in the presence of water.[107] EPA listed both hydrogen sulfide and mercury as potential drinking water contaminants associated with impurities in the carbon dioxide stream.[108] The Agency also highlighted that pressures induced by injection may force native brines, or naturally occurring salty water, into underground sources of drinking water. This could lead to the degradation of water quality and adversely impact drinking water.[109]

Pursuant to the SDWA,[110] EPA designated six classes of underground injection wells. These classes consider the type and depth of the injection activity and the potential of this injection to result in endangerment of an underground source of drinking water.[111] Construction, injection depth, design requirements, and operating techniques vary among these well classes.[112] The well class that currently applies most directly to permanent geological carbon dioxide storage is Class VI, which is further detailed in the next subsection.

☐ *The Class VI rule*. Under the SDWA,[113] EPA issued specific safety standards for carbon dioxide injection and sequestration in 2010.[114] The rule created UIC Class VI,[115] a new class of wells for injection of carbon dioxide into geologic formations for long-term storage or geologic sequestration.[116] As such, these standards are often simply referred to as the Class VI rule.[117]

The Class VI rule was the first federal rule to specifically regulate underground carbon dioxide injection for sequestration.[118] Before this rule entered into effect in January 2011, the injection of carbon dioxide was permitted according to either the Class II rule if the injection would occur for enhanced oil recovery purposes, or the Class V rule if the injection was conducted for experimental storage and research purposes.[119]

The Class VI rule establishes the minimum requirements for state UIC programs regulating the "subsurface injection of fluids onshore and offshore under submerged lands within the territorial jurisdiction of states," tribal lands, and any territories.[120] These jurisdictions are defined in the Submerged Lands Act for land beneath navigable waters within state boundaries,[121] and Territorial Submerged Lands Act for land beneath tribal lands and territories.[122] State jurisdiction typically extends 3 NM from shore,[123] but can extend further in some circumstances.[124] States seeking primary enforcement authority for UIC Class VI wells, also known as primacy, must show EPA that the state has jurisdiction over underground injection, that the state meets EPA's minimum requirements for the UIC program, and that the state has the necessary administrative, civil, and criminal enforcement penalty remedies.[125]

EPA delegated primacy to two states: North Dakota (in 2018) and Wyoming (in 2020). In late December 2023, EPA approved Louisiana's primacy authority.[126] In the remaining states and all territories, EPA retains direct implementation authority.[127] EPA is considering applications for primacy from Texas, West Virginia, and Arizona.[128] States that have secured primacy may receive grants from the Administrator of EPA to assist with the costs associated with UIC Class VI wells.[129] Challenges and considerations regarding primacy and the implementation of Class VI wells in different states is discussed in Part II.

☐ *Carbon dioxide injection under the Class VI rule.* The Class VI rule provides minimum federal requirements for the injection of carbon dioxide to protect underground sources of drinking water from endangerment, while providing consistency for the requirements of these injections across the United States.[130]

106. *Id*. §300h(d)(2).
107. Class VI Rule, *supra* note 30, at 77234.
108. *Id*. at 77235.
109. *Id*.
110. 42 U.S.C. §300h.
111. 40 C.F.R. §146.5 (This Article discusses in the next section the main classes of wells pertinent to carbon dioxide for permanent storage.); *id*. §§144 et seq. (regulating endangerment of underground sources of drinking water).
112. Jones, *supra* note 99, at 10.
113. 42 U.S.C. §§300f to 300j-26, 300h(b)(2).
114. Gerrard & Gundlach, *supra* note 61, at 109.
115. 40 C.F.R. §144(6)f.
116. Class VI Rule, *supra* note 30, at 77234-35.
117. *Id*.
118. Jones, *supra* note 99, at 10.
119. *Id*.
120. Class VI Rule, *supra* note 30, at 77235 (See 40 C.F.R. §144.3, for references to tribal government and territories.).
121. 43 U.S.C. §1311.
122. 48 U.S.C. §1705.
123. 43 U.S.C. §§1312-1313.
124. Texas and Florida extend their jurisdiction over the Gulf of Mexico out to 9 NM, and Louisiana extends its jurisdiction out 3 U.S. NM seaward of the baseline from which the breadth of the territorial sea is measured. DOI BOEM, *Outer Continental Shelf*, https://www.boem.gov/oil-gas-energy/leasing/outer-continental-shelf (last visited Aug. 5, 2024) [https://perma.cc/EDX5-MGT6]. *See also* DOI BOEM, *supra* note 34 (highlighting that the OCS includes the Gulf of Mexico). See also our discussion in Section I.B.3.
125. 42 U.S.C. §§1421-1422. *See also* 42 U.S.C. §300h-1 (detailing states' primacy enforcement).
126. U.S. EPA, State of Louisiana Underground Injection Control Program; Class VI Primacy (2023), https://www.epa.gov/system/files/documents/2023-12/signed_prepub_louisiana-002.pdf.
127. U.S. EPA, *Primary Enforcement Authority for the Underground Injection Control Program*, https://www.epa.gov/uic/primary-enforcement-authority-underground-injection-control-program-0 (last updated Feb. 14, 2024) [https://perma.cc/49A8-EJSS].
128. *Id*. (See table under "What states, territories, and tribes have primacy" section.).
129. 42 U.S.C. §300h-9(c)(2).
130. Class VI Rule, *supra* note 30, at 77234.

According to the Class VI rule, "geologic sequestration" is "the long-term containment of a gaseous, liquid, or supercritical carbon dioxide stream in subsurface geologic formations."[131] Carbon dioxide capture and transportation are not regulated by the rule—only sequestration itself is regulated.[132] Subsurface geologic formations, however, are not defined in the rule. Considering all the definitions proposed in the Class VI rule, it is reasonable to interpret that subsurface geologic formations include onshore federal as well as onshore and offshore state waters[133]; offshore wells in U.S. federal waters are not covered.[134]

The Class VI rule defines a "carbon dioxide stream" as "carbon dioxide that has been captured from an emission source (e.g., a power plant), plus incidental associated substances derived from the source materials and the capture process, and any substances added to the stream to enable or improve the injection process."[135]

The technical requirements of the Class VI rule include (1) permitting, which encompasses geologic site characterization, delineating the area of review where drinking water may be endangered[136] and identifying corrective action,[137] and financial responsibility; (2) well construction; (3) operation, specifically mechanical integrity testing and monitoring; (4) well plugging; (5) post-injection site care; and (6) site closure.[138] New Class VI wells can only be authorized by permits,[139] and a permit can only be authorized if information about the sources of the carbon dioxide stream and an analysis of the chemical and physical characteristics of this stream are provided to EPA.[140]

Under the Class VI rule, information about the analysis of the carbon dioxide stream shall be provided to EPA before commencing the injection and throughout the injection process, including both the carbon dioxide source as well as the likelihood of variability in the injected composition.[141] The rule also requires that the carbon dioxide stream be analyzed with sufficient frequency to provide data on its chemical and physical characteristics, including fluid composition (such as the percentage of carbon dioxide and other constituents), temperature, and pressure, as well as additional parameters that may be used for understanding potential interactions between the stream and the storage site.[142]

In 2013, EPA issued specific guidance regarding the testing of carbon dioxide streams.[143] The guidance is not mandatory, and EPA reserved its discretion to depart from the guidance if needed.[144] Owners or operators are encouraged to consult with the UIC program director to establish a carbon dioxide stream characterization protocol that is designed to the specificities of their geologic storage project.[145]

In short, the guidance indicates that since carbon dioxide for geologic sequestration is likely to be transported and injected in the supercritical phase, samples may need to be extracted from the pipeline or wellhead with a valve and then allowed to decompress into a gaseous phase within a sample holder or other device for analysis. However, if these samples decompress to the gas phase for chemical analysis, the sample's temperature and pressure will also decrease, no longer representing conditions in the pipeline or as injected.[146] EPA therefore recommends that, whenever possible, the temperature and pressure measurements represent the in situ conditions at the injection point. Where not possible, samples may be allowed to decompress prior to analysis and standard methods may be used to calculate the chemical and physical properties at in situ pressure and temperature from the results of analysis of the decompressed samples.[147]

At the time of writing, EPA had not provided any additional details on requirements for testing carbon dioxide streams.[148] Underscoring that EPA's Class VI rule was officially published without these details,[149] the U.S. Department of Energy (DOE) has summarized general tests used in previous injection projects.[150]

Having analyzed the current requirements of the carbon dioxide stream for capture and storage under the Class VI rule, this subsection concludes that the SDWA and its Class VI rule are unlikely to pose legal barriers for the

131. 40 C.F.R. §144.3.
132. *Id.*
133. Class VI Rule, *supra* note 30, at 77235, 77258 (the latter mentioning offshore state wells only).
134. See 40 C.F.R. §144.3 and 40 C.F.R. §144.1(2), which list specific exclusions: "The following are not covered by these regulations: (i) Injection wells located on a drilling platform or other site that is beyond the State's territorial waters." *See also* U.S. EPA, Geologic Sequestration of Carbon Dioxide: Underground Injection Control (UIC) Program Class VI Implementation Manual for UIC Program Directors 3-9, 3-10 (2018), https://www.epa.gov/sites/default/files/2018-01/documents/implementation_manual_508_010318.pdf [https://perma.cc/8DNN-TLPK].
135. Class VI Rule, *supra* note 30, at 77231 (also codified at 40 C.F.R. §146.81(d)). This definition specifically excludes any carbon dioxide stream that meets the definition of a "hazardous waste" under 40 C.F.R. §261. These wastes are subject to the notification requirements under RCRA §3010. Section I.B.2 discusses RCRA.
136. Class VI Rule, *supra* note 30, at 77231.
137. *Id.*
138. *Id.*
139. 40 C.F.R. §§146.81-.82. Other classes of wells can also be authorized by rule. *See, e.g.*, *id.* §144.21 (for well classes I, II, and III).
140. Class VI Rule, *supra* note 30, at 77293. Information about the carbon dioxide source is codified at 40 C.F.R. §146.82(a)(7)(iii). The analysis of the carbon dioxide stream prior to commencing injection is codified at 40 C.F.R. §146.82(a)(7)(iv); likewise, further monitoring is codified at 40 C.F.R. §146.90(a), (b), (c), and (f).
141. Class VI Rule, *supra* note 30, at 77259-60.
142. 40 C.F.R. §146.90(a)-(d), specifically.
143. U.S. EPA, Geologic Sequestration of Carbon Dioxide: Underground Injection Program (UIP) Class VI Well Testing and Monitoring Guidance (2013), https://www.epa.gov/sites/default/files/2015-07/documents/epa816r13001.pdf [https://perma.cc/Y33G-EZ2N].
144. *Id.* at 2.
145. *Id.* at 30 (noting that this protocol should be in the Testing and Monitoring Plan, which is detailed in 40 C.F.R. §146.90).
146. *Id.*
147. *Id.*
148. U.S. EPA, *Underground Injection Control Regulations*, https://www.epa.gov/uic/underground-injection-control-regulations (last updated Mar. 25, 2024) [https://perma.cc/737P-CZMR].
149. DOE, U.S. EPA Class VI Carbon Dioxide Injection Permit: Salient Features and Guidelines 2 (2018), https://netl.doe.gov/sites/default/files/2018-02/FE00006821-Class-VI-Injection-Permit--Salient-Features-and-Regulatory-Challenges_Final.pdf [https://perma.cc/GQF2-MEXS].
150. *Id.* at 20 (For carbon dioxide purity, DOE recommended the ISBT 2.0 method, which is the same used in the food industry.).

import of carbon dioxide for injection and storage in the United States.

2. RCRA

RCRA regulates the management of hazardous and nonhazardous solid waste. The Act is notoriously complex. This subsection first outlines the principal definitions and regulatory scheme potentially applicable to carbon dioxide streams under RCRA. It proceeds to discuss RCRA and EPA's conditional exemption of carbon dioxide streams for permanent storage under RCRA's definition of "hazardous waste." This discussion is followed by an analysis of the main consequences of this conditional exemption for the cross-border transportation and storage of carbon dioxide.

☐ *RCRA definitions and regulations*. Nonhazardous waste is regulated under Subtitle D of RCRA. Hazardous waste, which has more onerous regulatory requirements, is covered in Subtitle C.[151] Under Subtitle C, hazardous waste generators must (among other things) keep records that accurately identify the hazardous wastes generated; properly label containers of waste for transportation, storage, treatment, or disposal; use appropriate containers for storage; provide information regarding the composition of the hazardous waste; start the manifest system and use any other means necessary for tracking the hazardous waste from generation to a treatment, storage, or disposal facility; and file reports with EPA.[152]

Further downstream in the supply chain, RCRA requires hazardous waste transporters to keep records of all hazardous waste transported from the source and their delivery points; transport hazardous waste only if properly labeled as "hazardous waste"; continue the manifest system initiated by the generators; and transport the hazardous waste exclusively to a treatment, storage, or disposal facility determined in the manifest system.[153]

RCRA does not define "transporters."[154] However, the Act does define "disposal" as the discharge, deposit, injection, dumping, spilling, leaking, or placing of any solid waste or hazardous waste into or on any land or water such that solid waste or hazardous waste or any constituent thereof may enter the environment or be emitted into the air or discharged into any waters, including groundwaters.[155]

Under the Act, storage "when used in connection with hazardous waste, means the containment of hazardous waste, either on a temporary basis or for a period of years, in such a manner as not to constitute disposal of such hazardous waste."[156]

In short, Subtitle C of RCRA establishes a comprehensive "cradle-to-grave" regulatory scheme[157] for certain "solid wastes" that are also "hazardous wastes."[158] Importantly, RCRA defines "solid waste" as discarded material, including solid, liquid, semisolid, or contained gaseous material, among others.[159] The broad definition triggers relevant points for our analysis. First, some gaseous materials may qualify as solid waste under RCRA. Second, "solid waste" must be waste—in other words, discarded material.[160]

Under EPA regulations, generators of solid waste shall determine whether their wastes are "hazardous wastes."[161] A "solid waste" is considered a "hazardous waste" if it exhibits any of four characteristics of a "hazardous waste"—ignitability, corrosivity, reactivity, or toxicity[162]—or is a listed waste under 40 C.F.R. §§261.30-.33, which list several used chemical products, byproducts from specific industries, and unused commercial products.[163] Importantly, carbon dioxide streams are not themselves listed as "hazardous waste" under RCRA.[164]

☐ *RCRA conditional exemption for carbon dioxide streams into Class VI wells.* Carbon dioxide may not be considered a hazardous waste under RCRA, unless it is contaminated by other substances that are RCRA hazardous wastes.[165] In 2014, EPA conditionally exempted carbon dioxide streams injected into UIC Class VI wells from the hazardous waste requirements in Subtitle C of RCRA, so long as the Agency finds that the waste "might pose a hazard only

151. Robin Kundis Craig, Environmental Law in Context 154-55 (2022).
152. 42 U.S.C. §6922(a).
153. *Id.* §6923(a).
154. *Id.*
155. *Id.* §6903(3).
156. *Id.* §6903(33).
157. Craig, *supra* note 151, at 189-90.
158. 42 U.S.C. §6903(5) (codified at 40 C.F.R. §261.1). 42 U.S.C. §6903(5) defines "hazardous waste" as:
> a solid waste, or combination of solid wastes which because of its quantity, concentration, or physical, chemical, or infectious characteristics may—(A) cause, or significantly contribute to an increase in mortality or an increase in serious irreversible, or incapacitating reversible, illness; or (B) pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, or disposed of, or otherwise managed.
>
> In addition, 40 C.F.R. §260.10 determines that the definition of "hazardous waste" can be found at 40 C.F.R. §261.3. Importantly, to be considered "hazardous waste," a material must first be classified as a "solid waste" according to the regulations. 40 C.F.R. §261.2. *See also* U.S. EPA, *Criteria for the Definition of Solid Waste and Solid Hazardous Waste Exclusions*, https://www.epa.gov/hw/criteria-definition-solid-waste-and-solid-and-hazardous-waste-exclusions (last updated July 16, 2024) [https://perma.cc/AG9H-DW7X].

159. 42 U.S.C. §6903(27) conceptualizes "solid waste" as:
> any garbage, refuse, sludge from a waste treatment plant, water supply treatment plant, or air pollution control facility and other discarded material, including solid, liquid, semisolid, or contained gaseous material resulting from industrial, commercial, mining, and agricultural operations, and from community activities, but does not include solid or dissolved material in domestic sewage, or solid or dissolved materials in irrigation return flows or industrial discharges which are point sources subject to permits under section 1342 of title 33, or source, special nuclear, or byproduct material as defined by the Atomic Energy Act of 1954, as amended (68 Stat. 923) [42 U.S.C. 2001 et seq.].

160. Craig, *supra* note 151, at 122. EPA, when regulating under RCRA, provides for "solid waste" as needed to be "discarded material." 40 C.F.R. §261.2.
161. 40 C.F.R. §262.11.
162. *Id.* §§261.20-.24.
163. Class VI Rule, *supra* note 30, at 77260 (When issuing the Class VI rule, EPA highlighted the definition of "hazardous waste" under RCRA.).
164. *Id.*
165. *See generally* Craig, *supra* note 151, at 174 (noting that underground storage of carbon dioxide seems to fall within the scope of RCRA, at first glance).

under limited management scenarios, and other regulatory programs already address such scenarios."[166]

Similar to EPA's definition in the Class VI rule under the SDWA, the Agency's current regulations under RCRA define a "carbon dioxide stream" as "carbon dioxide that has been captured from an emission source (e.g., power plant), plus incidental associated substances derived from the source materials and the capture process, and any substances added to the stream to enable or improve the injection process."[167]

In its 2014 exemption, EPA concluded that supercritical carbon dioxide injected into Class VI wells for geologic sequestration is a "solid waste" under RCRA.[168] EPA found that such streams are "discarded material" under the purview of RCRA, as the streams are injected underground for the purpose of isolating them from reentry into the atmosphere.[169]

However, EPA decided to conditionally exclude carbon dioxide streams from the definition of "hazardous waste," so long as the streams are (1) captured from emission sources; (2) transported in compliance with DOT requirements; (3) injected into UIC Class VI wells for purposes of geologic sequestration; and (4) not mixed with, or otherwise co-injected with, any other hazardous waste.[170]

Finally, the owner or operator of any UIC Class VI well that claims the exclusion must have an authorized representative[171] sign a certification attesting that the carbon dioxide has not been mixed with other hazardous wastes and complies with the requirements for UIC Class VI wells.[172]

☐ *Implications of the RCRA conditional exemption.* The conditional exemption of carbon dioxide streams from hazardous waste regulations under RCRA requires a more detailed analysis of its scope and consequences. This analysis is organized into five main points.

First, there is a legal presumption that regulatory exemptions are interpreted restrictively. As such, the conditional exemption will not apply to carbon dioxide streams that are disposed of by means other than injection into a Class VI well.[173] EPA highlighted that the requirements of UIC Class VI injection wells are specifically tailored to ensure that carbon dioxide streams (as well as "any incidental substances derived from the source materials and capture process") will be isolated within the injection zone.[174] The Agency found that the permit requirements under the UIC Class VI wells will ensure protection, and that ultimately additional regulation under RCRA would be duplicative and therefore unnecessary.[175] Notably, because the exception only applies to carbon dioxide streams injected in UIC Class VI wells, it could not cover carbon dioxide injected on the OCS.

Second, it is worth noting that this conditional exemption was contentious,[176] with some stakeholders arguing that it should not even exist. In their view, carbon dioxide does not qualify as a hazardous waste to begin with, which means RCRA regulations do not apply; following this logic, an exemption for carbon dioxide streams is superfluous and inappropriate.[177] By contrast, other stakeholders were vocal about the risks of injecting hazardous waste underground, contending that UIC Class VI wells would not offer enough protection.

Ultimately, EPA determined that these wells did offer enough protection.[178] The Agency also justified the application of RCRA to carbon dioxide streams based on the fact that, at that time, the Agency could not unequivocally conclude that supercritical carbon dioxide streams could never exhibit any hazardous waste characteristic under RCRA.[179] EPA's rationale was as follows: because there are no "[h]azardous waste listings that apply to the supercritical CO_2 streams being considered here, a CO_2 stream could only be defined as a hazardous waste if it exhibits one or more of the hazardous waste characteristics as defined in 40 C.F.R. part 261, subpart C."[180] The Agency contended that the exemption was necessary due to "the early state of data development" in the field,[181] and committed to an adaptive approach for the analysis of both the exemption itself and to CCS more generally.[182]

Third, the conditional exclusion of carbon dioxide streams from RCRA's hazardous waste definition triggers the need to consider the potential that additional hazardous wastes may eventually be mixed or co-injected in such streams. With that in mind, it is worth clarifying that EPA limited the exclusion to "hazardous waste,"[183] not "waste components" or other classifications. Further, throughout

166. *Id.* at 353.
167. 40 C.F.R. §260.10.
168. Hazardous Waste Management System: Conditional Exclusion for Carbon Dioxide (CO_2) Streams in Geologic Sequestration Activities, 79 Fed. Reg. 350, 352 (Jan. 3, 2014). This is the case, because carbon dioxide streams are within the scope of RCRA's definition of "solid waste." *Id.* at 355.
169. *Id.*
170. 40 C.F.R. §261.4(h)(1)-(3).
171. 40 C.F.R. §260.10 defines "authorized representative" as "the person responsible for the overall operation of a facility or an operational unit (i.e., part of a facility), e.g., the plant manager, superintendent or person of equivalent responsibility."
172. 40 C.F.R. §261.4(h)(4)(ii) states:

> Any Class VI Underground Injection Control well owner or operator, who claims that a carbon dioxide stream is excluded under paragraph (h) of this section, must have an authorized representative (as defined in 40 CFR 260.10) sign a certification statement worded as follows:
>
> > I certify under penalty of law that the carbon dioxide stream that I am claiming to be excluded under 40 CFR 261.4(h) has not been mixed with, or otherwise co-injected with, hazardous waste at the Underground Injection Control (UIC) Class VI permitted facility, and that injection of the carbon dioxide stream is in compliance with the applicable requirements for UIC Class VI wells, including the applicable requirements in 40 CFR Parts 144 and 146.

173. CEQ, *supra* note 97, at 60.
174. 79 Fed. Reg. at 353, 357.
175. *Id.*
176. Carbon Sequestration Council v. Environmental Prot. Agency, 787 F.3d 1129, 1132-33, 45 ELR 20103 (D.C. Cir. 2015) (challenging the conditional exemption; this case was eventually dismissed on standing grounds).
177. 79 Fed. Reg. at 355.
178. *Id.* at 356.
179. *Id.*
180. *Id.* at 355.
181. *Id.* at 355-56.
182. *Id.* at 359-60.
183. 40 C.F.R. §261.4(h)(3).

RCRA's regulations, detailed substances and percentages are specified.[184] If regulators had wanted to depart from this standard practice, they would have done so.

Fourth, EPA underscored that the conditional exemption would provide additional regulatory certainty by significantly reducing uncertainty associated with identifying the carbon dioxide streams for permanent storage under RCRA Subtitle C. EPA argued that the exemption could facilitate the deployment of geologic sequestration activities.[185] According to the Agency, generators of nonhazardous waste carbon dioxide streams are not subject to RCRA Subtitle C regulations, and are therefore not required to use the conditional exemption.[186] However, the Agency also noted that generators may want to use the conditional exemption if uncertain about the hazardous waste status of their carbon dioxide stream. Ultimately, if EPA were aiming to bring certainty, the Agency would have specified threshold, percentages, and/or sources of carbon dioxide streams.

In its attempt to enhance certainty, EPA clarified that "incidental associated substances" are "other substances captured together with the carbon dioxide from a gas stream,"[187] and the numerical values addressed in the proposed rule's preamble are merely examples.[188] Importantly, EPA emphasized that the definitions under RCRA and UIC Class VI wells needed to be consistent; any addition of substances to the carbon dioxide stream to enable or improve the injection process will be part of the permitting process of UIC Class VI wells, and will already be regulated under the Class VI rule.[189]

Last, should hazardous waste be mixed with the carbon dioxide stream, this stream not only is ineligible for the conditional exclusion, but also will need to be managed as a RCRA hazardous waste. If well injection were the means for disposal, it would need to be injected into a UIC Class I hazardous well.[190]

In conclusion, it is unlikely that substances routinely used in the injection process will trigger additional protection required under the "hazardous waste" classification under RCRA and the currently applicable regulatory scheme.

3. OCSLA

OCSLA[191] was enacted in 1953, placing the administration of mineral exploration under the OCS within the purview of the Secretary of the Interior.[192] The Bureau of Ocean Energy Management (BOEM)—formerly the Bureau of Ocean Energy Management, Regulation, and Enforcement and, before that, the Minerals Management Service (MMS)—is the agency within the U.S. Department of the Interior (DOI) that administers OCSLA.[193]

OCSLA defines the OCS as "all submerged lands lying seaward and outside of the area of lands beneath navigable waters . . . and of which the subsoil and seabed appertain to the United States."[194] According to OCSLA, the subsoil and seabed of the OCS belong to the United States and are subject to its jurisdiction, control, and power of disposition.[195]

The U.S. OCS includes the area beyond state jurisdiction out to 200 NM from shore, with state jurisdiction over the seafloor extending out to 3 NM seaward of the baseline from which the breadth of the territorial sea is measured.[196] For context, 1 NM spans approximately 6,076 feet. There are three exceptions to how states establish jurisdiction over their territorial seas. Texas and the Florida Gulf Coast extend their jurisdiction out to 9 NM, and Louisiana extends its jurisdiction out 3 U.S. NM seaward of the baseline from which the breadth of the territorial sea is measured.[197] (The U.S. nautical mile is slightly longer, spanning approximately 6,080 feet.)

OCSLA initially focused on enabling mineral development regarding the exploration, development, and production of minerals from the OCS.[198] These concepts are defined in OCSLA, and they did not address permanent storage of carbon dioxide.[199]

184. *See, e.g.*, *id*. §261.4(a)(21)(i)(A) (specifically detailing in a table the contaminant limits for zinc fertilizers).
185. 79 Fed. Reg. at 352. Some stakeholders disagreed, arguing that the conditional exemption would lead to uncertainty. *Id*. at 360.
186. *Id*. at 356.
187. *Id*. at 359.
188. *Id*. For the preamble of the proposed rule, see 76 Fed. Reg. 48073, 48079 (Aug. 8, 2011), https://www.govinfo.gov/content/pkg/FR-2011-08-08/html/2011-19915.htm [https://perma.cc/2WD3-MM5J].
189. 79 Fed. Reg. at 359.
190. *Id*. at 353.
191. 43 U.S.C. §1301.
192. DOI BOEM, *OCS Lands Act History*, https://www.boem.gov/oil-gas-energy/leasing/ocs-lands-act-history (last visited Aug. 5, 2024) [https://perma.cc/CKG3-FKDS].
193. In 2011, the Barack Obama Administration created BOEM, as an agency to streamline offshore energy sources. Press Release, DOI, Interior Department Completes the Reorganization of the Former MMS (Sept. 30, 2011), https://www.doi.gov/news/pressreleases/Interior-Department-Completes-Reorganization-of-the-Former-MMS [https://perma.cc/FR2G-JAUL].
194. 43 U.S.C. §1331(a) provides:
> [T]he term "Outer Continental Shelf" means all submerged lands lying seaward and outside of the area of lands beneath navigable waters as defined in section 2 of the Submerged Lands Act (Public Law 31, Eighty-third Congress, first session), and of which the subsoil and seabed appertain to the United States and are subject to its jurisdiction and control.

195. *Id*. §1332(1).
196. *Id*. §1301(a). *See also* DOI BOEM, *Outer Continental Shelf*, https://www.boem.gov/oil-gas-energy/leasing/outer-continental-shelf (last visited Aug. 5, 2024) [https://perma.cc/HT69-E5S8].
197. DOI BOEM, *supra* note 196. *See also* DOI BOEM, *supra* note 34 (highlighting that the OCS includes the Gulf of Mexico).
198. 43 U.S.C. §1332(4).
199. 43 U.S.C. §1301(k) provides:
> The term "exploration" means the process of searching for minerals, including (1) geophysical surveys where magnetic, gravity, seismic, or other systems are used to detect or imply the presence of such minerals, and (2) any drilling, whether on or off known geological structures, including the drilling of a well in which a discovery of oil or natural gas in paying quantities is made and the drilling of any additional delineation well after such discovery which is needed to delineate any reservoir and to enable the lessee to determine whether to proceed with development and production; (l) The term "development" means those activities which take place following discovery of minerals in paying quantities, including geophysical activity, drilling, platform construction, and operation of all onshore support facilities, and which are for the purpose of ultimately

Prior to enactment of the IIJA,[200] BOEM could only issue leases for projects involving the storage of carbon dioxide captured at coal-fired power plants. After the IIJA, BOEM can now issue leases for the storage of any carbon dioxide that has been "captured" regardless of where it was sourced, provided certain purity requirements are met.[201] Considerations for meeting these purity requirements are examined below.

In the IIJA, the U.S. Congress amended OCSLA to add a definition of "carbon dioxide stream."[202] The term is defined as follows: "carbon dioxide that—(A) has been captured; and (B) consists overwhelmingly of—(i) carbon dioxide plus incidental associated substances derived from the source material or capture process; and (ii) any substances added to the stream for the purpose of enabling or improving the injection process."[203] The Act specifically excludes from this definition additional waste or other matter added to the carbon dioxide stream for the purpose of disposal.[204] Under OCSLA (as amended by the IIJA), "carbon sequestration" is defined as "the act of storing carbon dioxide that has been removed from the atmosphere or captured through physical, chemical, or biological processes that can prevent the carbon dioxide from reaching the atmosphere."[205]

OCSLA currently provides that the Secretary of the Interior may issue leases, easements, or rights-of-way for activities that "provide for, support, or are directly related to the injection of a carbon dioxide stream into sub-seabed geologic formations for the purpose of long-term carbon sequestration."[206] No further details or specifications are mentioned. Technically, this requirement to obtain a lease is a result of the fact that the U.S. federal government controls the OCS[207]; if a private party wants to use the OCS, it needs the approval of the federal government. Case law highlights this necessity.[208]

OCSLA has not yet been used to authorize permanent carbon dioxide storage.[209] After all, the explicit authority to issue leases for offshore carbon storage is still brand new. In any event, given the trend of current specific regulatory changes to enable and boost carbon dioxide storage, it is very unlikely that this statute will pose constraints on the import of carbon dioxide streams for permanent storage, especially when it comes to regulating purity levels of the stream and its sources.

Finally, additional guidance from BOEM on how it will exercise its new leasing authority for storage would be welcomed. According to the IIJA, BOEM was supposed to have issued regulations clarifying this authority "[n]ot later than 1 year after the date of enactment of this Act"[210]; though the date of enactment was November 15, 2021, as of this writing, this has yet to occur.[211]

C. *Contextualizing Our Previous Findings Under NEPA*

While there is no comprehensive domestic legal framework regulating the cross-border transportation of carbon dioxide for permanent storage in the United States, the 2021 amendments under the IIJA were consequential for closing previous gaps regarding permanent storage of carbon dioxide.

producing the minerals discovered; (m) The term "production" means those activities which take place after the successful completion of any means for the removal of minerals, including such removal, field operations, transfer of minerals to shore, operation monitoring, maintenance, and work-over drilling.

200. IIJA §§40306, 40307.
201. *See* Romany Webb, *Carbon Storage in the New Bipartisan Infrastructure Bill*, Climate L. Blog (Aug. 10, 2021), https://blogs.law.columbia.edu/climatechange/2021/08/10/carbon-storage-in-the-bipartisan-infrastructure-bill/.
202. IIJA, Pub. L. No. 117-58, §40307(a)(1), 135 Stat. 429, 1003, 1033 (2021).
203. 43 U.S.C. §1331(r)(1).
204. *Id.* §1331(r)(2).
205. *Id.* §1331(s).
206. 43 U.S.C. §1337(p)(1) provides:
> In general: The Secretary, in consultation with the Secretary of the Department in which the Coast Guard is operating and other relevant departments and agencies of the Federal Government, may grant a lease, easement, or right-of-way on the Outer Continental Shelf for activities not otherwise authorized in this subchapter, the Deepwater Port Act of 1974 (33 U.S.C. 1501 et seq.), the Ocean Thermal Energy Conversion Act of 1980 (42 U.S.C. 9101 et seq.), or other applicable law, if those activities . . . (E) provide for, support, or are directly related to the injection of a carbon dioxide stream into sub-seabed geologic formations for the purpose of long-term carbon sequestration.

207. *Id.* §1337.
208. *See, e.g.*, Ensco Offshore Co. v. Salazar, No. 10-1941, 2011 U.S. Dist. LEXIS 96652 (E.D. La. Aug. 29, 2011). The court agreed with the previous decision holding "[t]hat it is declared that the Outer Continental Shelf Lands Act ('OCSLA'), together with the Administrative Procedure Act, establishes a nondiscretionary duty on the Department of the Interior to act on OCSLA drilling permit applications within a reasonable time." *Id.* at *4.
> In a similar vein, see Mobil Oil Expl. & Producing SE Inc. v. United States, 530 U.S. 604, 609, 30 ELR 20716 (2000):
> [T]he companies received exploration and development permission in accordance with procedures set out in, *inter alia*, the Outer Continental Shelf Lands Act (OCSLA), the Coastal Zone Management Act of 1972 (CZMA), and regulations promulgated pursuant to those Acts. OCSLA, among other things, requires the Department of the Interior to approve a company's Plan of Exploration (Plan) within 30 days of its submission if the Plan meets certain criteria.
> Center for Biological Diversity v. Haaland, No. 2:22-cv-06996-CAS-KSx, 2023 U.S. Dist. LEXIS 68791 (C.D. Cal. Apr. 17, 2023):
> OCSLA establishes a framework under which the Secretary of the Interior may lease areas of the outer continental shelf ("OCS") for purposes of exploring and developing the oil and gas deposits of submerged land. 43 U.S.C. §§1131-1356b. There is a four-stage process for the development of offshore oil and gas resources: (1) formulation of a five-year leasing plan by the Department of the Interior; (2) lease sales; (3) exploration by the lessees; and (4) development and production.
> *But cf.* Friends of the Earth v. Haaland, 583 F. Supp. 3d 113, 126, 52 ELR 20016 (D.D.C. 2022) ("And although OCSLA's primary purpose is development of the Outer Continental Shelf, 'OCSLA does not mandate the approval of every proposed lease sale.' *Gulf Restoration Network v. Bernhardt*, 456 F. Supp. 3d 81, 97 (D.D.C. 2020)."). *See also* California v. Watt, 712 F.2d 584, 588, 13 ELR 20723 (D.C. Cir. 1983) ("[W]hile an area excluded from the [Five-Year] leasing program cannot be leased, explored, or developed, an area included in the program may be excluded at a latter stage.").
209. CEQ, *supra* note 97, at 32 (Until 2021, the OCSLA has never been used for permanent storage of carbon dioxide streams.).
210. IIJA §40307(d).
211. DOI BOEM, *Carbon Sequestration*, https://www.boem.gov/about-boem/regulations-guidance/carbon-sequestration (last visited Aug. 5, 2024) [https://perma.cc/X5LR-JBY2]. According to e-mail exchanges with BOEM on July 1, 2024, these regulations are expected to be issued in late 2024. The authors thank Karen A. Thundiyil and Peter R. Meffert for sharing this information.

All the federal statutes and related regulations researched here—MPRSA, HMTA, APPS, SDWA, RCRA, and OCSLA—are unlikely to impose legal barriers for the import of carbon dioxide for permanent injection and storage in the United States. This is primarily the case because most of these acts do not impose additional requirements beyond those currently in place under international law, which are mainly concerned with the purity levels of the carbon dioxide stream for storage and its sources.

While the SDWA and RCRA include additional requirements, EPA emphasized that the definitions under RCRA and UIC Class VI wells needed to be consistent and any addition of substances to the carbon dioxide stream to enable or improve the injection process will be part of the permitting process of the SDWA UIC Class VI wells and will already be regulated under the Class VI rule.[212] Ultimately, it is unlikely that substances routinely used in the injection process will trigger additional protection required under the "hazardous waste" classification under RCRA and the currently applicable regulatory scheme.

It is worth mentioning that NEPA requires an environmental impact statement (EIS) for any action with a substantial federal nexus that also significantly affects the quality of the human environment.[213] This includes any "major federal action," which previous regulations have defined as an activity or decision "subject to substantial Federal control and responsibility."[214] The recently modified NEPA now defines "major federal action" as "an action that the agency carrying out such action determines is subject to substantial federal control and responsibility."[215] Eligible actions often include applying for permits or receiving federal funding, among others.[216]

NEPA review is detailed in regulations issued by CEQ,[217] which considers NEPA a procedural statute[218] as determined by the U.S. Supreme Court.[219] NEPA requires agencies to take a "hard look" at the environmental impacts of their actions before deciding to proceed with them, but it does not require a particular result. So long as the NEPA process is obeyed, courts are not to substitute their own substantive judgments for those of the agencies.[220] While courts will not review an agency's environmental analysis to "second-guess substantive decisions committed to the discretion of the agency,"[221] courts have clarified that "simple, conclusory statements of no impact are not enough to fulfill an agency's duty under NEPA."[222]

In evaluating whether NEPA applies, federal agencies must determine (1) if the proposed activity or decision is expressly exempt from NEPA under another statute; (2) if compliance with NEPA would clearly and fundamentally conflict with the requirements of another statute; (3) if compliance with NEPA would be inconsistent with congressional intent as expressed in another statute; (4) if the proposed activity or decision is a major federal action and has, or could have, significant environmental effects; (5) if the proposed activity or decision, in whole or in part, is a non-discretionary action for which the agency lacks authority to consider environmental effects as part of its decisionmaking process; and (6) if the proposed action is one for which another statute's requirements serve the function of agency compliance with NEPA.[223]

Technically, agencies can comply with NEPA in three different ways: (1) prepare a comprehensive EIS; (2) prepare a simplified environmental assessment (EA) and make a finding of no significant impact (FONSI); or (3) apply a

212. Hazardous Waste Management System: Conditional Exclusion for Carbon Dioxide (CO_2) Streams in Geologic Sequestration Activities, 79 Fed. Reg. 350, 359 (Jan. 3, 2014).

213. 42 U.S.C. §4332(2)(C).

214. 40 C.F.R. §1508.1(w) (2023). EISs for proposed actions must include a discussion of (1) reasonably foreseeable environmental effects of the proposed agency action; (2) any reasonably foreseeable adverse environmental effects that cannot be avoided if the proposal is implemented; (3) a reasonable range of alternatives to the proposed agency action that are technically and economically feasible and that meet the purpose of the proposal, including a no-action alternative; (4) the relationship between local short-term uses of the environment and the maintenance and enhancement of long-term productivity; and (5) any irreversible and irretrievable commitments of federal resources that would be involved in the proposed agency action if implemented. *See* 42 U.S.C. §4332(2)(C)(1)-(v) (as amended by Fiscal Responsibility Act of 2023 div. C., tit. III).

215. Fiscal Responsibility Act of 2023, Pub. L. No. 118-5, div. C., tit. III, §111, 137 Stat. 10, 45-46. The current definition drops the "major" and "effects," adding uncertainty to the definition. Legal scholars have pointed out the consequences. *See, e.g.*, Daniel Farber, *On the Perils of Hasty Drafting*, Legal Planet (May 31, 2023), https://legal-planet.org/2023/05/31/on-the-perils-of-hasty-drafting/.

216. *See* 40 C.F.R. §1508(q)(3) (2023):

> Federal actions tend to fall within one of the following categories: (i) Adoption of official policy, such as rules, regulations, and interpretations adopted pursuant to the Administrative Procedure Act, 5 U.S.C. 551 et seq.; implementation of treaties and international conventions or agreements, including those implemented pursuant to statute or regulation; formal documents establishing an agency's policies which will result in or substantially alter agency programs. (ii) Adoption of formal plans, such as official documents prepared or approved by federal agencies which guide or prescribe alternative uses of Federal resources, upon which future agency actions will be based. (iii) Adoption of programs, such as a group of concerted actions to implement a specific policy or plan; systematic and connected agency decisions allocating agency resources to implement a specific statutory program or executive directive. (iv) Approval of specific projects, such as construction or management activities located in a defined geographic area. Projects include actions approved by permit or other regulatory decision as well as federal and federally assisted activities.

217. *Id.* §§1500.1 et seq.

218. *Id.* §1500.1(a).

219. Strycker's Bay Neighborhood Council, Inc. v. Karlen, 444 U.S. 223, 227, 10 ELR 20079 (1980):

> NEPA, while establishing "significant substantive goals for the Nation," imposes upon agencies duties that are "essentially procedural." . . . NEPA was designed "to insure a fully informed and well-considered decision," but not necessarily "a decision the judges of the Court of Appeals or of this Court would have reached had they been members of the decisionmaking unit of the agency."

220. Jamison E. Colburn, *The Risk in Discretion: Substantive NEPA's Significance*, 41 Colum. J. Env't L. 1, 2-4 (2016).

221. Delaware Riverkeeper Network v. Federal Energy Regul. Comm'n, 753 F.3d 1304, 1313, 44 ELR 20126 (D.C. Cir. 2014).

222. *Id.* (emphasizing that an arbitrary and capricious agency action in the NEPA context is one that "is not the product of 'reasoned decisionmaking'"). For example, the U.S. Court of Appeals for the Tenth Circuit recently held that the Bureau of Land Management's dismissal of a project involving 199 new oil and gas wells was "arbitrary and capricious" for disregarding the climate impacts of those wells and failing the "hard look" requirement under NEPA. *See* Diné Citizens Against Ruining Our Env't v. Haaland, 59 F.4th 1016, 1025, 53 ELR 20019 (10th Cir. 2023).

223. 40 C.F.R. §1501.1(a) (2023).

categorical exclusion (CE) if the project is a type that does not normally have significant environmental impacts.[224]

In assessing the appropriate level of NEPA review (EIS, EA and FONSI, or CE), federal agencies will assess if the proposed action (1) would normally not have significant effects and is categorically excluded; (2) is not likely to have significant effects (FONSI), or the significance of the effects is unknown and is therefore appropriate for an EA; or (3) is likely to have significant effects and is therefore appropriate for an EIS.[225]

Accordingly, NEPA's reviews do not occur in the abstract but are contingent on the agency's findings of a federal major action. For carbon capture, usage, and storage projects that occur on federal lands or require a federal permit, the lead federal agency will ultimately determine if the project significantly affects the environment and involves substantial control and responsibility.[226] These determinations will either trigger the preparation of an EIS or an EA or will fit within a CE. The agency will also need to conduct an environmental review with the appropriate public involvement prior to making a final decision about the project.[227]

Based on our main findings, several statutes regulate different aspects of the CCS chain, and each involves different agencies. These statutes and agencies are summarized in Table 1.

Table 1. Statutes and Agencies Involved in the CCS Chain

Part of CCS Chain	Statute	Agency
Storage	SDWA	EPA
	RCRA	EPA
	OCSLA	BOEM
Transportation	MPRSA	EPA
	HMTA	DOT (ships); PHMSA (pipelines)
	APPS	EPA

Our previous discussion in Section I.B showed that while the SDWA and RCRA offer potential regulatory tools over CCS, only OCSLA, which expressly provides for the issuance of leases for carbon storage,[228] and the SDWA currently have an active role in regulating geological carbon dioxide storage. However, EPA's current regulation exempts the SDWA UIC program from NEPA review based on the functional equivalence analysis—in other words, the idea that the review EPA conducts is the functional equivalent of a NEPA review. The pertinent EPA regulation provides as follows: "The SDWA UIC program is exempt from performing an Environmental Impact Statement (EIS) under section 101(2)(C) and an alternatives analysis under section 101(2)(E) of NEPA under a functional equivalence analysis."[229]

NEPA review would be required if BOEM leases offshore land for the sequestration of carbon dioxide in the OCS. Under the IIJA,[230] BOEM can now issue leases for the storage of any carbon dioxide that has been "captured" regardless of where it was sourced, provided certain purity requirements are met.[231] As discussed, no further details or specifications are mentioned.[232] The requirement to obtain a lease is a result of the fact that the U.S. federal government controls the OCS.[233] Therefore, this lease, which will be within the purview of BOEM as it is the agency within DOI that administers OCSLA,[234] would invoke NEPA.[235]

Considerations for triggering NEPA review during the transportation stage of the CCS process are notably more complex than those of carbon dioxide storage. Our previous analysis in Section I.A showed that MPRSA, the HMTA, and the APPS serve as potential regulators of CCS activities, with more significant regulatory implications from the first two acts than the third.

MPRSA is unlikely to trigger NEPA review. The IIJA provides that sub-seabed carbon storage projects authorized by BOEM do not require an EPA permit under MPRSA.[236] Therefore, no NEPA review would be required under these specific circumstances, as EPA would not be taking any "major federal action." The IIJA provides that a carbon dioxide stream injected for permanent sequestration into the OCS is not considered to be material under MPRSA.[237] Moreover, NEPA has been held not to apply to decisions taken under MPRSA.[238]

224. *Id.* §1508.1(h), (j), (l) (defining EA, EIS, and FONSI, respectively).
225. *Id.* §1501.3(a) (Current NEPA provisions added that such EA shall be a concise document prepared by a federal agency setting forth the agency's finding of no significance or determination that an EIS is necessary. It also has page limits. Fiscal Responsibility Act of 2023 §107).
226. A detailed discussion on how NEPA applies to the federal legislation analyzed in this Article was examined elsewhere. *See* Arlota et al., *supra* note 9, at 165-94.
227. CEQ, *supra* note 97, at 52.
228. 43 U.S.C. §1337(p)(1) (The Secretary of the Interior "may grant a lease, easement, or right-of-way on the outer Continental Shelf . . . , if those activities . . . (E) provide for, support, or are directly related to the injection of a carbon dioxide stream into sub-seabed geologic formations for the purpose of long-term carbon sequestration.").
229. Class VI Rule, *supra* note 30, at 77236.
230. IIJA §§40306, 40307.
231. *See* Webb, *supra* note 201.
232. Under the IIJA, BOEM was supposed to have issued regulations clarifying this authority "not later than 1 year after the date of enactment of this act." IIJA §40307(d). These regulations are yet to be issued. DOI BOEM, *supra* note 211.
233. 43 U.S.C. §1337.
234. Press Release, DOI, *supra* note 193.
235. 42 U.S.C. §4336e(10)(A).
236. IIJA §40307(c).
237. *Id.*
238. Webb & Gerrard, *supra* note 32, at 17 (discussing the following authorities: *Maryland v. Train*, 415 F. Supp. 116, 6 ELR 20496 (D. Md. 1976) (ruling that EPA is not obliged to prepare an EIS for actions taken under MPRSA as "[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"); and Policy and Procedures for Voluntary Preparation of National Environmental Policy Act (NEPA) Documents, 63 Fed. Reg. 58045, 58046 (Oct. 29, 1998) (stating that EPA will voluntarily comply with NEPA for the designation of dump sites under MPRSA)).

As for the HMTA, the Act provides that DOT regulates shipping transportation and PHMSA regulates pipeline transportation, with each agency imposing standards for relevant activities.[239] The application of either of these sets of standards is also not subject to NEPA as a federal action, as these agencies are not engaged in actions that amount to a "major federal action."[240] DOT issues the regulations, but ships subject to these regulations do not require permits from DOT. Therefore, no NEPA review is to be triggered.

In summary, all but one of the federal statutes (OCSLA) previously discussed are unlikely to trigger NEPA review. Under OCSLA, BOEM would be the federal agency to conduct such a review.

II. Current State Regulations

Part II outlines state laws that may pose a challenge for the import of carbon dioxide streams, to the extent that state laws may impose additional requirements for transport and permanent storage of carbon dioxide streams. Details about storage, property rights, liability rules, monitoring, carbon dioxide migration under the subsurface, leakage, and related topics are beyond the scope of this review.[241] It is worth highlighting that no state has developed a comprehensive legal framework to regulate carbon dioxide sequestration, which leaves the country with a patchwork system of different and incomplete rules of ownership and liability.[242]

The design of our research targets U.S. states that are a probable destination of carbon dioxide for permanent storage—Texas and Louisiana. That said, there is no best area for carbon sequestration in general. In the United States, the area with the most carbon dioxide storage potential is the Coastal Plains region, specifically in the coastal basins from Texas to Georgia.[243] This area accounts for 2,000 metric gigatons (65%) of the storage potential.[244]

This part is divided into three sections. Section A begins with an analysis of state authority regarding permanent storage of carbon dioxide. Section B is devoted to the analysis of pertinent intrastate pipeline regulations. Both sections study the state legislation of North Dakota and Wyoming, which have had primacy authority for a long time, as well as recent developments in Louisiana and Texas, which are especially likely to import carbon dioxide for storage. Finally, Section C concludes.

A. Carbon Dioxide Storage

With the exception of Louisiana, North Dakota, and Wyoming, the legal regime applicable to permanent carbon dioxide injection and storage is currently centralized at the federal level, as EPA regulates and administers all UIC Class VI rule wells in all other states. However, Texas is in the process of attempting to obtain primacy over Class VI wells, and Louisiana obtained its approval late in December 2023.[245]

This section starts with an overview about the Class VI rule and primacy conceptualization, examining current developments in Texas and Louisiana. It then compares existing North Dakota and Wyoming Class VI rules. This section concludes with an assessment of future regimes regarding primacy rules.

1. Primacy Under the Class VI Rule

As discussed in the last two subsections of Section I.B.1, EPA's UIC Class VI rule establishes the minimum federal requirements for the injection and storage of carbon dioxide to protect underground sources of drinking water from endangerment.[246] States may apply for primary enforcement authority, or primacy, with respect to Class VI wells. As previously examined, states seeking primacy for Class VI wells must show EPA that the state has jurisdiction over underground injection; that the state meets EPA's minimum requirements for a UIC program; and that the applicant state has the necessary administrative, civil, and criminal enforcement penalty remedies.[247] In the absence of state primacy, EPA is mandated to implement the federal UIC program.[248]

The delays involved in EPA's approval for Class VI wells have been repeatedly pointed out as jeopardizing the development of CCS in the country.[249] State developers in Texas and Louisiana currently have project applications for permits of Class VI wells with EPA.[250] In 2022, North Dakota, which has primacy under its UIC Class VI well program, issued three carbon dioxide injection permits for geologic

239. 49 C.F.R. §§172.101, 195.1(b)(9) (respectively, both provisions refer to carbon dioxide).

240. 42 U.S.C. §4336e(10)(A) ("The term 'major Federal action' means an action that the agency carrying out such action determines is subject to substantial Federal control and responsibility." (defining "major federal action," as amended by Fiscal Responsibility Act of 2023 div. C., tit. III, §111)).

241. A thorough analysis regarding the connections among these issues is provided in Owen Anderson, *Geologic Sequestration in the United States of America*, *in* Carbon Capture and Storage in International Energy Policy and Law 107, 109-21 (Hirdan Katarina de M. Costa & Carolina Arlota eds., Elsevier 2021).

242. Gerrard & Gundlach, *supra* note 61, at 110.

243. U.S. Geological Survey, *Frequently Asked Questions: Which Area Is the Best for Geologic Carbon Sequestration?*, https://www.usgs.gov/faqs/which-area-best-geologic-carbon-sequestration (last visited Aug. 5, 2024) [https://perma.cc/RP3C-SLUG].

244. *Id.*

245. State of Louisiana Underground Injection Control Program; Class VI Primacy, 89 Fed. Reg. 703, 703 et seq. (Jan. 5, 2024), https://www.govinfo.gov/content/pkg/FR-2024-01-05/pdf/2024-00044.pdf [https://perma.cc/VNF7-VDCJ].

246. Class VI Rule, *supra* note 30, at 77234.

247. *Id. See also* 42 U.S.C. §300h-1.

248. 42 U.S.C. §300h(b)(4).

249. *See, e.g.*, Gabriel Pacyniak, *Can We Just Bury It?: Towards Climate and Equity Principles for Carbon Sequestration After the Inflation Reduction Act*, 14 San Diego J. Climate & Energy L. 95, 138-40 (2023).

250. U.S. EPA, Class VI Wells Permitted by EPA (2024), https://www.epa.gov/system/files/documents/2024-03/class-vi-permit-tracker_3-15-2024_2.pdf [https://perma.cc/UZ3C-4EQW]. Meanwhile, Texas is opening more than one million acres of offshore, state-owned waters for proposals from companies interested in sequestering carbon dioxide. *See* Dylan Baddour, *Texas Opens More Coastal Waters for Carbon Dioxide Injection Wells*, Inside Climate News (June 29, 2024), https://insideclimatenews.org/news/29062024/texas-gulf-coast-carbon-dioxide-injection-wells/.

sequestration.[251] State primacy is experiencing increasing momentum, despite delays in the review process. EPA's process for delegating state primacy is comprehensive and includes five stages: pre-application activities, completeness determination, application evaluation, rulemaking and codification, and, finally, application approval.[252]

2. Primacy Efforts: Louisiana and Texas

Currently, Texas has primacy for all UIC wells, except UIC Class VI.[253] In June 2021, House Bill 1284 was introduced in the Texas Legislature. The bill would grant the Texas Railroad Commission exclusive jurisdiction over carbon sequestration wells, including offshore carbon storage in state waters.[254] Since this jurisdiction had previously been shared with the Commission on Environmental Quality, the centralization of authority would likely expedite Texas' primacy application.[255]

As of this writing, this bill has not been enacted. On May 3, 2022, the Railroad Commission approved submission to EPA of a pre-application for Class VI wells, formally requesting that the governor ask EPA for a Class VI UIC well program approval.[256] According to primacy under the Class VI rule, the state governor has to formally submit an application letter requesting approval for the UIC program.[257]

EPA's website currently lists Texas as within the "pre-application activities," or the first stage of the application process.[258] The Texas primacy application has been engulfed in controversies. Two Democratic members of the U.S. House of Representatives from Texas stated in a recent letter to the EPA Administrator that the Texas Railroad Commission has a reputation of not championing environmental justice considerations.[259] Meanwhile, EPA has issued an advisory guidance specifically addressing these considerations in the Class VI context.[260] In any case, the application review process is expected to last at least two years.[261]

Louisiana, meanwhile, obtained Class VI well primacy in December 2023.[262] Under the state's legal framework, the source of the carbon dioxide stream as well as the analysis of the chemical and physical characteristics must be provided, but no specific requirements of this analysis are determined.[263] EPA's rule on primacy for Louisiana has just recently been approved.[264]

3. Primacy Consolidated Examples: North Dakota and Wyoming

Both North Dakota and Wyoming—the only two states that had primacy for Class VI wells until the addition of Louisiana in December 2023—opted to not impose additional purity requirements or limitations on the sources of carbon dioxide streams. While a detailed analysis of North Dakota's and Wyoming's experiences regulating injection and storage of carbon dioxide is outside the scope of this Article, a few comparisons may be illustrative for future developments of state legislation elsewhere.

Under North Dakota's state Class VI wells program law, the applicable definition for "carbon dioxide" is as follows: "carbon dioxide produced by anthropogenic sources which is of such purity and quality that it will not compromise the safety of geologic storage and will not compromise those properties of a storage reservoir which allow the reservoir to effectively enclose and contain a stored gas."[265] It is telling, perhaps, that the state's statute highlighted in the policy justifications for the law that carbon dioxide is a valuable commodity.[266] In this statute, environmental pro-

251. North Dakota Department of Mineral Resources, *Class VI—Geologic Sequestration Wells*, https://www.dmr.nd.gov/dmr/oilgas/ClassVI (last visited Aug. 5, 2024) [https://perma.cc/HMF3-XM3E].
252. U.S. EPA, *supra* note 127.
253. *Id.*
254. H.B. 1284, 87th Leg., 2021-2022 Sess. (Tex. 2021), https://capitol.texas.gov/tlodocs/87R/billtext/html/HB01284I.HTM [https://perma.cc/3H3H-68VM]. On March 3, 2023, the bill was referred to the Pensions, Investments, and Financial Services Committee. *See* FastDemocracy, *HB 1284—Texas House Bill*, https://fastdemocracy.com/bill-search/tx/88/bills/TXB00059497/ (last visited Aug. 5, 2024) [https://perma.cc/C2ZA-FVUA].
255. Philip K. Lau & Nadav C. Klugman, *Carbon Capture, Utilization, and Storage: Class VI Wells and US State Primacy*, Mayer Brown (June 9, 2022), https://www.mayerbrown.com/en/insights/publications/2022/06/carbon-capture-utilization-and-storage-class-vi-wells-and-us-state-primacy [https://perma.cc/JDY6-9BH5].
256. *Id.*
257. U.S. EPA, *supra* note 127 (As of this writing, the governor of Texas does not appear to have submitted this request.).
258. *Id.* (See table under "What states, territories, and tribes have primacy" section.).
259. Letter from Reps. Lloyd Doggett & Joaquin Castro, to Michael S. Regan, Administrator, U.S. EPA (July 14, 2023), https://castro.house.gov/imo/media/doc/castro-doggett-epa-letter.pdf [https://perma.cc/972G-N6VD] ("The Commission has a history of waiving its own rules and regulations to favor oil and gas companies over health and environmental protection standards."). *See also* Practical Law Oil and Gas, *Texas Railroad Commission Proposes Additional Amendments to Carbon Storage Rules*, Thomson Reuters Prac. L. (June 15, 2023).
260. Memorandum from Radhika Fox, Assistant Administrator, U.S. EPA, to Regional Water Division Directors, Regions I-X, re: Environmental Justice Guidance for UIC Class VI Permitting and Primacy (Aug. 17, 2023), https://www.epa.gov/system/files/documents/2023-08/Memo%20and%20EJ%20Guidance%20for%20UIC%20Class%20VI_August%202023.pdf [https://perma.cc/F7GK-C96T].
261. Simon Willis et al., *Texas Crawls Towards Primacy for CCS Permits*, Vinson & Elkins LLP (Sept. 21, 2023), https://www.velaw.com/insights/texas-crawls-towards-primacy-for-ccs-permits/ [https://perma.cc/7UUM-PDP4].
262. U.S. EPA, *supra* note 127 (See table under "What states, territories, and tribes have primacy" section.).
263. See Louisiana Statewide Order No. 29-N-6 §3607f(iii) and (iv), respectively. *See* La. Admin. Code tit. 43, pt. XVII, https://www.dnr.louisiana.gov/assets/OC/im_div/uic_sec/43v17_2022.pdf#page=151 [https://perma.cc/8KRB-LG5N].
264. U.S. EPA, *supra* note 126.
265. N.D. Cent. Code §38-22-12, https://ndlegis.gov/cencode/t38c22.pdf [https://perma.cc/9RU8-6XAH]:
> Environmental protection—Reservoir integrity. (1) The commission shall take action to ensure that a storage facility does not cause pollution or create a nuisance. For the purposes of this provision and in applying other laws, carbon dioxide stored, and which remains in storage under a commission permit, is not a pollutant nor does it constitute a nuisance. . . . (3) The commission shall take action to ensure that substances that compromise the objectives of this chapter or the integrity of a storage reservoir do not enter a storage reservoir.
266. North Dakota Century Code §38-22-01 provides as follows:
> It is in the public interest to promote the geologic storage of carbon dioxide. Doing so will benefit the state and the global environment

tection is listed alongside reservoir integrity.[267] There are no specifications regarding sources or purity levels of the carbon dioxide stream.[268]

By contrast, Wyoming's underground storage program presents a more nuanced definition:

> "Carbon dioxide stream" means carbon dioxide, plus associated substances derived from the source materials and any processing, and any substances added to the stream to enable or improve the injection process. Within this Chapter, the term "carbon dioxide stream" does not include any carbon dioxide stream that meets the definition of a hazardous waste under 40 C.F.R. §261.3, [referring to the federal regulation that defines "hazardous waste" under RCRA].[269]

Several provisions in the state's law mention that the source and properties of the injected carbon dioxide shall be informed in the permit process.[270] The permit application specifically requires analysis of the carbon dioxide stream.[271] To fulfill construction requirements, information about corrosiveness as well as the chemical composition shall be provided so the administrator can determine the construction requirements for the well.

4. Summary of State Storage Regulations

Given the current experiences in Louisiana, North Dakota, and Wyoming regarding the regulation of Class VI wells, it seems unlikely that future state Class VI rules will depart from practice and impose additional requirements regarding the source and purity levels of the carbon dioxide. While our sample is admittedly limited to the only three states that currently have primacy for Class VI wells, the Texas proposal does not yet indicate any additional requirements. It would be surprising if Texas changes course and decides to include these specifications, departing from current state legislative experiences.

After all, there may be some competition to store carbon dioxide in the future. Considering the policy approach to treat carbon dioxide as a "valuable commodity"—as explicitly signaled in the North Dakota Class VI law—this kind of interstate market competition is not farfetched. Carbon dioxide may be treated as a commodity based on several interests, including enhanced oil recovery (which runs counter to the greenhouse gas (GHG) goals to the extent that the carbon dioxide in enhanced oil recovery is not permanently stored), the revenue that the disposal and/or storage facilities may receive, and benefits from green marketing, among others.

Therefore, states may be using CCS to accommodate their oil and gas industry; they may also be competing to become "storage magnets" for carbon dioxide storage. In any event, both scenarios appear to encourage CCS, which might lead to less rather than more stringent requirements. Ultimately, current incentives for states are unlikely to add requirements, but rather to reduce barriers to storage.

B. Carbon Dioxide Transportation by Pipeline

As addressed in the second subsection of Section I.A.2, only PHMSA has federal regulatory authority over pipelines carrying carbon dioxide.[272] Assuming compliance with minimum federal requirements,[273] intrastate pipeline safety is further regulated at the state level.[274] Based on the potential interest in storage, this section surveys both the Louisiana and Texas[275] state legislation to examine if either of them includes specifications referring to purity levels or sources of the carbon dioxide stream.

1. Louisiana

The Louisiana rule defines "carbon dioxide" as "a fluid consisting of more than 90 percent carbon dioxide molecules compressed to a supercritical state."[276] The rule also incorporates the federal PHMSA standards.[277] Extra requirements for safety include records, corrosion analysis, training, and

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by reducing greenhouse gas emissions. Doing so will help ensure the viability of the state's coal and power industries, to the economic benefit of North Dakota and its citizens. Further, geologic storage of carbon dioxide, a potentially valuable *commodity*, may allow for its ready availability if needed for commercial, industrial, or other uses, including enhanced recovery of oil, gas, and other minerals. (emphasis added).

267. *Id.* §38-22-02.

268. North Dakota Century Code §38-22-08 states:

> Before issuing a permit, the commission shall find: . . .
> 3. That the carbon dioxide to be stored is of a quality that allows it to be safely and efficiently stored in the storage reservoir. . . .
> 9. That substances that compromise the objectives of this chapter or the integrity of a storage reservoir will not enter a storage reservoir.
> 10. That the storage facility will not endanger human health nor unduly endanger the environment.

269. 20-29 Wyo. Code R. §29-2(a), https://www.law.cornell.edu/regulations/wyoming/020-29-Wyo-Code-R-SS-29-2 [https://perma.cc/PZ8V-7AWW].

270. 20-24 Wyo. Code R. §10(b)(xvii)(C), https://rules.wyo.gov/Search.aspx?mode=1.

271. *Id.* §10(b)(xvii)(D).

272. Gerrard & Gundlach, *supra* note 61, at 108-09 (explaining that the Federal Energy Regulatory Commission, the Surface Transportation Board, and the Office of Pipeline Safety in DOT's PHMSA regulate the siting, economics, and safety of several interstate pipelines in the country).

273. State regulations must be at least as strong as the federal regulations. The research in this Article indicates that the following provisions of PHMSA are often incorporated in state legislation. *See, e.g.*, 49 C.F.R. pts. 190-195 (Pipeline Safety Enforcement and Regulatory Procedures; Transportation of Natural and Other Gas by Pipeline; Annual, Incident, and Other Reporting; Transportation of Natural and Other Gas by Pipeline: Minimum Federal Safety Standards; Liquefied Natural Gas Facilities: Federal Safety Standards; Response Plans for Onshore Oil Pipelines; Transportation of Hazardous Liquids by Pipeline); *id.* pt. 199 (Drug and Alcohol Testing).

274. Gerrard & Gundlach, *supra* note 61, at 109.

275. Additional information about specific state rules on carbon dioxide utilization and storage (CCUS) is available at the CCUS Legislative Tracker, launched on March 15, 2023, by the Sabin Center for Climate Change Law and Arnold & Porter, at https://cdrlaw.org/ccus-tracker/ (last visited Aug. 5, 2024) [https://perma.cc/L827-P2AR].

276. Louisiana Hazardous Liquid Rule, La. Admin. Code tit. 33, §30105, https://www.dnr.louisiana.gov/assets/OC/pipe_div/33v05_after2021amendments-Louisiana.pdf [https://perma.cc/M2MT-2HD9].

277. *Id.* §30109 (citing 49 C.F.R. §195.4, i.e., PHMSA), §30114 (citing 49 C.F.R. §195.8).

notification; however, they all refer back to the federal regulation.[278] A careful reading of the rule yielded no results regarding specifications of the carbon dioxide stream or its sources. Likewise, research of additional state statutes led to no different results.[279]

2. Texas

The Texas Administrative Code regulates the "intrastate pipeline transportation of hazardous liquids or carbon dioxide and all intrastate pipeline facilities as provided in 49 U.S.C. §§60101, et seq.; and Texas Natural Resources Code, §117.011 and §117.012."[280] By explicit reference, this code incorporates all federal standards for the transportation of hazardous liquid or carbon dioxide.[281] Additional requirements exist for records and reporting, corrosion control requirements, education and liaison, and locations within 1,000 feet from public school buildings or facilities.[282] After researching additional state legislation,[283] no further requirements for carbon dioxide streams or their sources were found.

3. Summary of State Transportation Considerations

The research into state legislative and regulatory requirements for pipeline transport of carbon dioxide for storage indicates that no additional requirements have been imposed with respect to purity levels of the carbon dioxide stream and its sources.

III. Conclusion

This Article concludes that, in the absence of a single federal framework on carbon dioxide transportation and storage, the IIJA was consequential for filling previous regulatory gaps, implementing several federal statutory amendments and regulatory changes to enable carbon capture and permanent storage. These findings are consistent with previous studies that underscore the existing federal regulatory trend aiming to facilitate carbon dioxide use and storage.[284] This trend is particularly visible in both the transportation and storage stages of the CCS chain. Overall, the United States is trending toward excluding carbon dioxide for capture, transport, and permanent storage from regulatory frameworks applicable to waste and pollutants.[285]

Part I analyzed the federal statutes potentially applicable to cross-border transportation of carbon dioxide for permanent storage in the United States. Our analysis determined that MPRSA, the APPS, and OCSLA do not pose barriers for transportation and storage projects. Current PHMSA regulations, adopted pursuant to the HMTA, do not impose additional constraints on the import of carbon dioxide; they do not require specific purity levels of the carbon dioxide stream beyond the ordinary 90% purity level for transportation of carbon dioxide; nor do they impose extra requirements for the source of the carbon dioxide.

As for RCRA, EPA's 2014 conditional exclusion of carbon dioxide streams for injection from the Act's definition of "hazardous waste" provides, in practice, for the permanent storage of carbon dioxide streams so long as Class VI requirements are met, as carbon dioxide that is stored in Class VI wells is not considered hazardous waste and so is not subject to the requirements of Subtitle C. Unless additional hazardous wastes were injected into these streams beyond the chemicals that are ordinarily present, it is improbable that these streams would be classified as "hazardous waste" under RCRA.

Finally, under the SDWA, EPA's 2010 Class VI rule created a new class of wells for the express purpose of injecting carbon dioxide into geologic formations for long-term storage. Our research on the SDWA and its Class VI rule concludes that the current legislative framework does not appear to impose legal barriers for the import of carbon dioxide for permanent injection and storage in the United States.

At the state level, the research in Part II indicates that the current examples of state regulations of Class VI wells do not impose additional requirements for the source and purity levels of the carbon dioxide. The current Texas proposal for Class VI primacy does not indicate an interest in any of those additional requirements.

In conclusion, the current U.S. legal framework does not appear to impose additional restrictions on sources or purity-level standards of the carbon dioxide streams to be transported and stored. Accordingly, the country's regulatory framework is unlikely to pose obstacles to the import of carbon dioxide streams for permanent storage, provided a stream is not mixed with a hazardous substance.

278. *Id.* §§30109 et seq. (every subsection of the rule cites to the specific provision under PHMSA).

279. *See* 6 Environmental Law Practice Guide §60.12 (Michael B. Gerrard ed., 2023); *see id*. §60.14 (for injection wells and considerations on hazardous waste).

280. 16 Tex. Admin. Code §8.1(a)(1)(C), https://texreg.sos.state.tx.us/public/readtac$ext.TacPage?sl=R&app=9&p_dir=&p_rloc=&p_tloc=&p_ploc=&pg=1&p_tac=&ti=16&pt=1&ch=8&rl=1 [https://perma.cc/F7Y6-W4S2].

281. *Id.* §8.1(a)(2).

282. *Id.* §§8.301, 8.305, 8.310, 8.315, respectively.

283. Tex. Nat. Res. Code §86.002; 16 Tex. Admin. Code §3.70 (pipeline permits), §3.9 (disposal wells); 8 Environmental Law Practice Guide, *supra* note 279, §86.16.

284. Carbon Capture, Utilization, and Sequestration Guidance, 87 Fed. Reg. 8808, 8809 (CEQ Feb. 16, 2022), https://www.govinfo.gov/content/pkg/FR-2022-02-16/pdf/2022-03205.pdf [https://perma.cc/LX6S-7484] (recommending expedited procedures).

285. International Energy Agency, Legal and Regulatory Frameworks for CCUS: An IEA CCUS Handbook 34 (2022).