



COLUMBIA LAW SCHOOL

SABIN CENTER FOR CLIMATE CHANGE LAW

**POLICY READINESS FOR
OFFSHORE CARBON DIOXIDE
STORAGE IN THE NORTHEAST**

By Romany M. Webb & Michael B. Gerrard

June 2017

© 2017 Sabin Center for Climate Change Law, Columbia Law School

The Sabin Center for Climate Change Law develops legal techniques to fight climate change, trains law students and lawyers in their use, and provides the legal profession and the public with up-to-date resources on key topics in climate law and regulation. It works closely with the scientists at Columbia University's Earth Institute and with a wide range of governmental, non-governmental and academic organizations.

Sabin Center for Climate Change Law

Columbia Law School

435 West 116th Street

New York, NY 10027

Tel: +1 (212) 854-3287

Email: columbiaclimate@gmail.com

Web: <http://www.ColumbiaClimateLaw.com>

Twitter: @ColumbiaClimate

Blog: <http://blogs.law.columbia.edu/climatechange>

Disclaimer: This paper is the responsibility of The Sabin Center for Climate Change Law alone, and does not reflect the views of Columbia Law School or Columbia University. This paper is an academic study provided for informational purposes only and does not constitute legal advice. Transmission of the information is not intended to create, and the receipt does not constitute, an attorney-client relationship between sender and receiver. No party should act or rely on any information contained in this White Paper without first seeking the advice of an attorney.

About the authors: Romany M. Webb is an Associate Research Scholar at Columbia Law School and Climate Law Fellow at the Sabin Center for Climate Change Law. Michael B. Gerrard is the Andrew Sabin Professor of Professional Practice at Columbia Law School and the Faculty Director of the Sabin Center for Climate Change Law.

EXECUTIVE SUMMARY

Reducing the amount of carbon dioxide in the atmosphere is vital to mitigate climate change. To date reduction efforts have primarily focused on minimizing the production of carbon dioxide during electricity generation, transport, and other activities. Going forward, to the extent that carbon dioxide continues to be produced, it will need to be captured before release. The captured carbon dioxide can then be utilized in some fashion, or it can be injected into underground geological formations – e.g., depleted oil and gas reserves, deep saline aquifers, or basalt rock reservoirs – where, it is hoped, it will remain permanently sequestered (“carbon capture and storage” or “CCS”).

Research is currently being undertaken into the possibility of injecting carbon dioxide into the seabed. One study, involving researchers from Columbia’s Lamont-Doherty Earth Observatory, aims to identify possible injection sites in the seabed along the northeast coast of the U.S. It is anticipated that, following identification of suitable sites, a demonstration project will be undertaken to assess the feasibility of offshore CCS. This paper outlines key regulatory requirements for the demonstration project and any subsequent commercial operations.

The regulation of offshore CCS differs depending on where it occurs. In the northeastern U.S., projects within three nautical miles of the coast (i.e., in “state waters”) fall under the regulatory authority of the coastal state, while projects located three to 200 nautical miles from the coast (i.e., in “federal waters”) are subject to federal regulation. Neither the federal government nor the states have authority over areas more than 200 nautical miles offshore. Those areas form part of the high seas which are open to use by all countries in accordance with international law.

It is anticipated that any future CCS project off the northeast coast will occur in federal waters or on the high seas. There is currently no comprehensive regulatory regime for projects in those areas. Current regulations, adopted by the Environmental Protection Agency (“EPA”) as part of its Underground Injection Control Program, only apply to projects undertaken onshore or in state waters. Projects further offshore, in federal waters or on the high seas, are specifically exempt from the regulations.

While there is no regulatory regime specific to CCS beyond state waters, EPA may regulate such projects under general programs, such as the ocean dumping regime established in the Marine Protection, Research, and Sanctuaries Act (“MPRSA”). The MPRSA was enacted to fulfill the U.S.’s obligations under the London Convention, which aims to prevent pollution of the seas by waste and/or other materials. Consistent with the terms of the Convention, the MPRSA regulates the dumping of materials at sea. For the purposes of the MPRSA, “material” is defined broadly to mean “matter of any kind or description,” which would include carbon dioxide. Carbon dioxide and other materials are considered to be “dumped” if they are disposed of at sea. EPA has suggested that this may encompass the injection of carbon dioxide into the seabed.

Assuming it applies to seabed injection, the MPRSA may operate as a barrier to offshore CCS. Under the MPRSA, any person transporting material from the U.S. for the purpose of dumping it at sea, whether in state or federal waters or on the high seas, must obtain a permit from EPA. Notably however, EPA cannot grant a permit where the material consists of industrial waste, being “solid, semi-solid, or liquid waste generated by a manufacturing or processing plant.” The dumping of such waste is, therefore, effectively prohibited by the MPRSA.

Whether carbon dioxide is an “industrial waste” for the purposes of the MPRSA is debatable and may ultimately depend on its source. Some commentators have suggested that carbon dioxide captured at power plants is not “industrial waste” as it does not originate from a “manufacturing or processing plant.” However, it could be argued that power plants manufacture electricity, making the carbon dioxide they produce “industrial waste.” In any event, the term “industrial waste” would encompass carbon dioxide from steel and other manufacturing facilities.

Depending on whether carbon dioxide is an industrial waste, the MPRSA may operate either to ban offshore injection of carbon dioxide or allow it with a permit from EPA. Numerous other permits and authorizations will also be required for offshore injection. The requirements for each aspect of a hypothetical injection project are summarized in the table below.

Regulatory Requirements for Offshore CCS in the Northeast U.S.

Activity	Onshore	Offshore		
		State Waters	Federal Waters	High Seas
<i>Drilling Carbon Dioxide Injection Wells</i>				
Obtaining land for drilling	N/A	N/A	A lease must be obtained from the Bureau of Ocean Energy Management (“BOEM”). BOEM may issue leases for the drilling of wells to inject carbon dioxide from coal-fired power plants. If the carbon dioxide originates from another source, a lease may only be issued if the well is drilled from existing facilities, used in offshore oil, gas and/or other mineral development.	Lease not required.
Installing drilling platforms	N/A	N/A	If the platform will be attached to the seabed, a permit must be obtained from the Army Corps of Engineers (“ACE”). Moveable platforms must also be registered with the Coast Guard. If facilities on the platform will emit air pollutants, a permit(s) may be required from EPA or a state authority.	Permit not required. The drilling platform should be registered with the U.S. Coast Guard or an equivalent body in another country.
<i>Transporting Carbon Dioxide to the Well Site</i>				
Pipeline transportation	Federal / state siting authority not required for pipeline construction. Construction may be subject to local land use	A lease / easement must be obtained from the relevant coastal state. A permit must be	An easement / right-of-way must be obtained from BOEM (if the pipeline will be installed by an existing lessee within his/her lease area) or the Bureau of Safety and Environmental Enforcement (in all	Easement / right-of-way not required. Permit not required.

Activity	Onshore	Offshore		
		State Waters	Federal Waters	High Seas
	planning rules and federal / state environmental laws depending on the location of the pipeline.	obtained from ACE. Other permits may be required from the coastal state under environmental and/or other laws.	other cases). A permit must be obtained from ACE.	
Road / rail transportation	The road / rail transporter must be registered with the Department of Transportation (“DOT”).	N/A	N/A	N/A
Ship transportation	N/A	If carbon dioxide is transported in bulk, the ship must be registered with the U.S. Coast Guard. If carbon dioxide is transported on a non-bulk basis, the ship must be registered with DOT.		
Storage during transportation	Construction and/or other permits may be required depending on the location of the facility. Any facility storing ≥ 5 tons of carbon dioxide must notify state and local emergency officials.	N/A	N/A	N/A
<i>Injecting Carbon Dioxide at the Well Site</i>				
Conduct of injection operations	N/A	N/A	An MPRSA permit must be obtained from EPA if the carbon dioxide will be transported from within the U.S. or on a U.S. registered vessel. EPA cannot issue a permit if it determines that the carbon dioxide is an “industrial waste” produced by a manufacturing or processing plant.	

Activity	Onshore	Offshore		
		State Waters	Federal Waters	High Seas
Quality of injectate	N/A	N/A	If injection is permitted under the MPRSA, the injectate must contain no more than trace amounts of oil, organohalogen, mercury, cadmium, or known or suspected carcinogens, mutagens, or teratogens. The concentration of substances that are immiscible with, or highly soluble in, seawater must not exceed their solubility limit.	
Reporting on injection	N/A	N/A	If injection is permitted under the MPRSA, biannual reports must be submitted to EPA on the characteristics of the injectate and the time(s) and location(s) of injection. All injection operations, except those conducted as part of a research project, must report annually on the amount of carbon dioxide received, injected, sequestered, and emitted.	If injection is permitted under the MPRSA, biannual reports must be submitted to EPA on the characteristics of the injectate and the time(s) and location(s) of injection.
Post-injection monitoring	N/A	N/A	Unless injection operations are conducted as part of a research project, the operator must monitor the injection area until stabilization of the carbon dioxide plume.	No monitoring requirements.
Leak control	N/A	N/A	If injection is permitted under the MPRSA, EPA may require action to control leaks as a condition of the permit.	

CONTENTS

1.	Introduction	1
2.	Background	4
3.	Regulatory Jurisdiction Over Offshore CCS	6
3.1	International Legal Framework	6
3.2	U.S. Jurisdictional Areas	8
3.2.1	State Waters	8
3.2.2	Federal Waters	10
3.3	Areas Beyond U.S. Jurisdiction	11
4.	Regulation of Offshore CCS	12
4.1	Federal Regulation	12
4.2	International Law	15
5.	Drilling Carbon Dioxide Injection Wells	17
5.1	Drilling in Federal Waters	17
5.1.1	Leasing Land for Drilling	18
5.1.2	Installing Drilling Platforms in the Lease Area	24
5.1.3	Design of the Drilling Platform	26
5.1.4	Conduct of Drilling Activities	31
5.1.5	Well Design Requirements	31
5.2	Drilling on the High Seas	32
6.	Transporting Carbon Dioxide to the Well Site	35
6.1	Onshore Transportation	35
6.1.1	Pipeline Transportation	36
6.1.2	Road and Rail Transportation	49
6.2	Offshore Transportation	50
6.2.1	Pipeline Transportation	50
6.2.2	Ship Transportation	59
6.3	Storage During Transportation	62
7.	Injecting Carbon Dioxide at the Well Site	65
7.1	Requirements for Carbon Dioxide Injection	65
7.1.1	Carbon Dioxide Purity	67
7.1.2	Conduct of Injection Operations	69
7.2	Reporting on Injection	70
7.2.1	Additional Requirements for Operations in Federal Waters	70
7.2.2	Additional Requirements for Operations on the High Seas	71
7.3	Post-Injection Site Closure and Monitoring	72
7.3.1	Operations in Federal Waters	72
7.3.2	Operations on the High Seas	73
7.4	Controlling Leaks from Carbon Dioxide Injection Wells	73
7.5	Decommissioning Offshore Installations	74
8.	Conclusion	76
	Appendix A: Regulatory Framework for injection well drilling	78
	Appendix B: Regulatory Framework for Carbon Dioxide Transport	79
	Appendix C: Regulatory Framework for Carbon Dioxide Injection	80

LIST OF ACRONYMS

ACE	Army Corps of Engineers
Bcf	Billion cubic feet
BLM	Bureau of Land Management
BOEM	Bureau of Ocean Energy Management
BSEE	Bureau of Safety and Environmental Enforcement
CCS	Carbon dioxide capture and storage
CCUS	Carbon dioxide capture, utilization, and storage
CDEEP	Connecticut Department of Energy and Environmental Protection
COA	Corresponding Offshore Area
CWA	Clean Water Act
CZMA	Coastal Zone Management Act
DDNREC	Delaware Department of Natural Resources and Environmental Control
DEP	Department of Environmental Protection
DOI	Department of the Interior
DOT	Department of Transportation
EA	Environmental Assessment
EEZ	Exclusive Economic Zone
EIS	Environmental Impact Statement
EOR	Enhanced oil recovery
EPA	Environmental Protection Agency
EPCRA	Emergency Planning and Community Right-to-Know Act
ESA	Endangered Species Act
FERC	Federal Energy Regulatory Commission
GHGRP	Greenhouse Gas Reporting Program
HMTA	Hazardous Materials Transportation Act
MDE	Maryland Department of the Environment
MDEP	Massachusetts Department of Environmental Protection
MOU	Memorandum of Understanding

MPRSA	Marine Protection, Research, and Sanctuaries Act
MRC	Marine Resources Commission of Virginia
MW	Megawatt
n.m.	Nautical mile
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
NHDES	New Hampshire Department of Environmental Services
NJDEP	New Jersey Department of Environmental Protection
NMFS	National Marine Fisheries Service
NYDEC	New York Department of Environmental Conservation
PHMSA	Pipeline and Hazardous Materials Safety Administration
PSD	Prevention of Significant Deterioration
OCS	Outer Continental Shelf
OCSLA	Outer Continental Shelf Lands Act
OSHA	Occupational Safety and Health Administration
RICRMC	Rhode Island Coastal Resources Management Council
ROW	Right of way
RUE	Right of use and easement
SERC	State Emergency Response Commission
SLA	Submerged Lands Act
STB	Surface Transportation Board
UIC	Underground Injection Control
UNCLOS	United Nations Convention on the Law of the Sea
U.S.	United States
USCG	U.S. Coast Guard
VDEQ	Virginia Department of Environmental Quality

1. INTRODUCTION

The 2014 National Climate Assessment concluded that average temperatures in the U.S. have increased by up to 1.9°F since 1895 and may rise a further 4°F in coming decades.¹ This is primarily due to the emission of greenhouse gases which trap heat in the earth’s atmosphere causing surface temperatures to rise.² The most important greenhouse gas is carbon dioxide, which is emitted in larger quantities, and remains in the atmosphere longer, than other major heat trapping gases.³

Carbon dioxide emissions primarily result from the burning of fossil fuels – i.e., coal, oil, and natural gas – in electricity generation and other applications.⁴ Seeking to reduce emissions many policy-makers have called for the replacement of fossil fuels with lower-carbon alternatives. Although some progress has been made, a complete phase-out of fossil fuels would be difficult, at least in the short- to medium-term. Recognizing this, some researchers have begun investigating other emission reduction strategies. One such strategy involves capturing carbon dioxide at its source before it is released into the atmosphere. The captured carbon dioxide could then be used in some way or injected into underground geologic formations for the purposes of permanent storage (“carbon dioxide capture, utilization, and storage” or “CCUS”).

Currently, in North America, only small amounts of carbon dioxide are captured prior to release. All of the captured carbon dioxide is used for enhanced oil recovery (“EOR”) whereby it is injected into oil wells for the purpose of maintaining formation pressure (i.e., to replace oil and water that have been pumped out of the well). However, carbon dioxide could also be injected underground for the purpose of disposal, i.e., unrelated to EOR. This is known as carbon dioxide capture and storage or CCS. To date, most CCS research has focused on the possibility of injecting carbon dioxide into onshore geological formations, such as depleted oil and gas reservoirs and

¹ U.S. GLOBAL CHANGE RESEARCH PROGRAM, CLIMATE CHANGE IMPACTS IN THE UNITED STATES 8 (2014), available at <https://perma.cc/NM9N-YBGL>.

² INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, CLIMATE CHANGE 2014: SYNTHESIS REPORT 4 (2014), available at <https://perma.cc/U7Y4-DQ4L>.

³ *Id.* at 5.

⁴ *Id.*

deep saline aquifers. There is, however, growing interest in possibly injecting carbon dioxide offshore into geological formations underlying the seabed.

From a public policy perspective, offshore CCS has a number of advantages over onshore alternatives. Most notably, locating injection sites offshore keeps them away from populated areas, reducing risks to public safety and the potential for public opposition.⁵ It is not without difficulties, however. For instance, offshore injection is likely to be costly as it necessitates the building of complex drilling platforms and/or other structures at sea, as well as an extensive transportation system to deliver carbon dioxide to the injection wells.⁶ There are also significant regulatory risks as there is currently no comprehensive legal framework for offshore carbon dioxide injection.⁷ Most offshore injection operations are regulated under a patchwork of laws which were developed with other activities in mind and, as a result, are often poorly suited to CCS.

This paper examines the regulatory framework for offshore CCS along the northeastern U.S. coast. The possibility of CCS in this area is currently being studied by researchers at the Lamont-Doherty Earth Observatory. The study aims to identify potential carbon dioxide injection sites off the coast of Virginia, Maryland, Delaware, New Jersey, New York, Connecticut, Rhode Island, Massachusetts, New Hampshire, and Maine (together the “ten northeast states”). Assuming suitable sites are identified, a demonstration project will be undertaken to assess the viability of offshore CCS, with commercial-scale operations possible thereafter.

The remainder of this paper is structured as follows: background information on the likely design of any future offshore CCS project is provided in Part 2. Parts 3 and 4 are also intended as background, providing a general overview of the regulatory regimes governing offshore CCS, under both U.S. and international law. The subsequent parts explore the regimes in more detail and discuss their application to specific aspects of CCS. Part 5 focuses on injection well construction, outlining the regulatory requirements for installing offshore platforms and drilling wells. The regulatory regime governing the transport of carbon dioxide to the well site – i.e., by

⁵ For a discussion of this issue, see Daniel P. Schrag, *Storage of Carbon Dioxide in Offshore Sediments*, 325 *SCIENCE* 1658, 1659 (2009).

⁶ *Id.*

⁷ Regulations specific to carbon dioxide injection have been adopted by the Environmental Protection Agency (“EPA”) through its Underground Injection Control Program. Notably however, those regulations only apply to injection operations onshore or in state waters, i.e., within three nautical miles offshore.

pipeline, road, rail, and/or ship – is examined in Part 6. Part 7 then discusses the regulation of carbon dioxide injection at the well site. Part 8 concludes.

2. BACKGROUND

The Department of Energy has provided funding for a collaborative study, involving researchers from Columbia University's Lamont-Doherty Earth Observatory and other institutions, to assess the feasibility of CCS off the northeast coast of the U.S. ("Northeast CCS Study"). The Study aims to identify potential carbon dioxide injection sites in three geological reservoirs, namely:

1. the Baltimore Canyon Trough, which is located off the Mid-Atlantic coast and extends from Cape Hatteras in North Carolina to the eastern tip of Long Island in New York;
2. the Georges Bank Basin, which is located off the New England coast and extends from Cape Cod in Massachusetts to Nova Scotia in Canada; and
3. the Long Island Platform, which is located off the coast of Massachusetts, New Jersey, New York, and Rhode Island.

Following identification of potential sites, a demonstration project will be undertaken to assess the viability of CCS. Assuming the demonstration project is successful, commercial-scale operations may then begin.

It is anticipated that, during the demonstration project, carbon dioxide will be injected into a vertical well drilled up to one mile into the seabed. Directional wells will likely be drilled during commercial-scale operations. Each well is expected to be approximately one mile deep and could extend horizontally for several miles. No chemicals will be used during drilling, but water may be required, e.g., to cool and lubricate the drill-bit ("drilling fluid"). The drilling fluid will be re-circulated and used to bring tailings to the surface.

During both the demonstration project and commercial operations, well drilling will take place from offshore platforms, which may be fixed to the seafloor or floating. The platforms will be equipped with electricity generating facilities which will be used to power drilling and other equipment. No chemicals will be stored on the platform, but there will be storage for drilling fluids and tailings.

Following the completion of drilling, the well(s) will be fitted with a pressure monitor and emergency sealing device, capable of automatically shutting the wellbore if pressure exceeds a given level. The well will then be injected with carbon dioxide, likely sourced from power plants in the U.S. The carbon dioxide will be transported from the source plant to the well site in liquid form

via pipeline, road, rail, and/or ship. Once at the well site, the liquid carbon dioxide may be injected as is, or first mixed with seawater. After injection the well will be sealed and monitored for leaks.

We understand that all activities relating to the construction of platforms, drilling of wells, and injection of carbon dioxide will take place more than three nautical miles (“n.m.”) from shore, except for any pipelines that carry the carbon dioxide from the shore to the wells. It is expected that most activities will occur less than 200 n.m. from shore, though some may occur further offshore. We assume that such activities will occur on the high seas and not within the exclusive economic zone (“EEZ”) of any other country.

3. REGULATORY JURISDICTION OVER OFFSHORE CCS

The regulation of any future carbon dioxide injection project will depend on its location. Under international law, offshore areas are divided into several distinct zones, each with a different regulatory status. The various zones are discussed in this part.

KEY FINDINGS

- Under international law, each country's regulatory authority is limited to the water and submerged land within 200 n.m. of its coast or, if the continental margin exceeds 200 n.m.:
 - sixty n.m. from the foot of the continental shelf; or
 - beyond the shelf foot where the sediment thickness is one percent of the distance thereto.
- In the U.S. authority over this area is shared between:
 - coastal states, which regulate areas within three n.m. of their shores (or, in the Texas and the west coast of Florida, nine n.m.); and
 - the federal government, which regulates areas three (or, in Texas and the west coast of Florida, nine) to 200 n.m. offshore.
- Neither the federal government nor the states have jurisdiction over offshore areas more than 200 n.m. from shore (except for the provisions noted above regarding the continental shelf). Those areas form part of the high seas which are open to all countries for use in accordance with international law.

3.1 International Legal Framework

Jurisdiction over offshore areas is determined under the principles of international law as set out in the 1982 United Nations Convention on the Law of the Sea ("UNCLOS").⁸ Under UNCLOS, each country has jurisdiction over areas within 200 n.m. of its shores (and further in certain circumstances), as shown in Table 1 below. Areas more than 200 n.m. offshore are not

⁸ United Nations Convention on the Law of the Sea, Dec. 10, 1982, 1833 U.N.T.S. 397 [hereinafter UNCLOS]. The U.S. has not ratified UNCLOS, but recognizes most of its provisions, including those discussed in this part, as forming part of customary international law.

subject to the jurisdiction of any country, but rather form part of the high seas, which are open to use by all countries in accordance with international law.⁹

Table 1: Offshore Zones Identified in UNCLOS

Area	Definition	Status
<i>Offshore Waters</i>		
Territorial Sea	The area extending 12 n.m. from the baseline (i.e., normally the low-water line along the coast). ¹⁰	The territorial sea, its bed and subsoil, and the airspace above it form part of the sovereign territory of the coastal state. ¹¹
Exclusive Economic Zone or EEZ	The area adjacent to, and beyond, the territorial sea which extends 200 n.m. from the baseline. ¹²	Within the EEZ, the coastal state has: <ul style="list-style-type: none"> • sovereign rights to explore, exploit, conserve, and manage natural resources and undertake other activities for the economic exploitation of the zone; and • jurisdiction with regard to the establishment and use of artificial islands, installations, and structures, marine scientific research, and marine protection.¹³
The High Seas	All areas not included in the Territorial Sea or EEZ. ¹⁴	The high seas are open to use by all countries. No country has sovereign rights within the high seas. ¹⁵
<i>Offshore Land</i>		
Continental Shelf	The submarine area extending beyond the territorial sea to the farthest of: <ul style="list-style-type: none"> • 200 n.m. from the baseline; or • the outer edge of the continental margin¹⁶ up to: <ul style="list-style-type: none"> ○ 60 n.m. from the foot of the 	The coastal state has sovereign rights over the continental shelf for the purpose of exploring and exploiting its natural resources. ¹⁸

⁹ *Id.* at Art. 7.

¹⁰ *Id.* at Art. 3.

¹¹ *Id.* at Art. 2.

¹² *Id.* at Art. 55 & 57.

¹³ *Id.* at Art. 56.

¹⁴ *Id.* at Art. 86.

¹⁵ *Id.* at Art. 7.

¹⁶ The “continental margin” refers to the submerged prolongation of the land mass of the coastal state. *Id.* at Art. 76(1).

Area	Definition	Status
	continental shelf; or <ul style="list-style-type: none"> ○ the point where sediment thickness is 1 percent of the distance thereto.¹⁷ 	

3.2 U.S. Jurisdictional Areas

Consistent with UNCLOS the U.S. has claimed jurisdiction over all waters up to 200 n.m. from its coast (“U.S. waters”).¹⁹ Jurisdiction is shared between the states, which have title to areas within three n.m. of shore (and further in certain circumstances) and the federal government, which has title to areas further offshore.

3.2.1 State Waters

In the U.S., each coastal state has regulatory authority over the waters adjacent to its land, known as “state waters.” The Submerged Lands Act of 1953 (“SLA”) extended the boundaries of each coastal state to three n.m. from its coastline, except for Texas and the west coast of Florida, where the SLA extended state boundaries to nine n.m. from the coastline.²⁰ For the purposes of the SLA, a state’s “coastline” is defined as “the line of ordinary low water along that portion of the coast which is in direct contact with the open sea and the line marking the seaward limit of inland waters.”²¹

¹⁸ *Id.* at Art. 77.

¹⁷ The continental shelf shall not extend more than 100 n.m. from the 2,500 meter isobath or 350 n.m. from the baseline. *Id.* at Art. 76.

¹⁹ Proclamation No. 5030, 48 Fed. Reg. 10605 (Mar. 14, 1983).

²⁰ 43 U.S.C. § 1312 (providing that “[t]he seaward boundary of each original coastal State is approved and confirmed as a line three geographic miles distant from its coast line”). *See also Id.* § 1301(b) (defining the term “boundaries” and providing that “in no event shall the term boundaries . . . be interpreted as extending from the coast line more than three geographical miles in the Atlantic Ocean or the Pacific Ocean, or more than three marine leagues into the Gulf of Mexico”). A “marine league” is equivalent to three n.m. Thus, in the Gulf of Mexico, the boundaries of Texas and Florida extend nine n.m. from the coastline. *See generally* U.S. v. Louisiana, 100 S.Ct. 1618 (1980), 420 U.S. 529 (1975), 394 U.S. 11 (1969), 389 U.S. 155 (1967), 363 U.S. 1 (1960), 339 U.S. 699 (1950).

²¹ *Id.* § 1301(c).

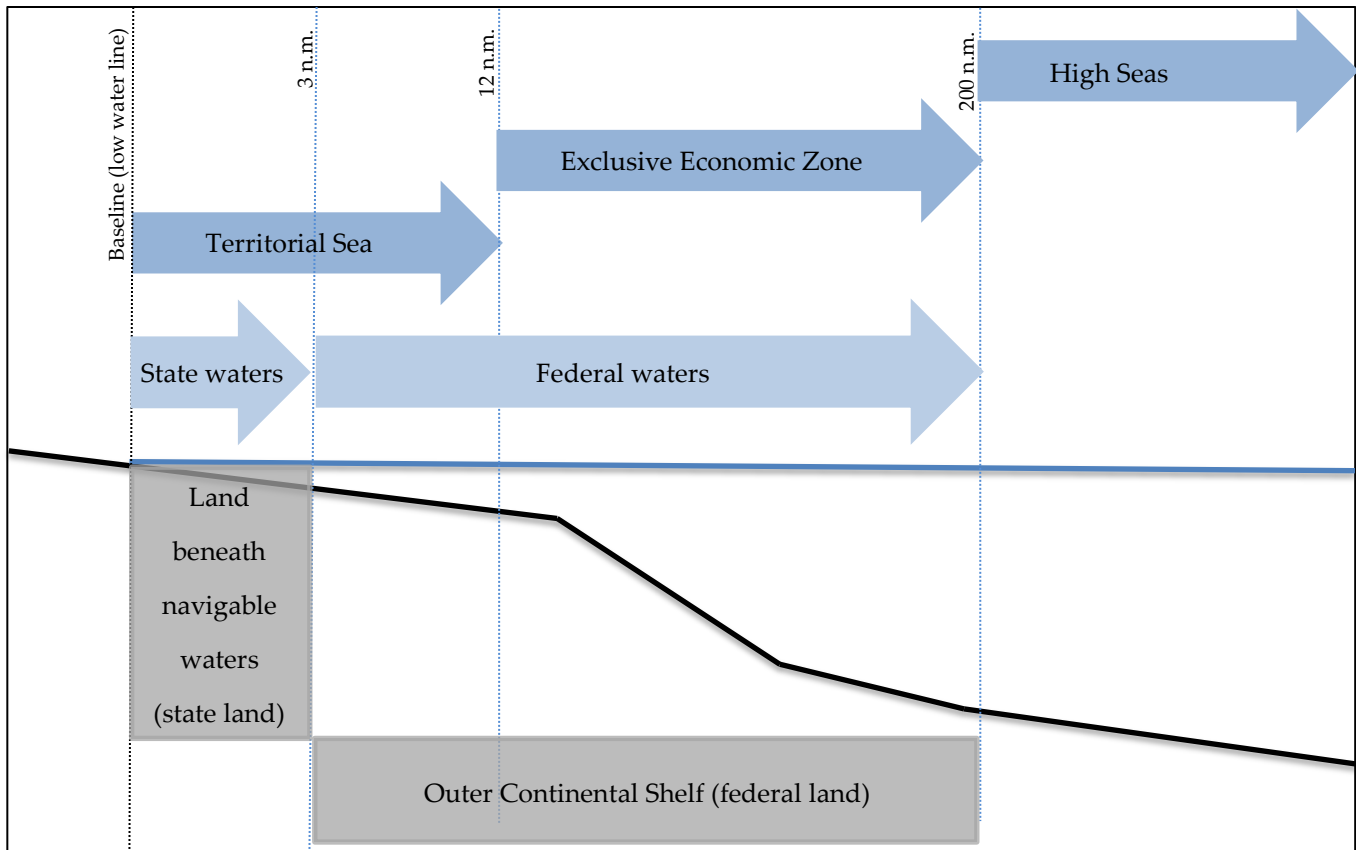


Figure 1: Regulatory Jurisdiction over Offshore Areas

The SLA confirms that each coastal state has title to, and ownership of, all lands beneath navigable waters within its boundaries.²² All natural resources within those lands and waters, including minerals, marine animals, and plant life, are also owned by the state.²³ The federal government has relinquished all of its rights to, and interests in, the land and resources within state waters (though it retains regulatory jurisdiction).²⁴

²² *Id.* § 1311(a)(1). The term “lands beneath navigable waters” is defined to mean “(1) all lands within the boundaries of each [State] . . . which are covered by nontidal waters that were navigable under the laws of the United States at the time such State became a member of the Union, or acquired sovereignty over such lands and waters thereafter, up to the ordinary high water mark . . . (2) all lands permanently or periodically covered by tidal waters up to but not above the line of mean high tide and seaward to a line three geographic miles distant from the coast line of each such State . . . and (3) all filled in, made, or reclaimed lands which formerly were lands beneath navigable waters.” *Id.* § 1301(a).

²³ *Id.* § 1311(a)(1). The term “natural resources” is defined to include, without limitation, “oil, gas, and all other minerals, and fish, shrimp, oysters, clams, crabs, lobsters, sponges, kelp, and other marine animal and plant life but does not include water power, or the use of water for the production of power.” *Id.* § 1301(e).

²⁴ *Id.* § 1311(b).

FINDING 1: Waters within three n.m. (or, in Texas and the west coast of Florida, nine n.m.) of the ordinary low water line are subject to the jurisdiction of the coastal state. Each coastal state has title to, and ownership of, all lands beneath those waters.

3.2.2 Federal Waters

Along the northeast coast, federal waters begin three n.m. from the coastline (i.e., as defined in the SLA)²⁵ and extend to the edge of the EEZ, located 200 n.m. from the baseline specified in UNCLOS.²⁶ The normal “baseline” used for measuring the EEZ is the low-water line along the coast.²⁷ In some instances, however, the baseline may be adjusted based on geological factors such as the nature of the coastline and/or the presence of reefs thereon.²⁸

The federal government has title to offshore land, comprising the subsoil and seabed of the outer continental shelf (“OCS”). The federal Outer Continental Shelf Lands Act (“OCSLA”) defines the OCS as those “submerged lands lying seaward and outside of the area [subject to state jurisdiction] . . . and of which the subsoil and seabed appertain to the U.S.”²⁹ As noted in subpart 3.2.1 above, state jurisdiction typically ends three n.m. from shore (except in Texas and the west coast of Florida, where it ends nine n.m. from shore), at which point the OCS begins. The OCS extends to the seaward limit of U.S. jurisdiction, defined under international law as the farthest of:

- 200 n.m. from the baseline (i.e., normally the low-water line along the coast); or
- if the continental margin³⁰ exceeds 200 n.m., a line:
 - sixty n.m. from the foot of the continental shelf; or
 - beyond the shelf foot where the sediment thickness is one percent of the distance thereto.³¹

²⁵ *Id.* § 1311(c).

²⁶ UNCLOS, *supra* note 8, at Art. 57.

²⁷ *Id.* at 5.

²⁸ *Id.* at 6-11.

²⁹ 43 U.S.C. § 1331.

³⁰ The “continental margin” comprises “the submerged prolongation of the land mass of the coastal state and consists of the seabed and subsoil of the [continental] shelf, the slope, and the rise.” See UNCLOS, *supra* note 8, at Art.

³¹ *Id.* At 76(1) & (4).

The OCS cannot, however, extend more than 350 n.m. from the baseline or 100 n.m. from the 2,500 meter isobath (i.e., a line connecting the depth of 2,500 meters).³²

FINDING 2: In the northeastern U.S., federal waters extend three to 200 n.m. from the low water line. The federal government has title to the submerged land underlying those waters and, if the continental margin extends beyond 200 n.m., additional land up to 250 n.m. from the low water line or 100 n.m. from the 2,500 meter isobath (known as the outer continental shelf or OCS).

3.3 Areas Beyond U.S. Jurisdiction

U.S. jurisdiction over offshore waters only extends to the outer edge of the EEZ (i.e., 200 n.m. from the baseline). Waters lying seaward of the EEZ are considered part of the “high seas” over which no country has exclusive jurisdiction. The high seas are open to all countries³³ – whether coastal or land-locked – for use in accordance with international law.³⁴ This so-called “freedom of the high seas” includes: (a) freedom of navigation; (b) freedom of overflight; (c) freedom to lay submarine cables and pipelines; (d) freedom to construct artificial islands and other installations; (e) freedom of fishing; and (f) freedom of scientific research.³⁵ Countries must exercise these freedoms “with due regard for the interests of other[s].”³⁶

FINDING 3: Waters more than 200 n.m. from the low water line form part of the high seas which are open to use by all countries.

³² *Id.* at 76(5).

³³ *Id.* at 87.

³⁴ *Id.*

³⁵ *Id.*

³⁶ *Id.*

4. REGULATION OF OFFSHORE CCS

The location of any future offshore CCS project, undertaken as part of the Northeast CCS Study, will have important implications for its regulation. We understand that neither the demonstration project, nor any subsequent commercial operations, will be undertaken in state waters. This paper does not, therefore, discuss state regulation of offshore CCS.³⁷ The paper instead focuses on the regulatory regimes existing at the federal level and under international law. A general overview of those regimes is provided in this part. The subsequent parts then discuss the application of the regimes to specific aspects of offshore CCS.

KEY FINDINGS

- There are currently no federal regulations specifically addressing carbon dioxide injection in federal waters or on the high seas. Injection operations in those areas may, however, be regulated under general programs.
- The Environmental Protection Agency (“EPA”) has proposed regulating offshore injection under the federal ocean dumping program. That program was adopted to fulfill the U.S.’s obligations under the London Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (“London Convention”).
- The London Convention regulates the dumping of waste and other material at sea. The London Convention does not expressly regulate offshore injection of carbon dioxide into the seabed, but may implicitly apply to it if such injection is found to be a form of “dumping.”
- Carbon dioxide injection is dealt with in a 1996 Protocol to the London Convention. That Protocol has been signed, but has not been ratified, by the U.S.

4.1 Federal Regulation

There are few federal regulations dealing specifically with offshore CCS. Certain CCS projects are regulated by EPA through its Underground Injection Control (“UIC”) Program, which was established under the Safe Drinking Water Act³⁸ to prevent the contamination of drinking

³⁷ The paper does discuss state regulation of offshore pipelines which are used to transport carbon dioxide to CCS injection sites in federal waters or on the high seas. See *infra* part 6.2.1.1.

³⁸ 42 U.S.C. § 300f et seq.

water by material injected underground.³⁹ As part of the UIC Program, in December 2010, EPA promulgated regulations with respect to the underground injection of carbon dioxide for geologic sequestration.⁴⁰ The regulations require wells used for carbon dioxide injection to be permitted⁴¹ and establish standards for injection well siting, construction, operation, testing, and monitoring.⁴² Notably however, the regulations only apply to wells located onshore or within state waters.⁴³ Wells situated “beyond [a] state’s territorial waters” are expressly exempt from regulation.⁴⁴

FINDING 4: EPA’s UIC Program regulates the construction and operation of carbon dioxide injection wells onshore and in state waters. The regulations do not apply to wells in federal waters or on the high seas.

No federal regulatory programs specifically address CCS outside state waters. CCS projects may, of course, be regulated under general programs developed with other activities in mind. The most relevant general program is established under the Marine Protection, Research, and Sanctuaries Act (“MPRSA”).⁴⁵ The MPRSA regulates the dumping of waste and other materials in the ocean. For the purposes of the Act, the term “materials” is defined broadly to include “matter of any kind or description,” which would encompass carbon dioxide.⁴⁶ There is, however, some uncertainty as to whether the Act applies to offshore CCS projects.

By its express terms, the MPRSA only applies to the dumping of materials into ocean waters, defined as “waters of the open seas lying seaward of the base line” (i.e., normally the low water line).⁴⁷ Based on this definition, it may be argued that CCS projects are not covered by the MPRSA as the carbon dioxide is injected into the seabed, rather than the water column. A similar

³⁹ EPA, *General Information About Injection Wells*, UNDERGROUND INJECTION CONTROL (UIC), <http://perma.cc/s7V2-PS4B> (last updated Sep. 6, 2016).

⁴⁰ Federal Requirements Under the Underground Injection Control Program for Carbon Dioxide Geologic Sequestration Wells, 75 Fed. Reg. 77,230 (Dec. 10, 2010) (codified at 40 C.F.R. pt. 124, 144, 145, et seq.) [hereinafter UIC Program Rules].

⁴¹ 40 C.F.R. §§ 144.11 & 144.18.

⁴² See generally *Id.* pt. 146, subpt. H.

⁴³ *Id.* § 144.1(g)(1).

⁴⁴ *Id.* § 144.1(g)(2)(i).

⁴⁵ 33 U.S.C. § 1401 et seq.

⁴⁶ *Id.* § 1402(c).

⁴⁷ *Id.* § 1402(b).

argument has been made with respect to the London Convention⁴⁸ - i.e., on which the MPRSA is based - though many commentators have disputed its validity in that context.⁴⁹ Some assert that, for the purposes of the London Convention, “what matters is not the final resting place of the material, but the location of the act of [dumping] itself,” and whether it occurs at sea.⁵⁰ Others emphasize that “the purpose of the Convention was . . . to protect the sea” and, as such, it should be interpreted as applying to “activities in the sea-bed that have the potential to harm the sea.”⁵¹

Some support for a broad interpretation of the MPRSA, as applying to activities in the seabed, is provided by the Act’s definition of “dumping.” Section 3(f) of the MPRSA defines “dumping” to mean:

a disposition of material: Provided, That it does not mean a disposition of any effluent from any outfall structure to the extent that such disposition is regulated under the provisions of the Federal Water Pollution Control Act, as amended, under the provisions of section 407 of this title, or under the provisions of the Atomic Energy Act of 1954, as amended, nor does it mean a routine discharge of effluent incidental to the propulsion of, or operation of motor-driven equipment on, vessels: Provided, further, that it does not mean the construction of any fixed structure or artificial island nor 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 (emphasis added).⁵²

The exclusion for construction or placement of structures or artificial islands “on or in the submerged lands beneath [ocean] waters” would be unnecessary if the MPRSA did not apply to seabed activities. Thus, it appears that seabed activities are subject to the MPRSA, unless covered by the exclusion. Disposal is specifically excepted from the exclusion.

Consistent with this view, EPA has suggested that “sub-seabed CO₂ [carbon dioxide] injection . . . may, in certain circumstances, be defined as ocean dumping and subject to regulation

⁴⁸ See e.g. MARK A. DE FIGUEIREDO, THE INTERNATIONAL LAW OF SUB-SEABED CARBON DIOXIDE STORAGE 18 (2005), available at <https://perma.cc/R399-MJBM>.

⁴⁹ See generally Yvette Carr, *The International Legal Issues Relating to the Facilitation of Sub-Seabed CO₂ Sequestration Projects in Australia*, 14 AUSTL. INT’L L. J. 137, 144 (2007).

⁵⁰ *Id.*

⁵¹ RAY PURDY & RICHARD MACRORY, GEOLOGICAL CARBON SEQUESTRATION: CRITICAL LEGAL ISSUES 19 (2004), available at <https://perma.cc/6YK6-9HA7>.

⁵² 33 U.S.C. § 1402(f).

under the MPRSA.⁵³ Such injection is unlikely to fall within the exclusion noted above, including because carbon dioxide is arguably not a “structure” or “device” as those terms imply man-made, artificial objects or systems, and also because the injection is for the purposes of disposal.⁵⁴ In this paper, then, we assume that the MPRSA applies to the injection of carbon dioxide into the seabed.

FINDING 5: EPA may regulate offshore CCS through the ocean dumping program established under the MPRSA.

4.2 International Law

The only international agreement dealing specifically with offshore CCS is the 1996 Protocol to the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matters (“London Protocol”). The London Protocol aims to prevent pollution of the seas⁵⁵ through “dumping,” defined broadly to include the “storage of wastes or other matter in the seabed.”⁵⁶ It requires contracting nations to “prohibit the dumping of any wastes or other matter with the exception of those listed in Annex I.”⁵⁷ The list in Annex I includes “[c]arbon dioxide streams from carbon dioxide capture processes for sequestration.”⁵⁸ The dumping of carbon dioxide for sequestration requires a permit.⁵⁹ Each contracting nation must adopt procedures for issuing permits that ensure, as far as practicable, that environmental disturbance and detriment are minimized and benefits are maximized.⁶⁰

The London Protocol was signed, but has not been ratified, by the U.S. The U.S. has ratified the London Convention, under which the protocol was adopted. The London Convention

⁵³ UIC Program Rules, *supra* note 40.

⁵⁴ The Cambridge dictionary defines “structure” to mean “something that has been made or built from parts” and “device” to mean “an object or machine that has been invented for a particular purpose.”

⁵⁵ The term “sea” is defined broadly to mean “all marine waters other than the internal waters of the States, as well as the seabed and the subsoil thereof.” Protocol to the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matters, Nov. 7, 1996, Art. 1.7.

⁵⁶ *Id.* at Art. 1.4.1.3.

⁵⁷ *Id.* at Art. 4.1.1

⁵⁸ *Id.* at Annex I.

⁵⁹ *Id.* Art. 4.1.2.

⁶⁰ *Id.* at Art. 4.1.2 & Annex 2.

regulates the dumping of waste and other material at sea.⁶¹ While it does not expressly address the injection of carbon dioxide into the seabed, some commentators have argued that injection operations implicitly fall within its terms, constituting “dumping” for the purposes of the Convention.⁶²

FINDING 6: The London Protocol, which regulates offshore CCS, has not been ratified by the U.S. The U.S. has ratified the London Convention, under which the Protocol was adopted, and pursuant to its obligations thereunder it has enacted the MPRSA.

⁶¹ Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter, Dec. 29. 1972, Art. I.

⁶² See e.g., Purdy & Macrory, *supra* note 51, at 19; Carr, *supra* note 49, at 144.

5. DRILLING CARBON DIOXIDE INJECTION WELLS

As part of the Northeast CCS Study, carbon dioxide collected at power plants and/or other facilities will be injected into wells, drilled one or more miles into the seabed. Drilling will take place from offshore platforms, which may be fixed to the seabed or floating. The regulatory requirements for installing platforms and drilling wells are outlined in this part. A diagram summarizing the requirements is included in Appendix A.

KEY FINDINGS

- Persons wishing to drill carbon dioxide injection wells in federal waters must obtain a lease from the Bureau of Ocean Energy Management (“BOEM”). Under its current authorizing statute, BOEM may only grant a lease if:
 - the well drilled will be injected with carbon dioxide collected at coal-fired power plants; or
 - well drilling will use existing facilities used in oil, gas, and/or other mineral development (i.e., regardless of the source of the carbon dioxide injected therein).
- A BOEM lease grants the lessee the right to occupy, and install and operate facilities on, a designated portion of the OCS. That right is, however, subject to the lessee obtaining any necessary approvals from other federal agencies.
- If a lessee wishes to install a drilling platform or other structure that will be permanently or temporarily attached to the seabed, he/she/it must obtain a permit from the Army Corps of Engineers (“ACE”). Certain moveable structures, including mobile offshore drilling units, must also be registered with the U.S. Coast Guard (“USCG”).
- Carbon dioxide injection wells may be drilled on the high seas without federal government approval. Platforms used for drilling on the high seas do not need to be permitted by ACE or any other authority. We recommend, however, that such platforms be registered with USCG or an equivalent body in another country. There are no restrictions on where platforms are registered.

5.1 Drilling in Federal Waters

As noted in subpart 3.2.2 above, in the northeastern U.S., federal waters extend three to 200 n.m. from the coast. The federal government has title to the land underlying those waters and, if

the continental margin extends beyond 200 n.m., additional land up to 350 n.m. from the low water line or 100 n.m. from the 2,500 meter isobath (i.e., the OCS). Activities on the OCS are, therefore, subject to federal regulation. This subpart outlines federal permitting and other requirements for drilling offshore carbon dioxide injection wells on the OCS.

5.1.1 Leasing Land for Drilling

Persons wishing to drill on the OCS must obtain a lease from the Department of the Interior's ("DOI's") BOEM.⁶³ BOEM's current authorizing statute – i.e., the OCSLA – restricts the circumstances in which it may lease land on the OCS. Under section 8(p)(1) of the OCSLA, BOEM may only grant leases for activities that:

- (A) support exploration, development, production, or storage of oil or natural gas . . . ;
- (B) support transportation of oil or natural gas, excluding shipping activities;
- (C) produce or support production, transportation, or transmission of energy from sources other than oil and gas; or
- (D) use, for energy-related purposes or for other authorized marine-related purposes, facilities currently or previously used for activities [relating to oil, gas, and other mineral development on the OCS].⁶⁴

BOEM has asserted authority under section 8(p)(1)(C) of the OCSLA to grant leases for offshore injection of carbon dioxide “generated as a byproduct of . . . coal-fired power plants.”⁶⁵ According to BOEM, injection of carbon dioxide from coal-fired power plants supports the production of energy from sources other than oil and gas, bringing it within paragraph (C). That paragraph would not apply to the injection of carbon dioxide from natural gas power plants or other non-energy industries. Injection of carbon dioxide from those sources may, however, fall within paragraph (D) in some circumstances. BOEM staff have suggested that paragraph (D) “may

⁶³ ADAM VANN, WIND ENERGY: OFFSHORE PERMITTING 3 (2012), available at <https://perma.cc/36W3-3E66> (indicating that “[u]se of federal and federally controlled lands, including the OCS [i.e., the outer continental shelf], requires some form of permission”).

⁶⁴ 43 U.S.C. § 1337(p)(1).

⁶⁵ Email from Melissa Batum, Sen. Prog. Analyst, Bureau of Ocean Energy Management, Department of the Interior (Feb. 21, 2017, 13:58 EST) (on file with author). See also PAUL G. THOMAS, III & REBECCA C. SMYTH, ANALYSIS OF APPLICABILITY OF EXISTING BOEM/BSEE REGULATIONS TO OFFSHORE SUB-SEABED GEOLOGIC SEQUESTRATION OF CARBON DIOXIDE 4 (2013), available at <https://perma.cc/MQ2F-Z7MJ> (reporting BOEM's interpretation as expressed by bureau staff in personal communications with the authors).

allow BOEM to authorize the conversion of existing . . . oil and gas facilities” for use in CCS.⁶⁶ To date, however, BOEM has not taken an official position on this issue.⁶⁷

5.1.1.1 Leases for New Drilling Operations

BOEM regulations outline the process it will follow when leasing land under section 8(p)(1)(C) of the OCSLA.⁶⁸ Notably however, the regulations currently only apply to leases for activities producing, or supporting the production of, energy from renewable sources.⁶⁹ BOEM is yet to adopt regulations with respect to activities supporting energy production from coal (e.g., CCS).

The OCSLA requires section 8(p)(1)(C) leases to be issued “on a competitive basis unless [BOEM] determines . . . that there is no competitive interest” in the lease area.⁷⁰ We anticipate that, in leasing land for activities supporting energy production from coal, BOEM will use a similar process as is currently used for activities supporting renewable energy production. Under its current renewable energy regulations, BOEM may propose areas for leasing on its own motion,⁷¹ or accept requests from interested parties.⁷² In both cases, prior to leasing, BOEM must publish a notice in the *Federal Register* seeking expressions of interest from third parties.⁷³ If it receives expressions of interest, BOEM must issue leases through a competitive auction;⁷⁴ otherwise leases will be issued on a non-competitive basis.⁷⁵

⁶⁶ Thomas et al., *supra* note 65, at 4-5.

⁶⁷ Email from Melissa Batum, Sen. Prog. Analyst, Bureau of Ocean Energy Management, Department of the Interior (Feb. 21, 2017, 13:58 EST) (on file with author).

⁶⁸ 30 C.F.R. Pt. 585.

⁶⁹ “Renewable energy” is defined to mean “any resource other than oil and gas or minerals.” *Id.* § 585.112. The term “minerals” includes “all minerals authorized by an Act of Congress to be produced from public lands.” *Id.* § 580.1. This definition likely encompasses coal. While coal is not a “mineral” in the strict scientific sense of a naturally occurring inorganic substance, the term “mineral” can also be used more broadly to refer to any substance obtained by mining. It appears that the regulations use “mineral” in this broad sense as the term is defined to include “oil” and “gas” neither of which are inorganic. Therefore, as coal is a substance obtained by mining and is authorized to be produced from public lands (i.e., under the Mineral Leasing Act), it is a mineral for the purposes of the regulations. It would not, therefore, fall within the regulatory definition of “renewable energy.”

⁷⁰ 43 U.S.C. § 1337(p)(3).

⁷¹ 30 C.F.R. § 585.210.

⁷² *Id.* § 585.230.

⁷³ *Id.* § 585.230.

⁷⁴ *Id.* §§ 585.220, 585.231(c).

⁷⁵ *Id.* §§ 585.212(a), 585.231(d).

When issuing leases, BOEM must comply with various procedural requirements, including:

- BOEM must conduct an environmental review under the National Environmental Policy Act (“NEPA”).⁷⁶ NEPA requires an environmental impact statement (“EIS”) to be prepared for any major federal action (i.e., an action undertaken, authorized, or funded by a federal agency) “significantly affecting the quality of the human environment.”⁷⁷ The EIS must include an assessment of the likely effect of the action on natural, economic, social, and cultural resources.⁷⁸ Pursuant to NEPA, there is a process for release of the relevant documents to the public and opportunities for public input.
- BOEM must complete any required consultation under the Endangered Species Act (“ESA”).⁷⁹ Consultation is required under section 7 of the ESA where a federal agency undertakes, authorizes, or funds an action that may affect species listed as endangered⁸⁰ or threatened^{81,82}. Where an action may affect endangered or threatened marine species, the federal agency must consult with the National Marine Fisheries Service (“NMFS”).⁸³
- BOEM must consult with other federal agencies with an interest in leasing, as well as the governor of any state or the executive any local government affected by the lease.⁸⁴ A state or local government is “affected” by a lease if:
 - it is, or is proposed to be, used as a support base for activities permitted in the lease area; or
 - there is a reasonable probability of significant effects on land or water uses in its jurisdiction from activities permitted in the lease area.⁸⁵

⁷⁶ 42 U.S.C. § 4321 et seq.

⁷⁷ *Id.* § 4332(2)(C).

⁷⁸ *Id.*

⁷⁹ 30 C.F.R. § 585.203.

⁸⁰ A species is considered “endangered” if it “is in danger of extinction throughout all or a significant portion of its range.” See 16 U.S.C. § 1532(6).

⁸¹ A species is considered “threatened” if it “is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.” See *Id.* § 1532(20).

⁸² *Id.* § 1536(a)(2).

⁸³ NOAA Fisheries, *Endangered Species Act*, <https://perma.cc/E937-SQSG> (last updated Feb. 11, 2016).

⁸⁴ 43 U.S.C. § 1337(p)(7) (requiring the BOEM to “provide for coordination and consultation with the Governor of any State or the executive of any local government that may be affected by a lease”); 30 C.F.R. § 585.203 (providing that, when awarding leases, the BOEM will consult with “relevant federal agencies” and “any affected State, the executive of any affected local government, and any affected Indian Tribe).

⁸⁵ *Id.* § 585.112.

- If leasing will affect⁸⁶ land or water use or natural resources in state waters, BOEM must ensure, to the maximum extent practicable, consistency with any state management plan adopted under the Coastal Zone Management Act (“CZMA”).⁸⁷ BOEM must submit a consistency determination to the relevant state, describing the proposed activity, its expected effects, and how it consistent with the CZMA management plan.⁸⁸ If the state objects to the determination, BOEM must work with it to address the objection.⁸⁹

Using the information obtained through the various reviews and consultations, BOEM will evaluate the effect of leasing on the human, marine, and coastal environments.⁹⁰ It must develop measures to mitigate any adverse effects.⁹¹

FINDING 7: BOEM may lease land on the OCS for the establishment of new facilities to drill wells to inject carbon dioxide sourced from coal-fired power plants. Leases will be issued through a competitive auction, unless there is no competitive interest, in which case issuance will be on a first-come-first served basis.

5.1.1.2 Leases for Operations Using Existing Facilities

BOEM regulations provide for the issuance of rights of use and easement (“RUEs”) authorizing “alternative use” of existing facilities under section 8(p)(1)(D) of the OCSLA.⁹² The regulations define “alternative use” to mean “the energy- or marine-related use of an existing OCS facility for activities not otherwise authorized by . . . law.”⁹³ The terms “energy-related use” and

⁸⁶ An activity “will affect” land or water use or natural resources if it has “any reasonably foreseeable effect on any coastal use or resource . . . Effects are not just environmental effects, but include effects on coastal uses. Effects include both direct effects which result from the activity and occur at the same time and place as the activity, and indirect (cumulative and secondary) effects which result from the activity and are later in time or farther removed in distance, but are still reasonably foreseeable.” 15 C.F.R. § 930.11(g).

⁸⁷ 16 U.S.C. § 1456(c).

⁸⁸ *Id.* § 1456(c)(1)(C); 15 C.F.R. § 930.39.

⁸⁹ If resolution cannot be reached, BOEM may only proceed with leasing after serving the state with a notice, which clearly describes how leasing is consistent with the state management plan, to the maximum extent practicable. See *Id.* § 930.43.

⁹⁰ *Id.* § 585.211(b)(2).

⁹¹ *Id.* § 585.211(2).

⁹² 30 C.F.R. § 585.1000(a).

⁹³ *Id.* § 585.112.

“marine-related use” are not defined in the regulations. Nor are those terms defined in the OCSLA. The legislative history does not provide any indication of their scope.

Based on previous statements by BOEM we consider that it is likely to interpret “energy-related use” broadly to include offshore injection of carbon dioxide captured at power plants. As noted in part 5.1.1 above, BOEM has previously taken the view that such storage supports the production of energy, arguably making it “energy-related.” Offshore injection of carbon dioxide from sources other than power plants (e.g., industrial facilities) would likely not be considered energy-related. It may, however, be considered marine-related. The meaning of “marine-related” as used in the OCSLA and associated regulations has not been considered by the courts. The courts have, however, considered its meaning in other contexts. The term has generally been construed broadly to include activities taking place at sea and on-land enterprises supporting such activities.⁹⁴ Consistent with this view, offshore CCS is likely to be considered a marine-related activity, as it occurs at sea.

Interested persons may apply to BOEM for an RUE to make use of an existing facility on a portion of the OCS that has already been leased by BOEM.⁹⁵ If the person is not the lessee of the area or the owner of the facility, prior to making an application, he/she/it must reach an agreement with the lessee and/or owner as to his/her/its use thereof. The person must then file an application with BOEM, containing basic information about the use including:

- an overview of the type of activities proposed to use the existing facility;
- a description of the existing facility to be used, including a map showing its location;
- the name(s) of the lessee of the area and the owner and operator of the facility (if different);
- a description of any additional structures or equipment that will be located on or in the vicinity of the facility;

⁹⁴ See e.g., *U.S. v. Transocean Deepwater Drilling Inc.*, 767 F. 3d 485 (5th Cir. Tex. 2014) (finding that an oil spill at sea was properly classified as a “marine-related” spill); *Boudreaux v. American Workover Inc.*, 680 F. 2d 1034 (5th Cir. La. 1982 (defining injuries occurring at sea as “marine-related” injuries); *Stuart Sportfishing, Inc. v. Kehoe*, 541 So. 2d 169 (Fla. Dist. Ct. App., 1989 (indicating that an on-shore business may be considered “marine-related” if it supports activities at sea by, for example, serving the needs of boat owners); *Dravo Corp. v. Occupational Safety & Health Review Com.*, 613 F.2d 1227 (3d Cir. 1980) (finding that a product will be considered “marine-related” if it goes into a boat or barge used at sea).

⁹⁵ *Id.* § 585.1005.

- a statement indicating whether the proposed use will occur before existing activities at the facility have ceased; and
- a statement describing how existing activities at the facility will be affected if the proposed use is conducted at the same time.⁹⁶

On receiving an application BOEM will publish a notice in the *Federal Register* to determine if there is competitive interest in making alternative use of the facilities.⁹⁷ If no interest is expressed, BOEM will issue the RUE on a non-competitive basis, otherwise a competitive process will be used. BOEM will ask each competing applicant to submit a description of the use he/she proposes to make of the facilities.⁹⁸ BOEM will then evaluate each proposal to determine whether the use is compatible with existing activities at the facility.⁹⁹ Based on that evaluation BOEM will select one or more acceptable proposals and submit them to the lessee and owner for acceptance.¹⁰⁰ An RUE may be issued with respect to any accepted proposal.¹⁰¹

When issuing RUEs, BOEM must complete the procedural steps described in part 5.1.1.1 above, including consulting with other government agencies. Based on the information obtained through consultation, BOEM will evaluate whether the activities to be permitted under the RUE can be conducted in a manner that:

- ensures safety and minimizes adverse effects to coastal and marine environments;
- does not inhibit or restrain orderly development of OCS mineral or energy resources;
- avoids serious harm or damages to, or waste of, any natural resource, life, or property;
- is otherwise consistent with section 8(p) of the OCSLA; and
- can be effectively regulated by BOEM.¹⁰²

Based on that evaluation, BOEM may authorize, authorize with modifications, or reject the proposed activity.¹⁰³

⁹⁶ *Id.* § 585.1005(b).

⁹⁷ *Id.* § 585.1007(b).

⁹⁸ *Id.* § 585.1007(c).

⁹⁹ *Id.* § 585.1007(d).

¹⁰⁰ *Id.* § 585.1007(f).

¹⁰¹ *Id.*

¹⁰² *Id.* § 585.1006(a).

¹⁰³ *Id.* § 585.1006(b).

FINDING 8: BOEM may lease land on the OCS for projects involving the conversion of existing facilities for use in CCS. Leases will be issued through a competitive auction, unless there is no competitive interest.

5.1.2 Installing Drilling Platforms in the Lease Area

A BOEM issued lease grants the lessee the right to occupy, and install and operate facilities on, a designated portion of the OCS.¹⁰⁴ That right is, however, subject to the lessee obtaining any necessary approvals from other agencies.¹⁰⁵ Where the lessee wishes to install a drilling platform or other structure in the lease area, which will be permanently or temporarily attached to the seabed, he/she/it must obtain a permit from the Army Corps of Engineers (“ACE”).¹⁰⁶

Permit applications must be filed with the relevant district office of ACE and include:

- a complete description of the project, including drawings, sketches, and plans;
- details of the location, purpose, need for, and scheduling of the project;
- the names and addresses of adjoining property owners;
- the location and dimensions of adjacent structures; and
- a list of authorizations required from other agencies for the project.¹⁰⁷

Within fifteen days of receiving a permit application, ACE will issue a public notice, advising interested parties of the project for which a permit is sought and soliciting comments.¹⁰⁸ Based on the comments received and any responses from the applicant, ACE will decide whether or not the project should be permitted.¹⁰⁹ In making this decision, ACE will consider the impact of the project on the public interest, balancing its beneficial and detrimental effects.¹¹⁰ As part of that balancing, ACE will consider all factors relevant to the project, including “conservation, economics, aesthetics, general environmental concerns . . . navigation, recreation . . . and, in general, the needs

¹⁰⁴ *Id.* § 585.200(a).

¹⁰⁵ *Id.*

¹⁰⁶ ACE regulations require a permit to be obtained prior to the construction of any “structures . . . in or affecting navigable waters of the United States,” including “artificial islands, installations, and other devices on the seabed” of the OCS. *See* 33 C.F.R. § 322.3(a)-(b).

¹⁰⁷ *Id.* § 325.1.

¹⁰⁸ *Id.* §§ 325.2(a)(2), 325.3.

¹⁰⁹ *Id.* § 325.2(a)(3).

¹¹⁰ *Id.* § 320.4(a)(1).

and welfare of the people.”¹¹¹ ACE must complete any necessary reviews under NEPA and/or other federal legislation.¹¹² In undertaking the NEPA review, ACE must cooperate with BOEM and any other agency which has jurisdiction over, or special expertise with respect to the project. A lead agency must be appointed to prepare an environmental assessment (“EA”) or EIS¹¹³ for project in cooperation with other involved agencies.¹¹⁴

FINDING 9: A permit must be obtained from the ACE prior to installing any drilling platform or other structure that is attached to the seabed of the OCS.

In addition to being permitted by ACE, certain moveable drilling platforms must also be registered with the USCG. Registration is required for any vessel that measures at least five net tons and is used in connection with offshore drilling.¹¹⁵ The term “vessel” is defined broadly to mean “every description of watercraft or other artificial contrivance used, or capable of being used, as a means of transportation on water.”¹¹⁶ The definition includes mobile offshore drilling units¹¹⁷ and ships involved in the setting, relocation, or recovery of the anchors or other mooring equipment of those units.¹¹⁸

¹¹¹ *Id.*

¹¹² For a discussion of NEPA, see *supra* section 5.1.1.

¹¹³ 40 C.F.R. § 1501.5(a) (providing that a “lead agency shall supervise the preparation of an environmental impact statement if more than one Federal agency either: (1) Proposes or is involved in the same action; or (2) Is involved in a group of actions directly related to each other because of their functional interdependence or geographical proximity”). See also *Id.* § 1501.5(c) (providing that the lead agency shall be agreed between the involved agencies. “If there is disagreement among the agencies, the following factors . . . shall determine lead agency designation: (1) Magnitude of agency’s involved. (2) Project approval/disapproval authority. (3) Expertise concerning the action’s environmental effects. (4) Duration of agency’s involvement. (5) Sequence of agency’s involvement”).

¹¹⁴ *Id.* § 1501.6.

¹¹⁵ 46 U.S.C. § 12102.

¹¹⁶ *Id.* § 115; 1 U.S.C. § 3.

¹¹⁷ 46 C.F.R. § 107.111 (defining mobile offshore drilling units as vessels). USCG regulations provide for the registration of any mobile offshore drilling unit “capable of engaging in drilling operations . . . that is (1) seagoing and 300 or more gross tons and self-propelled by a motor; (2) seagoing and 100 or more gross tons and non-self-propelled; or (3) more than 65 feet in length and propelled by steam.” See *Id.* § 107.111.

¹¹⁸ 46 U.S.C. § 12111(d)(1) (defining such ships as “vessels”).

USCG registration is evidenced by a Certificate of Inspection which may be issued for any mobile offshore drilling unit that is wholly owned by an eligible¹¹⁹ individual or entity in the U.S.¹²⁰ The owner or builder of a mobile offshore drilling unit may apply for a certificate prior to its construction by filing an application for inspection, together with design plans and related information, with the USCG.¹²¹ The USCG will conduct inspections while the unit is being constructed and, if it finds that the unit meets safety and other requirements, issue a certificate of inspection that is valid for five years.¹²² The certificate may be renewed for subsequent five year periods following another inspection by the USCG.¹²³

FINDING 10: Mobile offshore drilling units and vessels used in the positioning of those units must be registered with the USCG.

5.1.3 Design of the Drilling Platform

Drilling platforms and other structures on the OCS must be designed and constructed in accordance with any requirements specified in the permit issued by ACE.¹²⁴ Additional requirements may also be imposed by other federal agencies in some circumstances. For example, if the structure will be a significant source of air pollution, it must comply with requirements established by EPA under section 328 of the Clean Air Act.¹²⁵ Those requirements may apply to

¹¹⁹ The following are eligible owners: (1) an individual who is a citizen of the U.S., (2) an association, trust, joint venture, or other entity if all of its members are U.S. citizens and it is capable of holding title to a vessel under the laws of the U.S. or a state, (3) a partnership if each general partner is a U.S. citizen and the controlling interest in the partnership is owned by U.S. citizens; (4) a corporation if it is incorporated under the laws of the U.S. or a state, its chief executive officer and the chairman of its board of directors are U.S. citizens, and no more of its directors are non-citizens than the number necessary to constitute a quorum; (5) the U.S. government; and (6) the government of a state. See 49 U.S.C. § 12103(b).

¹²⁰ *Id.* § 12103(a).

¹²¹ 46 C.F.R. § 107.211(a).

¹²² *Id.* §§ 107.211(b), (d). For a list of the requirements, see *Id.* § 107.231.

¹²³ *Id.* § 107.215.

¹²⁴ 33 C.F.R. § 325.4(a) (authorizing the Army Corps to impose conditions on permits when “necessary to satisfy legal requirements or to otherwise satisfy the public interest requirement”). See also *Id.* § 325.4(d) (providing that, if the Army Corps has reason to believe that the permit holder may be prevented from completing work necessary to protect the public interest, it may require him/her to post a bond of sufficient amount to indemnify the government against any loss as a result of corrective action it may take).

¹²⁵ 42 U.S.C. § 7627.

structures installed in connection with the Northeast CCS Project where they are equipped with electric generating facilities that emit air pollutants.

Pursuant to the Clean Air Act, EPA has adopted regulations governing the construction and operation of “OCS sources,”¹²⁶ defined as “any equipment, activity, or facility which:

- (1) Emits or has the potential to emit any air pollutant;
- (2) Is regulated or authorized under the [OCSLA]; and
- (3) Is located on the OCS or in or on waters above the OCS.”¹²⁷

The regulations impose different requirements depending on the location of the OCS source. Generally, sources located within twenty-five miles seaward of the seaward boundary of state waters (“Near Shore OCS Source”) must comply with the air quality requirements of the corresponding onshore area (“COA”),¹²⁸ i.e. typically the onshore area geographically closest to the source.¹²⁹ Sources located further offshore (“Seaward OCS Sources”) are subject to federal air quality requirements.¹³⁰

All OCS Sources are subject to New Source Review (“NSR”) under the Clean Air Act.¹³¹ Pursuant to the NSR Program OCS Sources must obtain a pre-construction permit if their emissions exceed certain thresholds. Permits for Near Shore OCS Sources are generally issued by EPA in accordance with the rules applicable to sources in the COA.¹³² Different permitting rules apply depending on local air quality in the COA and, in particular, whether it has attained the National Ambient Air Quality Standards (“NAAQS”) for carbon monoxide, nitrogen oxides, sulfur oxides, lead, ozone, and particulate matter (together the “NAAQS Pollutants”). In summary:

1. If the COA has attained the NAAQS, permitting occurs under the Prevention of Significant Deterioration (“PSD”) Program. Each state has its own PSD Program, which will apply to Near Shore OCS Sources off its coast. The state programs generally require a permit to be obtained by any source with annual emissions of 250 tons or more. The permit will require the source to

¹²⁶ 40 C.F.R. Pt. 55.

¹²⁷ *Id.* §§ 55.2 & 55.3(a). The EPA regulations do not apply to OCS Sources located in the Gulf of Mexico west of 87.5 degrees longitude. *Id.* § 55.3(a).

¹²⁸ 42 U.S.C. § 7627(a)(1). *See also* 40 C.F.R. § 55.3(b).

¹²⁹ *Id.* § 55.2.

¹³⁰ *Id.* § 55.3(c).

¹³¹ *Id.* §§ 55.13 & 55.14.

¹³² *Id.* §§ 55.11 & 55.14.

apply the best available control technology which the permitting authority determines is achievable taking into account energy, environmental, and economic impacts and other costs.¹³³

2. If the COA has not attained the NAAQS, permitting will occur under the relevant state's non-attainment program. Generally, in each state, a permit must be obtained by any source emitting 100 tons or more of air pollution annually. Some states have lower permitting thresholds for certain pollutants and/or areas.¹³⁴ In all states, permitted sources must install pollution control technologies to meet the lowest achievable emissions rate,¹³⁵ and provide offsets for any increase in emissions.¹³⁶

Only one class of pre-construction permit, issued under the PSD Program, is available for Seaward OCS Sources.¹³⁷ Permits are issued by EPA and must be obtained by any Seaward OCS Source emitting 250 tons or more of air pollution annually.¹³⁸ Seaward OCS Sources emitting 100 tons of a NAAQS Pollutant or ten tons of a hazardous air pollutant must also obtain an operating permit from EPA.¹³⁹ Operating permits are also required by certain Near Shore OCS Sources.¹⁴⁰

¹³³ *Id.* § 52.21(b)(12).

¹³⁴ *See e.g.* 7-1100-1125 DEL. ADMIN. CODE § 2.2.2 (providing that the permitting threshold for facilities emitting volatile organic compounds or nitrogen oxide is: (1) for areas in ozone attainment or marginal or moderate non-attainment – 50 tons per year volatile organic compounds or 100 tons per year of nitrogen oxides; (2) for serious ozone non-attainment areas – 50 tons per year of either volatile organic compounds or nitrogen oxides; (3) for severe ozone non-attainment areas – 25 tons per year of either volatile organic compounds or nitrogen oxides; or (4) for extreme ozone non-attainment areas – 10 tons per year of either volatile organic compounds or nitrogen oxides).

¹³⁵ The Lowest Achievable Emissions Rate or LAER is a technology-based standard reflecting the most stringent emissions limitation that can be achieved in practice. *See* 42 U.S.C. § 7501(3).

¹³⁶ Offsets take the form of emissions reductions from existing facilities. Any emissions increase from the source must be balanced by equivalent or greater offsets.

¹³⁷ 40 C.F.R. § 55.13(d)(2). *See also Id.* § 52.21.

¹³⁸ 40 U.S.C. § 7479. *See also* 40 C.F.R. § 52.21.

¹³⁹ 40 C.F.R. § 55.13(f)(2). *See also Id.* § 71.3.

¹⁴⁰ In the ten northeast states, operating permits are generally required for facilities emitting 100 tons of an air pollutant, or 10 tons of a hazardous air pollutant. Some states have lower thresholds for certain pollutants, most commonly nitrogen oxide and volatile organic compounds. *See e.g.* 7-1100-1130 DEL. ADMIN. CODE § 3.0; MD. CODE REGS. 26.11.03.01; 310 MASS. CODE REGS. § 7, Appendix C; N.J. ADMIN. CODE § 7:27-22.2; N.Y. COMP. CODES R & REGS. tit. 6, §§ 201-2.1 & 201-6.1; VA. ADMIN. CODE § 5-80-50 et seq.

FINDING 11: Drilling platforms equipped with electric generating facilities that emit air pollutants may be subject to permitting under the Clean Air Act. Platforms within twenty-five miles of state waters are generally subject to the same permitting requirements as apply to onshore facilities within the relevant state. Federal permitting requirements apply to platforms more than twenty-five miles from state waters.

Both Near Shore and Seaward OCS Sources must comply with emissions standards adopted under the Clean Air Act.¹⁴¹ The minimum standards for sources with electric generating facilities are summarized in Table 2 below.

¹⁴¹ 40 C.F.R. § 55.13(c).

Table 2: Emissions Limits for Electric Generating Facilities

Facility Type	Emissions Limit		
	Particulate Matter	Sulfur Dioxide	Nitrogen Oxides
Steam generating unit ¹⁴² with capacity \geq 2.9 megawatts (“MW”) but \leq 29 MW ¹⁴³	13 ng/J or 22 ng/J and 0.2% of the combustion concentration if coal, oil, and/or wood are used and unit capacity \geq 8.7 MW. ¹⁴⁴	87 ng/J or 10% of the potential emissions rate if coal is used ¹⁴⁵ or 215 ng/J if oil is used. ¹⁴⁶	N/A
Steam generating unit with capacity $>$ 29 MW but \leq 73 MW ¹⁴⁷	13 ng/J if coal, oil, and/or wood are used. ¹⁴⁸	87 ng/J or 8% of the potential emission rate and 520 ng/J. ¹⁴⁹	86 ng/J if coal, oil, or gas are used. ¹⁵⁰
Steam generating unit with capacity $>$ 73 MW ¹⁵¹	43 ng/J or 20% opacity. ¹⁵²	340 ng/J if liquid fossil fuels are used or 520 ng/J if solid fossil fuels are used. ¹⁵³	86 ng/J if the gaseous fossil fuel are used, 129 ng/J if liquid fossil fuels are used, or 300 ng/J if solid fossil fuels ¹⁵⁴ are used. ¹⁵⁵

¹⁴² EPA regulations define a “steam generating unit” as “a device that combusts any fuel and produces steam or heats water or heats any heat transfer medium.” *Id.* § 60.41c.

¹⁴³ *Id.* § 60.40c.

¹⁴⁴ *Id.* §60.43c(e).

¹⁴⁵ *Id.* § 60.42c(a). Higher emissions limits apply to units that combust coal refuse in a fluidized bed combustion steam generating unit or use an emerging technology for the control of sulfur dioxide emissions. See *Id.* § 60.42c(b).

¹⁴⁶ *Id.* § 60.42c(d). This emissions limit will not apply if the unit uses oil containing \leq 0.5% sulfur

¹⁴⁷ *Id.* §§ 60.40b & 60.41b.

¹⁴⁸ *Id.* § 60.43b(h)(1)

¹⁴⁹ *Id.* § 60.42b(k)(1).

¹⁵⁰ *Id.* § 60.44b(l)(1). This emissions limit does not apply to certain units operating with a capacity factor of ten percent or less. *Id.* § 60.44b(j)-(k).

¹⁵¹ *Id.* § 60.40. Only fossil-fuel-fired and fossil fuel and wood residue-fired steam generating units are included within this category.

¹⁵² *Id.* § 60.42(a). These emissions limits do not apply to facilities that combust only natural gas or gaseous or liquid fuel (excluding residual oil) with potential sulfur dioxide rates of twenty-six ng/j. *Id.* § 60.42(d)-(e)

¹⁵³ *Id.* § 60.43(a).

¹⁵⁴ If the solid fossil fuel consists of lignite mined in North Dakota, South Dakota, or Montana and burned in a cyclone-fired unit, the emissions limit is 340 ng/J. For other types of lignite, the emissions limit is 260 ng/J. *Id.* § 60.44(a)(4)-(5).

¹⁵⁵ *Id.* § 60.44(a).

FINDING 12: Electric generating facilities on drilling platforms must limit their emissions of sulfur dioxide, nitrogen oxides, and particulate matter.

5.1.4 Conduct of Drilling Activities

Drilling and other activities on the OCS must be undertaken in accordance with any conditions specified in the applicable BOEM lease. BOEM may condition a lease to ensure that activities on the OCS are conducted safely and in a manner that provides for the:

- prevention of waste;
- protection of the environment;
- conservation of the natural resources of the OCS;
- protection of correlative rights in the OCS; and
- prevention of interference with reasonable uses of the ocean.¹⁵⁶

The lessee must guarantee compliance with all conditions and provide a bond or other form of security sufficient to cover all of its obligations¹⁵⁷ under the lease.¹⁵⁸

FINDING 13: Drilling and other activities on the OCS must be undertaken in accordance with any conditions specified by BOEM.

5.1.5 Well Design Requirements

There are currently no federal regulations governing the design of carbon dioxide injection wells on the OCS. Regulations have been adopted with respect to wells located onshore and in state waters as part of EPA's UIC Program.¹⁵⁹ Key requirements under that program include:

- *Well siting:* Wells used to store carbon dioxide must be sited in areas with a suitable geologic system. The system must comprise:

¹⁵⁶ 43 U.S.C. § 1337(4); 30 C.F.R. §§ 585.201, 585.1006.

¹⁵⁷ This includes the holder's decommissioning obligations. The holder of an RUE is responsible for all commissioning obligations that accrue following issue of, and pertain to the RUE. It is not, however, responsible for decommissioning obligations that accrue before issuance of the RUE or that accrue after issuance but are associated with continuing activities. See 30 C.F.R. § 585.1018.

¹⁵⁸ 43 U.S.C. § 1337(p)(6); 30 C.F.R. §§ 585.515, 585.516, & 585.1012.

¹⁵⁹ 40 C.F.R. Pt. 146, Subpt. H.

- an injection zone(s) of sufficient areal extent, thickness, porosity, and permeability to receive all of the carbon dioxide proposed to be injected; and
- a confining zone(s) free of transmissive faults or fractures and of sufficient areal extent and integrity to contain the injected carbon dioxide and allow injection at proposed maximum pressures and volumes without initiating or propagating fractures.¹⁶⁰
- *Casing and cementing*: Wells must be cased using materials that have sufficient structural strength and are designed for the life of the project.¹⁶¹ At least one long string casing, using a sufficient number of centralizers, must extend to the injection zone and be cemented by circulating cement to the surface in one or more stages.¹⁶² The cement must be compatible with the carbon dioxide stream and formation fluids and of sufficient quality and quantity to maintain integrity over the life of the project.¹⁶³
- *Tubing and packer*: Well tubing must be secured with a packer. Tubing and packer materials must be compatible with all fluids they are expected to come into contact with.¹⁶⁴
- *Testing*: Wells must be tested prior to use to ensure compliance with all applicable design requirements.

These requirements do not apply to wells in federal waters. Those wells may, however, be subject to similar requirements as a condition of the lease or RUE issued by BOEM for drilling.¹⁶⁵

FINDING 14: BOEM may establish requirements for the design of carbon dioxide injection wells in federal waters. The requirements could be based on those established by EPA for injection wells in state waters.

5.2 Drilling on the High Seas

As discussed in subpart 3.3 above, U.S. jurisdiction generally only extends 200 n.m. from shore, with areas beyond that considered part of the high seas, which are open to all countries. The

¹⁶⁰ *Id.* § 146.83.

¹⁶¹ *Id.* § 146.86(b)(1).

¹⁶² *Id.* § 146.86(b)(3).

¹⁶³ *Id.* § 146.86(b)(5).

¹⁶⁴ *Id.* § 146.86(c).

¹⁶⁵ As noted in subpart 5.1.1, BOEM may impose terms and conditions on leases and RUEs to ensure drilling is conducted safely and in a manner that protects the environment. See 43 U.S.C. § 1337(4).

high seas have been described as “an international common space available for lawful uses by all [countries] and their citizens.”¹⁶⁶ Use of the high seas is regulated under a patchwork of international agreements, the most important of which is UNCLOS, which establishes the principal of “freedom of the high seas” described in subpart 3.3 above.¹⁶⁷ UNCLOS declares the land underlying the high seas – i.e., the “Area” beyond the limits of national jurisdiction – to be “open to use . . . for peaceful purposes by all.”¹⁶⁸ Activities in the Area must, however, “be carried out for the benefit of mankind as a whole.”¹⁶⁹ The drilling of injection wells arguably meets this requirement as CCS helps to mitigate climate change and thereby benefits mankind.

FINDING 15: The drilling of carbon dioxide injection wells on the high seas is consistent with UNCLOS.

UNCLOS defines the principle of “freedom of the high seas” to include, among other things, freedom to construct artificial islands and other installations.¹⁷⁰ The term “installations” is not defined in UNCLOS, but is widely considered to encompass drilling platforms.¹⁷¹

UNCLOS does not establish any permitting or registration requirements for drilling platforms or other installations. It does, however, impose such requirements on “ships.” The term “ship” is not defined in UNCLOS, but is used in other international agreements to refer to “a vessel of any type whatsoever operating in the marine environment,” including a “fixed or floating platform.”¹⁷² On this basis a number of commentators have argued that platforms should be

¹⁶⁶ LOUIS B. SOHN ET AL., *LAW OF THE SEA IN A NUT SHELL* 13 (2nd ed. 2010).

¹⁶⁷ UNCLOS, *supra* note 8, at art. 87(1) (defining “freedom of the high seas” to include freedom of navigation, freedom of overflight, freedom to lay submarine cables and pipelines, freedom to construct artificial islands and other installations, freedom of fishing, and freedom of scientific research).

¹⁶⁸ *Id.* Art. 141 (declaring that “[t]he Area shall be open to use exclusive for peaceful purposes by all States”). *See also Id.* Art. 1(1)(1) (defining the “Area” as “the seabed and ocean floor and subsoil thereof beyond the limits of national jurisdiction”).

¹⁶⁹ *Id.* Art. 140(1).

¹⁷⁰ *Id.* Art. 87(1)(d).

¹⁷¹ *See e.g.*, Djamchid Momtaz, *The High Seas in HANDBOOK ON THE NEW LAW OF THE SEA* 391 (René-Jean Duput & Daniel Vignes eds, 1991).

¹⁷² *See e.g.*, International Convention for the Prevention of Pollution from Ships, Art. 2(4).

considered “ships” for the purposes of UNCLOS and subject to its registration requirements.¹⁷³ Consistent with that view platforms used to drill oil and gas wells are generally registered in accordance with UNCLOS.¹⁷⁴ We recommend that platforms used to drill carbon dioxide injection wells also be registered.

UNCLOS requires all ships to be registered in one, but no more than one, country.¹⁷⁵ A ship can generally be registered in any country,¹⁷⁶ provided it complies with the country’s registration rules.¹⁷⁷ Under U.S. rules, the owner of a ship wishing to register in the U.S. must apply to the USCG for a certificate, which evidences registration.¹⁷⁸ A certificate may be issued for any vessel that measures at least five net tons and is U.S. owned.¹⁷⁹ If the vessel is to be used in connection with offshore drilling, the certificate must be endorsed for “registry” (i.e., foreign trade) use.¹⁸⁰

FINDING 16: Platforms may be installed on the high seas for the purpose of drilling carbon dioxide injection wells. Drilling platforms should be registered in accordance with UNCLOS. Registration may be obtained by filing an application for a certificate with the USCG.

¹⁷³ George K. Walke & John E. Noyes, *Definitions for the Law of the Sea Convention – Part II*, 33 CAL. W. INT’L L.J. 191, 318-319 (2003); Brandon A. Carroll, *Drilling in the Deep: Jurisdiction over Oil Rigs Operating Outside of the Territorial Zone in Light of the Deepwater Horizon Spill*, SW. J. INT’L LAW 667, 676-677.

¹⁷⁴ See e.g. Carroll, *supra* note 173, at 679 (discussing registration of the Deepwater Horizon drilling unit in the Republic of the Marshall Islands).

¹⁷⁵ UNCLOS, *supra* note 8, at Art. 92 (declaring that “ships shall sail under the flag of one State only”).

¹⁷⁶ There are some exceptions. Ships engaging in coastwise trade within the U.S., for example, must be registered in the U.S. See 46a U.S.C. § 886 (providing that “[n]o merchandise . . . shall be transported by water . . . between points in the United States . . . in any vessel other than a vessel built in and documented under the laws of the United States and owned by persons who are citizens of the United States”).

¹⁷⁷ *Id.* Art. 91(1) (stating that “[e]very State shall fix the conditions for the grant of its nationality to ships, for the registration of ships in its territory, and for the right to fly its flag”).

¹⁷⁸ 49 U.S.C. § 12104.

¹⁷⁹ *Id.* § 12103(a). The owner may be (1) an individual who is a citizen of the U.S., (2) an association, trust, joint venture, or other entity if all of its members are U.S. citizens and it is capable of holding title to a vessel under the laws of the U.S. or a state, (3) a partnership if each general partner is a U.S. citizen and the controlling interest in the partnership is owned by U.S. citizens; (4) a corporation if it is incorporated under the laws of the U.S. or a state, its chief executive officer and the chairman of its board of directors are U.S. citizens, and no more of its directors are non-citizens than the number necessary to constitute a quorum; (5) the U.S. government; and (6) the government of a state. See *Id.* § 12103(b).

¹⁸⁰ *Id.* § 12111.

6. TRANSPORTING CARBON DIOXIDE TO THE WELL SITE

The carbon dioxide injected into offshore wells will likely be collected at power plants and transported to the well site via pipeline, road, rail, and/or ship. While carbon dioxide can be transported as a gas, for economic and other reasons, transportation in liquid form is more common. This part discusses the regulatory framework for transporting liquid carbon dioxide from onshore collection points to injection wells located offshore. A diagram summarizing the regulations is included in Appendix B.

KEY FINDINGS

- New pipelines may be constructed onshore to transport carbon dioxide without federal or state siting authority. Depending on the pipeline route, construction may be subject to local land use planning rules, as well as state and federal environmental laws.
- Offshore carbon dioxide pipelines must be permitted by the Army Corps of Engineers. If the pipeline passes through state waters, approval must be obtained from the relevant coastal state. Approval is also required from BOEM if the pipeline crosses federal waters.
- Both on- and offshore pipelines must be designed and constructed in accordance with federal safety standards adopted by the Department of Transportation's ("DOT's") Pipeline and Hazardous Materials Safety Administration ("PHMSA").
- As an alternative to pipeline transportation, carbon dioxide may be transported via road, rail, and/or ship. Road and rail transporters must be registered with the DOT. The DOT also registers ships engaged in non-bulk transportation of carbon dioxide. Bulk transportation ships must register with the USCG.
- Storage and/or other facilities used during transportation must report to state and local emergency officials if they handle 10,000 pounds or more of carbon dioxide at any one time.

6.1 Onshore Transportation

The safest and most efficient means of transporting carbon dioxide is via pipeline. Currently, however, there are no carbon dioxide pipelines in the northeast. In the short-run, then, carbon dioxide will likely need to be transported by road or rail. This subpart identifies the permitting and other requirements for each mode of transport.

6.1.1 Pipeline Transportation

There are currently fifty carbon dioxide pipelines in the U.S., with a combined length of over 4,500 miles¹⁸¹ and the capacity to transport 3.53 billion cubic feet (“Bcf”) of carbon dioxide per day, most of which is used in EOR.¹⁸² The majority of carbon dioxide pipelines are, therefore, located in oil producing regions. The entire carbon dioxide pipeline system covers just twelve states, mostly in the south and mid-west.¹⁸³ There are currently no carbon dioxide pipelines in the northeastern U.S.

As a practical matter, any person wishing to develop a new carbon dioxide pipeline, for example in the northeast, must obtain easements or other rights to cross private property. To facilitate the acquisition of such rights, federal and/or state statutes often grant pipeline developers eminent domain authority, allowing them to take title to private property, subject to the payment of compensation and other requirements. Without such authority, developers may be unable to secure agreement from private property owners to use their land, or be forced to pay excessive compensation therefor. Recognizing this, several states have granted eminent domain authority to private entities for the development of carbon dioxide pipelines. Such authority has, for example, been granted in Texas and other states with a history of carbon dioxide use in EOR.¹⁸⁴ Notably however, the ten northeast states considered for this study have not granted eminent domain authority for carbon dioxide pipelines, making development there more difficult.

Even if developers can obtain easements or other rights to cross private property, expanding the carbon dioxide pipeline system to serve the northeast would take several years. It is, therefore, unlikely to be a viable option for the demonstration project. It may, however, be of interest to developers of future commercial-scale projects. Project developers could construct new, or repurpose existing, pipelines to transport carbon dioxide.

¹⁸¹ MATTHEW WALLACE ET AL., A REVIEW OF THE CO₂ PIPELINE INFRASTRUCTURE IN THE U.S. 1 (2015), available at <https://perma.cc/4X76-CU7P>

¹⁸² *Id.*

¹⁸³ *Id.* at 3.

¹⁸⁴ See e.g. Tex. Nat. Res. Code Ann. § 111.019 (providing that “[c]ommon carriers have the right and power of eminent domain”). See also *Id.* § 111.002(6) (defining the term “common carrier” to include a person who “owns, operates, or manages, wholly or partially, pipelines for the transportation of carbon dioxide . . . if such person files with the [Texas Railroad] Commission a written acceptance of the provisions of this chapter expressly agreeing that, in consideration of the rights acquired, it becomes a common carrier subject to the duties and obligations conferred or imposed by this chapter”).



Figure 2: Carbon Dioxide Pipelines in the U.S.¹⁸⁵

6.1.1.1 Constructing New Pipelines

Pipeline Siting

Developers are unlikely to require federal approval to construct a new carbon dioxide pipeline. No federal agency currently regulates pipeline construction on private or state land. The Government Accountability Office has suggested that construction may be regulated by the Surface Transportation Board (“STB”), which oversees pipelines transporting commodities other than water, oil, or gas.¹⁸⁶ Jurisdiction over carbon dioxide pipelines was, however, disclaimed by the STB’s predecessor agency (i.e., the Interstate Commerce Commission) on the basis that carbon dioxide is a gas.¹⁸⁷ The Federal Energy Regulatory Commission (“FERC”), which regulates the

¹⁸⁵ Lincoln Pratson, *Buildings an Underground ‘Highway’ for Carbon Dioxide*, THEGREENGROK, DUKE NICHOLAS SCHOOL OF THE ENVIRONMENT (Jul. 28, 2008), <https://perma.cc/6NEY-45K3>

¹⁸⁶ Government Accountability Office, *Issues Associated with Pipeline Regulation by the Surface Transportation Board*, RCED-98-99, Appendix 1 (1998).

¹⁸⁷ Cortez Pipeline Co., 7 FERC 61,024 (1979) (concluding that the Natural Gas Act did not give FERC jurisdiction over an interstate pipeline transporting ninety-eight percent pure carbon dioxide); Southern Natural Gas Co., 115 FERC 62266 (2006) (affirming that facilities used to transport carbon dioxide are exempt from jurisdiction under the Natural Gas Act).

interstate transportation of gas, has also disclaimed jurisdiction over carbon dioxide pipelines.¹⁸⁸ Indeed, to date, the only federal agency to have asserted authority over carbon dioxide pipelines is the DOI's Bureau of Land Management ("BLM").¹⁸⁹ BLM's authority is limited to pipelines crossing federal land, however. Given the small amount of such land in the northeast, any new carbon dioxide pipeline there is likely to be constructed on private land, eliminating the need for BLM approval.

State regulation of carbon dioxide pipeline siting varies, with some states exercising little or no regulatory authority over such pipelines, while others have more comprehensive regulatory regimes. Regulation tends to be limited in states with little history of carbon dioxide use (e.g., for EOR). The ten northeast states considered for this study do not currently require developers to obtain approval for new carbon dioxide pipelines.

In the absence of state and federal regulation, developers need only secure an easement or right-of-way from the relevant land owner and comply with any applicable local siting ordinances, such as zoning or land use plans. Some local government plans restrict pipeline construction in designated areas (e.g., near drinking water sources) and/or require a permit to be obtained therefor. This is common in the state of New York, for example.¹⁹⁰ Before permitting a pipeline, local governments in New York must conduct an EA under the State Environmental Quality Review Act, which requires preparation of an environmental impact statement for any action with potentially significant adverse environmental impacts.¹⁹¹ Similar environmental reviews must also be conducted by local governments in Massachusetts.¹⁹²

FINDING 17: Neither federal nor state siting authority will be required to construct a new carbon dioxide pipeline in the northeast. Authority may be required from local governments.

¹⁸⁸ Cortez Pipeline Company, 7 FERC ¶ 61,024 (1979) (disclaiming jurisdiction over carbon dioxide pipelines, even where they transport small amounts of natural gas, under the Natural Gas Act). *See also* Southern Natural Gas Co., 115 FERC ¶ 62,266 (2006).

¹⁸⁹ BLM requires carbon dioxide pipelines crossing public lands to obtain a right-of-way under the Mineral Leasing Act (30 U.S.C. § 181 et seq.). *See generally* Exxon Corp. v. Lujan, 970 F. 2d 757 (10th Cir. 1992).

¹⁹⁰ Email from Amanda Mulhern, Public Affairs Officer, New York Department of Public Service (Feb. 15, 2017, 09:29 EST) (on file with author).

¹⁹¹ N.Y. ENVTL. CONSERV. LAW § 8-0101 et seq.

¹⁹² MASS. GEN. LAWS Ch. 30, §§ 61 – 62H.

In addition to complying with local siting ordinances, pipeline developers may also be subject to other requirements, e.g., under federal and/or state environmental law. The key requirements are summarized, in general terms, in Table 3 below. Once a specific pipeline route is chosen, further analysis should be undertaken to identify the precise requirements for construction in that area.

Table 3: Environmental Approvals Required for Pipeline Projects

Jurisdiction	Permits Required
Federal	<ul style="list-style-type: none"> • If the pipeline will be constructed in navigable waters, a permit must be obtained from ACE under section 10 of the Rivers and Harbors Act.¹⁹³ • If pipeline construction will require the discharge of dredged or fill material into waters of the United States, a permit may be required from ACE (or an authorized state agency) under section 404 of the Clean Water Act (“CWA”).¹⁹⁴ • If pollutants other than dredged or fill material will be discharged during construction, a permit may be required from EPA (or an authorized state agency) under section 402 of the CWA.¹⁹⁵
Connecticut	<ul style="list-style-type: none"> • If the pipeline will be constructed in an inland wetland or other water body, a license may be required from the state Department of Energy and Environmental Protection (“CDEEP”) or a local inland wetlands agency.¹⁹⁶ • If the pipeline will be constructed in a coastal wetland, a wetlands permit may be required from the CDEEP.¹⁹⁷

¹⁹³ 33 U.S.C. § 403 (requiring a permit to be obtained from ACE prior to the construction of any “structure” in navigable waters of the U.S.). If construction may result in a discharge into navigable waters, before a permit can be issued by ACE, the applicant must obtain a certificate from the state in which the discharge originates or will originate, indicating that the discharge will comply with applicable provisions of the CWA. See *Id.* § 1341(a).

¹⁹⁴ *Id.* § 1344 (authorizing the issuance of permits “for the discharge of dredged or fill material into the navigable waters”). See also *Id.* § 1341(a).

¹⁹⁵ *Id.* § 1342 (authorizing the issuance of permits “for the discharge of any pollutant, or combination of pollutants” to waters of the U.S.).

¹⁹⁶ CONN. AGENCIES REGS. § 22a-39-4.1 (providing that a license must be obtained to undertake regulated activities affecting wetlands or water courses within the State of Connecticut). See also *Id.* §§ 22a-39-2(12) (defining “regulated activity”), 22a-39-2(18) (defining “water course”), & 22a-39-2(19) (defining “wetland”).

Jurisdiction	Permits Required
Delaware	<ul style="list-style-type: none"> • If the pipeline will be constructed in or adjacent to state waters, a subaqueous lands permit may be required from the state Department of Natural Resources and Environmental Control (“DDNREC”).¹⁹⁸ • If the pipeline will be constructed in a wetland, a wetlands permit may be required from the DDNREC.¹⁹⁹
Maine	<ul style="list-style-type: none"> • If the pipeline will be constructed in or adjacent to a freshwater wetland, river, stream, brook, or pond, a wetlands permit may be required from the state Department of Environmental Protection (“DEP”).²⁰⁰ • If the pipeline and associated facilities will occupy more than twenty acres or result in the permanent clearing of more than three acres, a site law permit may be required from the state DEP.²⁰¹
Maryland	<ul style="list-style-type: none"> • If the pipeline will be constructed in or through the Potomac River, a waterway construction permit may be required from the state Department of the Environment (“MDE”).²⁰² • If the pipeline will be constructed in a wetland, a wetlands permit may be

¹⁹⁷ CONN. GEN. STAT. § 22a-32 (providing that a permit is required to carry out any regulated activity within a wetland). *See also Id.* § 22a-29 (defining “regulated activity”).

¹⁹⁸ 7-7500-7504 DEL. ADMIN. CODE § 2.4.2 (providing that a permit is required to construct any structure on, in, under, or over public subaqueous lands”). *See also Id.* § 1.0 (defining “subaqueous lands”).

¹⁹⁹ 7-7500-7502 DEL. ADMIN. CODE § 6.1.1 (providing that a permit is required to undertake activities in wetlands”). *See also Id.* § 5.0 (defining “wetlands”).

²⁰⁰ ME. REV. STAT. tit. 38, § 480-C (providing that a permit is required to undertake activities involving “A. Dredging, bulldozing, removing or displacing soil, sand, vegetation or other materials; B. Draining or otherwise dewatering; C. Filling, including adding sand or other material to a sand dune; or D. Any construction, repair or alteration of any permanent structure” in “A. A coastal wetland, great pond, river, stream or brook or significant wildlife habitat contained within a freshwater wetland; or B. Freshwater wetlands consisting of or containing: (1) Under normal circumstances, at least 20,000 square feet of aquatic vegetation, emergent marsh vegetation or open water, except for artificial ponds or impoundments; or (2) Peatlands dominated by shrubs, sedges and sphagnum moss”). *See also Id.* § 480-B (defining “coastal wetland,” “great pond,” “river, stream, or brook” and “freshwater wetland”).

²⁰¹ ME. REV. STAT. tit. 38, § 483-A (requiring a permit to be obtained for “any development of state or regional significance that may substantially affect the environment”). *See also Id.* § 482 (defining “development of state or regional significance that may substantially affect the environment”).

²⁰² MD. CODE REGS. § 26.17.04.09 (providing that a permit is required to construct any pipeline “in, under, through, or over the bed or waters of the Potomac River).

Jurisdiction	Permits Required
	required from MDE.
Massachusetts	<ul style="list-style-type: none"> • If the pipeline will be constructed in an inland wetland or other water body, a waterways license may be required from the state Department of Environmental Protection (“MDEP”).²⁰³ • If the pipeline will be constructed in a coastal wetland, approval may be required from the relevant local government.²⁰⁴
New Hampshire	<ul style="list-style-type: none"> • If the pipeline will be constructed in or adjacent to state waters, a wetlands permit may be required from the state Department of Environmental Services (“NHDES”).²⁰⁵ • If the pipeline will be constructed within 250 feet of a protected lake, river, or stream, a shoreland impact permit may be required from the NHDES.²⁰⁶
New Jersey	<ul style="list-style-type: none"> • If the pipeline will be constructed in or adjacent to a state waterway, a flood hazard area permit may be required from the state Department of Environmental Protection (“NJDEP”).²⁰⁷ • If the pipeline will be constructed in a wetland, a wetlands permit may be required from NJDEP.²⁰⁸ • If the pipeline will be constructed in tidelands, a tidelands license may be

²⁰³ 310 MASS. CODE REGS. § 9:05(1) (providing that a license is required to construct structures in, place fill in, remove fill from, or perform certain other activities in trust lands). *See also Id.* § 9:04 (defining “trust lands”).

²⁰⁴ *Id.* § 10.02 (providing that approval must be obtained for any activity proposed to be undertaken in coastal wetlands). *See also Id.* § 10.27(2) (defining “coastal wetlands”).

²⁰⁵ N.H. Rev. Stat. Ann. § 482-A:3 (providing that a permit must be obtained to “excavate, remove, fill, dredge, or construct any structure in or on any bank, flat, marsh, or swamp in and adjacent to any waters of the state”). *See also Id.* § 482-A:4 (specifying the “waters and adjacent areas” to which the permitting requirement applies).

²⁰⁶ *Id.* § 483-B:5-b (providing that a permit must be obtained to undertake construction, excavation, or filling activities within the protected shoreland). *See also Id.* § 483-B:4 (defining “protected shoreland”).

²⁰⁷ N. J. ADMIN. CODE § 7:13-2.1(a) (providing that a permit must be obtained to undertake a regulated activity in a regulated area). *See also Id.* §§ 7:13-1.2 (defining “regulated area”), 7:13-2.2(a) (identifying regulated waters), 7:13-2.3 (defining the “flood hazard area” and “riparian zone” of regulated waters), & 7:13-2.4 (defining “regulated activities”).

²⁰⁸ *Id.* § 7:7A-2.1(a) (providing that a permit must be obtained to engage in a regulated activity). *See also Id.* §§ 7:7A-2.2(a) (identifying regulated activities & 7:7A-1.4 (defining “freshwater wetland”).

Jurisdiction	Permits Required
	required from the NJDEP. ²⁰⁹
New York	<ul style="list-style-type: none"> • If the pipeline will be constructed in the bed or banks of a designated stream, a protection of waters permit may be required from the state Department of Environmental Conservation (“NYDEC”).²¹⁰ • If the pipeline will be constructed in or adjacent to a freshwater wetland, a freshwater wetlands permit may be required from NYDEC.²¹¹ • If the pipeline will be constructed in or adjacent to a tidal wetland, a tidal wetlands permit may be required from NYDEC.²¹²
Rhode Island	<ul style="list-style-type: none"> • If the pipeline will be constructed in a wetland, a wetlands permit may be required from the Rhode Island Department of Environmental Management.²¹³
Virginia	<ul style="list-style-type: none"> • If the pipeline will be constructed in a wetland, a wetlands permit may be required from the relevant local government or the state Marine Resources Commission (“MRC”).²¹⁴ • If pipeline construction will disturb one acre or more of land, a storm water permit may be required from the state Department of Environmental Quality (“VDEQ”).²¹⁵

²⁰⁹ N.J.S.A. § 13:1B-13. Tidelands include all lands currently and formerly flowed by the mean high tide of a natural waterway.

²¹⁰ NEW YORK COMP. CODES R. & REGS., tit. 6, § 608.2(a) (providing that a permit is required to change, modify, or disturb any protected stream, its bed or banks). *See also Id.* §§ 608.1(a) (defining “bank”), (b) (defining “bed”) & (aa) (defining “protected stream”).

²¹¹ *Id.* § 663.3(e) (providing that a permit must be obtained to conduct activities on wetlands or adjacent areas). *See also Id.* §§ 662.1(b) (defining “adjacent area”) & (k) (defining “freshwater wetlands”).

²¹² *Id.* § 661.8 (providing that a permit is required to conduct a new regulated activity on any tidal wetland or any adjacent area). *See also Id.* §§ 661.4(b) (defining “adjacent area”), (ee) (defining “regulated activity”) & (hh) (defining “tidal wetlands”).

²¹³ Rules & Regulations Governing the Administration & Enforcement of the Freshwater Wetlands Act, § 5.01 (providing that a permit is required to undertake any project or activity which may alter a freshwater wetland). *See also Id.* § 4.00 (defining “alter”).

²¹⁴ VA. CODE ANN. § 28.2-1306 (making it unlawful for any person to conduct an activity which would require a permit under a wetlands zoning ordinance without such a permit). *See also Id.* § 28.2-1302 (providing that a local government may adopt a wetlands zoning ordinance requiring a permit for any use of, or development in, a wetland subject to limited exceptions”).

²¹⁵ *Id.* § 62.1-44.15:34 (providing that a permit is required to conduct any land disturbing activities that disturb more than one acre of land (subject to limited exceptions)).

Before any permit can be issued at the federal level, the permitting agency must undertake an environmental review under NEPA.²¹⁶ Some states, including Massachusetts and New York, have their own laws requiring environmental review of state- and/or locally-approved projects.²¹⁷ The federal and state reviews are generally coordinated, with the agencies involved often undertaking joint studies and preparing a joint EA or EIS, so as to reduce duplication and streamline the review process.²¹⁸ Some pipeline projects may be eligible for expedited review under the 2015 Fixing America’s Surface Transportation (“FAST”) Act. The FAST Act applies to large pipeline and other infrastructure projects subject to NEPA that are likely to require a total investment of more than \$200 million or are of such “size and complexity” that they are “likely to benefit from enhanced oversight and coordination.”²¹⁹ The determination of whether a project is likely to benefit from enhanced oversight and coordination is made by the Federal Permitting Improvement Steering Council,²²⁰ which is established in the FAST Act and headed by an executive director appointed by the President.²²¹ The executive director must, in consultation with the council, “develop recommended performance schedules, including intermediate and final completion dates, for environmental reviews and authorizations most commonly required for each category” of covered projects.²²² Initial schedules were finalized in January 2017 and require federal agencies to complete environmental reviews of covered projects within 180 days after all information needed to complete the review is in the possession of the agency.²²³

²¹⁶ For a discussion of NEPA, see *supra* part 5.1.1.1.

²¹⁷ New York state agencies must prepare, or cause to be prepared, an environmental impact statement for any action they permit which may have a significant effect on the environment under the State Environmental Quality Review Act before granting approval. See N.Y. ENVTL. CONSERV. LAW § 8-0109(2). Similarly, state agencies in Massachusetts must review the impact of actions on the natural environment under the Massachusetts Environmental Policy Act. See MASS. GEN. LAWS Ch. 30, § 61.

²¹⁸ 40 C.F.R. § 1506.2(b) (requiring federal agencies to “cooperate with state and local agencies to the fullest extent possible to reduce duplication between NEPA and state and local requirements” including by undertaking joint planning processes, joint environmental research and studies, joint public hearings, and joint environmental assessments).

²¹⁹ 42 U.S.C. § 4370m(6)(A).

²²⁰ *Id.* § 4370m(6)(A)(ii).

²²¹ *Id.* § 4370m-1(a)-(b).

²²² *Id.* § 4370m-1(c)(1)(C).

²²³ See Recommended Performance Schedules for Environmental Reviews and Authorizations for FAST-41 Covered Infrastructure Projects (2017), available at <https://perma.cc/T49E-5EZK>.

FINDING 18: Depending on the pipeline route and method of construction, the developer may require various permits, e.g. under state and/or federal environmental laws.

Pipeline Design

Carbon dioxide pipelines must be designed and constructed in accordance with applicable federal safety regulations. Current safety regulations, adopted by the Department of Transportation's ("DOT's") Pipeline and Hazardous Materials Safety Administration ("PHMSA"), only apply to pipelines transporting carbon dioxide as a supercritical liquid²²⁴ ("supercritical liquid pipelines").²²⁵ The PHMSA is yet to adopt regulations with respect to pipelines transporting carbon dioxide as a subcritical liquid or gas. It is, however, expected to do so in the near future.²²⁶

Current PHMSA regulations establish various requirements for the construction of supercritical liquid pipelines. Most deal with technical aspects of pipeline design such as:

- *Pipe materials:* All supercritical liquid pipelines must be made of steel capable of withstanding the internal pressures and external loads and pressures anticipated for the pipeline system.²²⁷ The pipes must have an external coating designed to mitigate corrosion²²⁸ and be equipped with a cathodic protection system.²²⁹

²²⁴ This requires the carbon dioxide to be maintained at or above its critical temperature (i.e., 88°F) and pressure (i.e., 73 atmospheres).

²²⁵ 49 U.S.C. § 60102(i)(1); 49 C.F.R. Pt. 195.

²²⁶ The 2011 Pipeline Safety, Regulatory Certainty, and Job Creation Act directed the DOT to "prescribe minimum safety standards for the transportation of carbon dioxide by pipeline in gaseous state." In February 2015, the PHMSA published a report recommending that the transport of gaseous carbon dioxide be subject to similar standards as are currently applied to transport of carbon dioxide as a subcritical liquid (i.e., under 49 C.F.R. Pt. 195). The report noted that "[s]ince the transportation of gases is subject to [49 C.F.R.] Part 192, an amendment to Part 192 would be needed to accommodate the regulation of the transportation of [carbon dioxide] CO₂ by pipelines in a gaseous state even if the requirements would be referenced within or very similar to those for supercritical liquid pipelines under Part 195. However, some of the regulations in Part 195 applicable to supercritical CO₂ would need to be modified to be applicable to the transport of gaseous CO₂." OFFICE OF PIPELINE SAFETY, PHMSA, BACKGROUND FOR REGULATING THE TRANSPORTATION OF CARBON DIOXIDE IN A GASEOUS STATE 2 (2015), available at <https://perma.cc/ZP64-PJHN>.

²²⁷ 49 C.F.R. § 195.112(a).

²²⁸ *Id.* § 195.557, 195.559.

²²⁹ *Id.* § 195.563.

- *Valves*: Valves must be installed at various locations along supercritical liquid pipelines.²³⁰ Each valve must be of sound engineering design²³¹ and made of materials that are compatible with carbon dioxide.²³² Valves subject to the internal pressure of the pipeline system must be compatible with the pipe or fittings to which they are attached.²³³
- *Fittings*: Fittings must be suitable for the intended service and at least as strong as the pipe.²³⁴ There must not be any buckles, dents, cracks, gouges, or other defects in the fitting that might reduce its strength.²³⁵
- *Pumping equipment*: Each pump station must contain safety devices that prevent over-pressuring of pumping equipment and can automatically shut-off equipment in the event of an emergency. Adequate ventilation must be provided in pump station buildings to prevent the accumulation of hazardous vapors. Hazardous vapor warning devices and fire protection systems must be installed in buildings.

The PHMSA regulations also contain provisions governing the location of supercritical liquid pipelines. Under the regulations, pipeline rights-of-way must be selected to avoid areas containing private dwellings, industrial buildings, and places of public assembly, as far as practicable.²³⁶ Pipelines generally cannot be located within fifty feet of a private dwelling, industrial building, or place of public assembly.²³⁷ With some exceptions,²³⁸ pipelines must be buried underground, such that the cover between the top of the pipe and ground level is at least thirty inches²³⁹ or:

²³⁰ See e.g. *Id.* § 195.260 (requiring valves to be installed on each side of water crossings that are more than 100 feet (thirty meters) wide and reservoirs holding water for human consumption).

²³¹ *Id.* § 195.116(a).

²³² *Id.* § 195.116(c).

²³³ *Id.* § 195.116(b).

²³⁴ *Id.* § 195.118(c).

²³⁵ *Id.* § 195.118(b).

²³⁶ *Id.* § 195.210(a).

²³⁷ *Id.* § 195.210(b).

²³⁸ Pipeline components may be installed above ground in the following situations: (1) Overhead crossings of highways, railroads, or a body of water. (2) Spans over ditches and gullies. (3) Scraper traps or block valves. (4) Areas under the direct control of the operator. (5) In any area inaccessible to the public. *Id.* § 195.25.

²³⁹ Where rock excavation is required, only eighteen inches cover is required. Rock excavation is any excavation that requires blasting or removal by equivalent means. See *Id.* § 195.248(a).

- if the pipeline is in an industrial, commercial, and residential area or drainage ditch at a public road or railway, thirty-six inches;²⁴⁰
- if the pipeline crosses an inland water body with a width of at least 100 feet from high water mark to high water mark, forty-eight inches.²⁴¹

Pipelines located within fifty feet of a private dwelling, industrial building, or place of public assembly must have an additional twelve inches of cover.²⁴²

FINDING 19: Pipelines used to transport supercritical liquid carbon dioxide must be made of steel and equipped with appropriate safety devices. To the extent practicable, the pipelines must be located outside of populated areas and buried underground, with at least thirty inches of cover.

6.1.1.2 Repurposing Existing Pipelines

Given the high cost of constructing new carbon dioxide pipelines, project developers may seek to make use of existing lines, e.g., used in transporting natural gas and/or other substances.²⁴³ Whether this is permissible may ultimately depend on the terms of the existing pipeline easement. We understand that easements often include provisions restricting the substances that can be transported via the pipeline. Where this is the case, before the pipeline can be converted to transport another (unapproved) substance, a new easement would need to be negotiated.

Certain regulatory requirements must also be met prior to converting an existing gas and/or other pipeline to transport carbon dioxide. The key requirements are set out in regulations adopted by the PHMSA. Those regulations only apply where the converted pipeline will be used to transport carbon dioxide as a supercritical liquid.

Under the PHMSA regulations, any pipeline may be converted to transport supercritical liquid carbon dioxide, regardless of whether it meets the design requirements for new lines.²⁴⁴

²⁴⁰ Where rock excavation is required, only thirty inches of cover is required. *See Id.*

²⁴¹ *Id.* § 195.248.

²⁴² *Id.* § 195.210(b).

²⁴³ We assume that pipelines designed to transport natural gas are technically suitable for transporting carbon dioxide (e.g., in terms of the materials used and pressures involved). This should be verified before any existing natural gas pipeline is used to transport carbon dioxide.

²⁴⁴ *See supra* section 6.1.1.1.

Thus, for example, the pipeline to be converted need not be made of steel. Generally however, prior to converting a non-steel pipeline, the operator must notify the PHMSA, which may prevent conversion if use of the pipeline to transport carbon dioxide is found to be unduly hazardous.²⁴⁵

The PHMSA need not be notified where the pipeline to be converted is made of steel. Prior to pipeline conversion, the operator must:

- review the design, construction, operation, and maintenance history of the pipeline and, if sufficient historical records are not available, perform appropriate tests to confirm it is in satisfactory condition for safe operation;
- visually inspect the pipeline right-of-way, all aboveground segments of the pipeline, and appropriately selected underground segments and correct any unsafe defects or operating conditions; and
- pressure test the pipeline for at least four continuous hours at a pressure equal to 125 percent or more of the maximum operating pressure and, if the pipeline is not visually inspected for leaks during the test, an additional four continuous hours at a pressure equal to 110 percent or more of the maximum operating pressure.²⁴⁶

FINDING 20: Subject to any restrictions in the pipeline easement, an existing steel pipeline may be used to transport carbon dioxide, provided the operator undertakes various safety checks. Similar checks are not required to use existing non-steel pipelines. The PHMSA may prevent use of a non-steel pipeline if it finds the transportation of carbon dioxide therein to be unduly hazardous.

Additional regulatory requirements may apply to the conversion of pipelines previously used to transport natural gas. Prior to converting a natural gas pipeline crossing state boundaries (i.e., an interstate pipeline) the operator must obtain approval from FERC to stop transporting natural gas and abandon the line.²⁴⁷ FERC may only approve pipeline abandonment if it finds that “the available supply of natural gas is depleted to the extent that the continuation of

²⁴⁵ 49 C.F.R. § 195.8.

²⁴⁶ *Id.* § 195.5(a).

²⁴⁷ 15 U.S.C. § 717f(b) (prohibiting any natural gas company from “abandon[ing] all or any portion of its facilities . . . without the permission and approval of” FERC).

[transportation] service[s] is unwarranted, or that the present or future public convenience or necessity permit such abandonment.”²⁴⁸ In evaluating whether the public convenience or necessitate permit abandonment, FERC applies a “presumption in favor of continued service”²⁴⁹ and requires proof “that the public interest will in no way be disserved” by cessation of service.²⁵⁰ This must be assessed on a case-by-case basis considering “all relevant factors,”²⁵¹ including the availability of alternative transportation,²⁵² the extent to which the pipeline is underused,²⁵³ the economic effects of pipeline abandonment,²⁵⁴ the environmental impacts of abandonment,²⁵⁵ and general public policy and safety considerations (e.g., the effect of abandonment on the nation’s gas supply and retail prices).²⁵⁶

FERC does not have regulatory authority over natural gas pipelines located wholly within the boundaries of a single state (i.e., intrastate pipelines). Those pipelines are regulated by state public utility commissions or other energy agencies. While the state commissions or agencies oversee pipeline construction and operation, their approval is generally not required to abandon the line.²⁵⁷

FINDING 21: Before an existing interstate natural gas pipeline can be converted to transport carbon dioxide, FERC must approve abandonment of the pipeline as a gas transportation line. Approval will generally only be granted if FERC determines that abandonment will not adversely affect the public interest.

²⁴⁸ *Id.*

²⁴⁹ *Transcontinental Gas Pipe Line Corp. v. FPC*, 488 F.2d 1325, 1330 (D.C. Cir. 1973).

²⁵⁰ *S. Nat. Gas Co., L.L.C.*, 139 FERC ¶ 61,237 (2012).

²⁵¹ *N. Nat. Gas Co. et al.*, 135 FERC ¶ 61,048 (2011).

²⁵² *See e.g. Transcontinental Gas Pipe Line Co.*, 134 FERC ¶ 61,238 (2011).

²⁵³ *See e.g. Florida Gas Transmission Co.*, 129 FERC ¶ 61,135 (2009), *reh’g denied*, 131 FERC ¶ 61,119 (2010).

²⁵⁴ *See e.g. Transcontinental Gas Pipe Line Corp.*, 110 FERC ¶ 61,337 (2005); *Transcontinental Gas Pipeline Corp v. FPC*, 488 F.2d 1325, 1330 (D.C. Cir. 1973).

²⁵⁵ *See e.g. El Paso Nat. Gas Co.*, 137 FERC ¶ 62,123 (2011).

²⁵⁶ *See e.g. N. Nat. Gas Co. et al.*, 135 FERC ¶ 61,048 (2011); *Nw. Pipeline GP*, 139 FERC ¶ 62,147 (2012).

²⁵⁷ *See e.g. 220 MASS CODE REGS. 107.00* (outlining rules for the abandonment of natural gas pipelines. The rules do not require advance notice to be given to, or approval to be obtained from, the state Department of Public Utilities); *N.Y. COMP. CODES R. & REGS. tit. 16, § 255.727* (providing for pipeline abandonment without approval from the New York Department of Public Service).

6.1.2 Road and Rail Transportation

In areas lacking pipeline infrastructure, carbon dioxide may be transported by road or rail. For the purposes of road and rail transportation, carbon dioxide has been designated a hazardous material, pursuant to the Hazardous Materials Transportation Act (“HMTA”).²⁵⁸ Regulations issued under the HMTA require persons transporting hazardous materials to be registered with the PHMSA.²⁵⁹ The transporter must renew his/her/its registration annually, by submitting a registration statement to the PHMSA, along with a fee of \$2,600.²⁶⁰

A registered operator may transport carbon dioxide in gaseous or liquid form.²⁶¹ The HMTA regulations outline various requirements for transportation including:

- *Packaging*: Liquid carbon dioxide may be transported in bulk by road cargo tanks or rail tank cars equipped with appropriate safety systems (e.g., pressure relief devices).²⁶² Carbon dioxide may also be transported, via road or rail, in high-pressure metal cylinders.²⁶³
- *Labeling*: Cylinders, cargo tanks, and tank cars used to transport carbon dioxide must be clearly marked.²⁶⁴ Cylinders must have a green label stating “NON-FLAMMABLE GAS,” unless they are permanently mounted in or on a vehicle that is placarded.²⁶⁵
- *Placarding*: Road vehicles and rail cars transporting carbon dioxide must display a green placard stating “NON-FLAMMABLE GAS” on each side and end.²⁶⁶ There is an exception for road vehicles carrying less than 1001 pounds aggregate gross weight of carbon dioxide.²⁶⁷

²⁵⁸ 49 U.S.C. § 5103(a) (requiring the Secretary of Transportation to “designate material . . . as hazardous when the Secretary determines that transporting the material in commerce in a particular amount and form may pose an unreasonable risk to health and safety or property”). See also 49 C.F.R. § 172.101 (designating “carbon dioxide” and “carbon dioxide, refrigerated liquid” as division 2.2 hazardous materials).

²⁵⁹ *Id.* § 171.2. See also *Id.* Pt. 107, Subpt. G.

²⁶⁰ *Id.* §§ 107.608(a), 107.612. Small businesses (defined as “a person that qualified as a small business under 13 C.F.R. part 121”) and not-for-profit organizations (defined as “an organization exempt from taxation under 26 U.S.C. § 501(a)) are only required to pay a fee of \$275. *Id.* § 107.612.

²⁶¹ *Id.* § 172.101.

²⁶² *Id.* §§ 173.314 & 173.315. See also *Id.* §§ 173.31, 173.32, & 173.33.

²⁶³ The cylinder must be a pressure vessel built to Department of Transportation or UN standards. *Id.* § 173.301(a)(1). See also *Id.* § 171.8 (defining “cylinder” to mean “a pressure vessel designed for pressures higher than 40 psia and having a circular cross section”).

²⁶⁴ *Id.* §§ 172.301, 172.302, 172.328, & 172.330.

²⁶⁵ *Id.* §§ 172.400, 172.400a & 172.415.

²⁶⁶ *Id.* §§ 172.504, 172.508, 172.514, & 172.528.

²⁶⁷ *Id.* § 172.504(c).

- *Documentation*: Cylinders, cargo tanks, and tank cars cannot be transported by road or rail unless a shipping order, manifest, or other document has been prepared indicating that it contains carbon dioxide.²⁶⁸
- *Loading*: Cylinders containing carbon dioxide may be secured in an upright or horizontal position on the floor of a road vehicle or rail car or in racks, crates, or boxes.²⁶⁹ A qualified person, trained in emergency response, must be present during loading and unloading.²⁷⁰

FINDING 22: Carbon dioxide may be transported by road or rail carriers registered with the PHMSA. Transportation may occur in bulk in marked road cargo tanks or rail tank cars equipped with appropriate safety systems.

6.2 Offshore Transportation

As explained in subpart 6.1 above, carbon dioxide will likely be transported from the point of collection to a storage hub on the coast by road, rail, or in the longer-term pipeline. A separate offshore transportation system will then be needed to connect the storage hub to the well site. Offshore transportation may occur via pipeline or ship. The requirements for each are discussed in the following subparts.

6.2.1 Pipeline Transportation

Offshore pipelines – i.e., lying on or in the seabed – may be used to transport carbon dioxide to the well site. We understand that the carbon dioxide would likely be transported in liquid form, necessitating the installation of underwater pumps next to the pipeline to move liquid along it. The pipeline system would extend from the coast, through state and federal waters, and potentially into the high seas. This subpart outlines the regulatory framework for pipeline development in each of those areas.

²⁶⁸ *Id.* §§ 174.24 & 177.817. *See also Id.* pt. 172, subpt. C.

²⁶⁹ *Id.* §§ 174.201(a) & 177.840(a).

²⁷⁰ *Id.* § 177.834(i).

6.2.1.1 Pipeline Construction in State Waters

Pipeline Siting

Carbon dioxide pipelines in state waters must be permitted by ACE. As noted in part 5.1.2 above, an ACE permit is required to construct any structure in the navigable waters of the U.S., including state waters “within a zone three [n.m.] from the baseline.”²⁷¹ The permit requirement applies to all devices, including pipelines, constructed on the ocean floor.²⁷²

In permitting offshore pipelines, ACE follows the same basic procedures as are used to permit drilling platforms and other structures, described in subpart 5.1.2 above. Permit applications must be filed with the relevant district office of ACE.²⁷³ On receiving an application, ACE will publish a notice, requesting comments from the public.²⁷⁴ Based on the comments received and any responses from the applicant, ACE will decide whether or not a permit should be issued.²⁷⁵ In making this decision, ACE evaluates the probable impacts of pipeline construction on the public interest, balancing its beneficial and detrimental effects.²⁷⁶ As part of this balancing, ACE will consider the need for the pipeline, and its likely effect on other uses of the area.²⁷⁷ In addition, if the pipeline is to be constructed in an area with recognized historic, cultural, scenic, conservation, recreational, or similar values, ACE must consider its likely effects on those values.²⁷⁸

Prior to permitting a pipeline, ACE must complete any necessary environmental and/or other reviews, for example under NEPA.²⁷⁹ ACE must also work with the relevant coastal state(s) to ensure the pipeline project is consistent with any management plan(s) adopted under the

²⁷¹ 33 C.F.R. § 329.12(a) (providing that “[t]he navigable waters of the United States over which [ACE] regulatory jurisdiction extends include all ocean and coastal waters within a zone three geographic (nautical) miles seaward from the baseline”). See also *Id.* § 322.3(a) (indicating that a permit is required “for structures and/or work in or affecting navigable waters of the United States”).

²⁷² *Id.* § 322.5(b) (requiring permits “for the construction of artificial islands, installations, and other devices on the seabed, to the seaward limit of the outer continental shelf”).

²⁷³ *Id.* § 325.1(d)(1).

²⁷⁴ *Id.* §§ 325.2(a)(2), 325.3.

²⁷⁵ *Id.* § 325.2(a)(3) – (3).

²⁷⁶ *Id.* § 320.4(a)(1).

²⁷⁷ *Id.* § 320.4(a)(2).

²⁷⁸ *Id.* § 320.4(e).

²⁷⁹ *Id.* §§ 320.4(h), 325.2(a)(4). ACE’s NEPA review will need to be coordinated with any reviews undertaken by other federal, state, and/or local agencies. For a discussion of this issue, see part 6.1.1.1.

CZMA.²⁸⁰ The developer must provide ACE and the relevant state(s) with a consistency certification, indicating that the project complies with the management plan and will be undertaken in a manner consistent with that plan.²⁸¹ The state(s) must approve the certificate before the project can be permitted by ACE.²⁸²

Various other state approvals may also be required to construct carbon dioxide pipelines in state waters. Generally, as the land underlying state waters is publicly owned, a lease or similar authorization must be obtained prior to pipeline construction. One or more construction permits may also be required depending on the pipeline route. Key permits and other approvals required in the ten northeast states are summarized in Table 4 below.²⁸³

Table 4: State Approvals Required for Offshore Carbon Dioxide Pipelines

State	Required Approvals
Connecticut	<ul style="list-style-type: none"> • A certificate authorizing the use of submerged lands may be required from the CDEEP.²⁸⁴ • If the pipeline will pass through a tidal wetland, a wetlands permit may be required from the CDEEP.²⁸⁵

²⁸⁰ 16 U.S.C. § 1456(c). Under the CZMA, all federally-approved actions that affect coastal uses or resources must be consistent with state management plans, to the maximum extent practicable. See *Id.* § 1456(c)(3). This includes actions undertaken by non-federal agencies that require federal approval. Such actions are deemed to affect coastal uses or resources if they occur within state waters and the relevant state has listed the action in its management plan. See 15 C.F.R. § 930.53. Actions requiring ACE permits have been listed in the management plans adopted by Connecticut, Delaware, Massachusetts, New Jersey, New York, Rhode Island, and Virginia. See CONNECTICUT’S PROPOSED FEDERAL CONSISTENCY LIST (2010), available at <https://perma.cc/UDY5-AZOR>; DELAWARE’S LISTED FEDERAL ACTIONS (2011), available at <https://perma.cc/ZQ55-3K5R>; MASSACHUSETTS COASTAL ZONE MANAGEMENT POLICY GUIDE (2011), available at <https://perma.cc/BK6N-J6SJ>; NEW JERSEY COASTAL MANAGEMENT PROGRAM FEDERAL CONSISTENCY LISTINGS (2008), available at <https://perma.cc/82F9-2P7S>; NEW YORK STATE COASTAL MANAGEMENT PROGRAM (2006), available at <https://perma.cc/9E4C-GMOD>; RHODE ISLAND COASTAL ZONE MANAGEMENT PROGRAM (2015), available at <https://perma.cc/2PVH-V97Q>; FEDERAL CONSISTENCY INFORMATION PACKAGE OR VIRGINIA COASTAL ZONE MANAGEMENT PROGRAM (2011), available at <https://perma.cc/NWL8-D3JM>.

²⁸¹ 15 C.F.R. § 930.57.

²⁸² *Id.* §§ 930.62 – 930.64.

²⁸³ The table is intended as a general overview only. We recommend that a more detailed analysis of the relevant permitting requirements be undertaken once the pipeline route is selected.

²⁸⁴ CONN. GEN. STAT. § 22a-361 (providing that a certificate is required to erect any structure in the tidal, coastal, or navigable waters of the state).

²⁸⁵ *Id.* § 22a-32 (providing that a permit is required to carry out any regulated activity within a wetland). See also *Id.* § 22a-29 (defining “regulated activity”).

State	Required Approvals
Delaware	<ul style="list-style-type: none"> • A lease may be required from the DDNREC.²⁸⁶ • If the pipeline will pass through a wetland, a wetlands permit may be required from the DDNREC.²⁸⁷
Maine	<ul style="list-style-type: none"> • A lease may be required from the state Bureau of Parks and Public Lands.²⁸⁸ • If the pipeline will be constructed in or within seventy five feet of a coastal wetland, a wetlands permit may be required from the state DEP.²⁸⁹ • If the pipeline will be constructed in a coastal sand dune system, a sand dune permit may be required from the state DEP.²⁹⁰
Maryland	<ul style="list-style-type: none"> • A license may be required from the Maryland Board of Public Works.²⁹¹ • If pipeline construction will affect a wetland, a wetlands permit may be required from the MDE.
Massachusetts	<ul style="list-style-type: none"> • A license may be required from the MDEP.²⁹² • If the pipeline will pass through a coastal wetland, beach, dune, or bank, and construction will remove, fill, dredge, or otherwise alter that area, approval may be required from the relevant local government.²⁹³

²⁸⁶ 7-7500-7504 DEL. ADMIN. CODE § 2 (providing that a lease is required to lay a pipeline in, on, over, or under the beds of public subaqueous lands). See also *Id.* § 1 (defining “subaqueous lands”).

²⁸⁷ 7-7500-7502 DEL. ADMIN. CODE § 6 (providing that a permit is required to undertake any “activity in wetlands”). See also *Id.* § 5 (defining “activity”).

²⁸⁸ ME. REV. STAT. tit. 1, §§ 1 & 2 (declaring the state’s ownership of certain land and providing for the conveyance of that land to private entities).

²⁸⁹ ME. REV. STAT. tit. 38, § 480-C (providing that a permit is required to undertake activities involving “A. Dredging, bulldozing, removing or displacing soil, sand, vegetation or other materials; B. Draining or otherwise dewatering; C. Filling, including adding sand or other material to a sand dune; or D. Any construction, repair or alteration of any permanent structure” in a “coastal wetland”). See also *Id.* § 480-B (defining “coastal wetland”).

²⁹⁰ 06-096-355 ME. CODE R. §§ 2(A) & 4 (indicating that permits must be obtained for activities in coastal sand dune systems). See also ME. REV. STAT. tit. 38, § 480-B (defining “coastal sand dune permit”).

²⁹¹ MD. CODE REGS. § 23.02.04.04(C) (providing that “[t]he “construction [of] any . . . pipeline . . . over, on, in, or under State tidal wetlands or waters of the State requires a license”).

²⁹² 310 MASS. CODE REGS. §§ 9.03 – 9.05 (providing that a license is required for activities involving the “construction [or] placement . . . of any fill or structure” in all waterways in Massachusetts). See also *Id.* § 9.02 (defining “structure”).

²⁹³ *Id.* § 10.02 (providing that approval must be obtained for any activity proposed to be undertaken in coastal wetlands, coastal beaches, coastal dunes, and certain other areas which will remove, fill, dredge, or alter that

State	Required Approvals
New Hampshire	<ul style="list-style-type: none"> • A lease may be required from the NHDES.²⁹⁴ • If the pipeline will pass through a sand dune, tidal wetland, or bog, a permit must be obtained from the NHDES.²⁹⁵
New Jersey	<ul style="list-style-type: none"> • A lease may be required from the New Jersey Tidelands Resource Council.²⁹⁶ • A waterfront development permit may be required from the NJDEP.²⁹⁷ • If the pipeline will pass through a designated coastal wetland, a coastal wetlands permit may be required from the NJDEP.²⁹⁸ • If the pipeline will be constructed on a beach or dune, a CAFRA permit may be required from the NJDEP.²⁹⁹
New York	<ul style="list-style-type: none"> • A lease or easement may be required from the New York State Office of General Services.³⁰⁰ • If the pipeline will pass through a tidal wetland, a tidal wetlands permit may be required from the NYDEC.³⁰¹ • If the pipeline will pass through a coastal erosion hazard area, a coastal erosion management permit may be required from the relevant local

wetland). See also *Id.* §§ 10.27(2) (defining “coastal beach”), 10.28(2) (defining “coastal dune”) & 10.30(2) (defining “coastal bank”).

²⁹⁴ N.H. REV. STAT. ANN. § 4:40 (authorizing the conveyance of state-owned land).

²⁹⁵ *Id.* § 482-A:3 (providing that a permit must be obtained to “excavate, remove, fill, dredge, or construct any structure in or on any bank, flat, marsh, or swamp in and adjacent to any waters of the state”). See also *Id.* § 482-A:4 (specifying the “waters and adjacent areas” to which the permitting requirement applies).

²⁹⁶ New Jersey Department of Environmental Protection, *Tidelands*, <https://perma.cc/C47Y-VA5S>.

²⁹⁷ N.J. ADMIN. CODE § 7:7-2.4(d) (providing that a “permit shall be required for the construction . . . of any structure . . . in the waterfront area”). See also *Id.* §§ 7:7-1.5 (defining “structure”) & 7:7-2.4 (defining “waterfront area”).

²⁹⁸ *Id.* § 7:7-2.3(a). (providing that “[c]oastal wetlands permits are required for all activities in coastal wetlands . . . including, but not limited to[,] . . . the construction of any structure.” See also N.J. STAT. ANN. § 13:9A-2 (defining “coastal wetlands”).

²⁹⁹ N.J. ADMIN CODE § 7:7-2.2 (providing that “a CAFRA permit shall be required for . . . any development located on a beach or dune”). See also *Id.* §§ 7:7-1.5 (defining “development”), 7:7-9.16(a) (defining “dune”) & 7:7-9.22(a) (defining “beach”).

³⁰⁰ N.Y. PUB. LANDS LAW § 3(2) (authorizing the Office of General Council to lease state lands).

³⁰¹ N.Y. COMP. CODES R. & REGS. tit. 6, § 661.8 (providing that a permit is required to conduct a regulated activity on any tidal wetland). See also *Id.* §§ 661.4(hh) (defining “tidal wetlands”) & 661.5(ee) (defining “regulated activity”).

State	Required Approvals
	government or the NYDEC. ³⁰²
Rhode Island	<ul style="list-style-type: none"> • A lease or easement may be required from the Rhode Island Coastal Resources Management Council (“RICRMC”).³⁰³ • A construction permit may be required from the RICRMC.³⁰⁴
Virginia	<ul style="list-style-type: none"> • A lease or easement may be required from the MRC.³⁰⁵ • If the pipeline will pass through a wetland, a wetlands permit may be required from the relevant local government or the MRC.³⁰⁶ • If the pipeline will pass through a coastal primary sand dune, a sand dune permit may be required from the relevant local government or the MRC.³⁰⁷

In addition to securing any necessary state environmental permits, the pipeline developer must also obtain any permits required under federal environmental law. The key federal permits are discussed in subpart 6.1.1 above.

FINDING 23: Persons wishing to develop carbon dioxide pipelines in state waters must obtain a lease or other authorization from the relevant state. The pipeline developer must also secure a construction permit from ACE. Depending on the pipeline route, other permits may be required under federal and/or state environmental law.

³⁰² *Id.* § 505.2(hh) (providing that any person proposing to undertake a regulated activity in an erosion hazard area must obtain a coastal erosion management permit. *See also Id.* §§ 505.2(o) (defining “erosion hazard area”) & 505.2(hh) (defining “regulated activity”).

³⁰³ R.I. GEN. LAWS § 46-23-6(4)(iii) (authorizing the RICRMC to “grant licenses, permits, and easements for the use of coastal resources which are held in trust by the state for all its citizens”).

³⁰⁴ *Id.* § 46-23-6(4)(i) (authorizing the RICRMC to “[i]ssue permits . . . for any work in, above, or beneath the areas under its jurisdiction”). *See also* Coastal Resources Management Program § 100.1 (providing that a council assent is required for “any alteration or activity that are proposed for (1) tidal waters within the territorial seas . . . (2) shoreline features and (3) areas contiguous to shoreline features).

³⁰⁵ VA. CODE ANN. § 28.2-1208 (authorizing the Marine Resources Commission to grant easements over or under or lease the beds of state waters).

³⁰⁶ *Id.* § 28.2-1306.

³⁰⁷ *Id.* § 28.2-1406 (making it unlawful for any person to conduct an activity which would require a permit under a coastal primary sand dune zoning ordinance without such a permit). *See also Id.* §§ 28.2-1400(A) (defining “coastal primary sand dune”).

Pipeline Design

Carbon dioxide pipelines in state waters must be designed and constructed in accordance with safety regulations adopted by the PHMSA. The PHMSA regulations apply to pipelines transporting carbon dioxide³⁰⁸ and certain other hazardous liquids³⁰⁹ in state waters, except “where the pipeline is located upstream of the outlet flange of the following farthest downstream facility: [t]he facility where hydrocarbons or carbon dioxide are produced or the facility where produced hydrocarbons or carbon dioxide are first separated, dehydrated, or otherwise processed.”³¹⁰ This exception was intended to capture pipelines associated with offshore production (“production lines”), which are regulated by the states, while leaving other transportation pipelines to be regulated by the PHMSA.³¹¹ The PHMSA regulations have been applied to pipelines used to transport liquids between offshore production sites and onshore storage or other facilities.

Pipelines serving offshore carbon dioxide injection wells are unlikely to fall within the production line exception. Such pipelines are not associated with carbon dioxide production, but rather used in transportation between on- and offshore facilities. The pipelines would, therefore, be subject to regulation by the PHMSA. The PHMSA applies the same safety regulations to both onshore and offshore pipelines. The regulations, described in subpart 6.1.1.1 above, include requirements with respect to the design of pipelines and associated equipment (e.g., valves, fittings, and pumps). Notably however, the requirements only apply to pipelines transporting carbon dioxide as a supercritical liquid. No requirements have been adopted with respect to pipelines transporting gaseous or subcritical liquid carbon dioxide.

FINDING 24: Carbon dioxide pipelines in state waters must be designed and constructed in accordance with federal safety regulations.

³⁰⁸ The PHMSA regulations only apply to pipelines transporting carbon dioxide as a supercritical liquid.

³⁰⁹ The regulations apply to petroleum, petroleum products, anhydrous ammonia, and ethanol. See 49 C.F.R. § 195.2.

³¹⁰ *Id.* § 195.1(b)(5).

³¹¹ PHMSA, *Fact Sheet: Offshore Pipelines*, <https://perma.cc/495A-YN43> (last updated Dec. 1, 2011).

When installing a new carbon dioxide pipeline in state waters, developers should take care to avoid damage to existing pipes and/or other facilities. Maps showing the location of existing facilities are maintained by BOEM and should be consulted by developers prior to pipeline installation.³¹²

FINDING 25: Developers should identify and avoid existing facilities when installing new carbon dioxide pipelines in state waters.

6.2.1.2 Pipeline Construction in Federal Waters

Pipeline Siting

Like carbon dioxide pipelines in state waters, those in federal waters must be authorized by ACE.³¹³ Authorization must also be obtained from the DOI's BOEM or Bureau of Safety and Environmental Enforcement ("BSEE"). BOEM may authorize "on-lease pipelines" that are to be installed by an existing lease holder within the area covered by of his/her/its drilling lease. Each lease confers on the holder "the right to one or more project easements without further competition for the purpose of installing . . . pipelines and appurtenances on the OCS as necessary for the full enjoyment of the lease."³¹⁴ Easement applications must be included as part of the Construction and Operations Plan³¹⁵ or General Action Plan³¹⁶ which the lease holder is required to submit to BOEM before undertaking any activity in the lease area.³¹⁷ The plan must describe all facilities to be constructed in connection with the lease, including any pipelines, and include information regarding pipe design, installation, testing, maintenance, and repair.³¹⁸

³¹² See BOEM, *Maps and GIS Data*, <https://perma.cc/7SRV-GZDG> (last visited Apr. 3, 2017).

³¹³ 33 C.F.R. § 322.5(b) (indicating that permits "are required for the construction of artificial islands, installations, and other devices on the seabed, to the seaward limit of the outer continental shelf").

³¹⁴ 30 C.F.R. § 585.200(b). Despite the broad language used in the provision, BOEM staff reported that the provision is only applied where a pipeline is situated "on lease." In all other circumstances, pipelines must be authorized by BSEE, through a right-of-way. Personal communication with Melissa Batum, Sen. Prog. Analyst, Bureau of Ocean Energy Management, Department of the Interior (Jun. 6, 2017).

³¹⁵ A construction and operations plan must be submitted before activities are undertaken pursuant to a commercial lease. See *Id.* § 585.600(b).

³¹⁶ A general action plan must be submitted before activities are undertaken pursuant to a limited lease, ROW grant, or RUE grant. See *Id.* § 585.600(c).

³¹⁷ *Id.* § 585.200(b)(1).

³¹⁸ *Id.* §§ 585.620(a), 585.640(a), 585.626(b), 585.640(c).

Off-lease pipelines – i.e., located in areas not covered by the drilling lease – will require a stand-alone authorization from BSEE. The OCSLA confers broad authority on BSEE to issue rights-of-way (“ROWs”) through the OCS “for pipeline purposes . . . under such regulations and upon such conditions as may be prescribed.”³¹⁹ BSEE regulations establish a framework for issuing ROWs for pipelines transporting oil, gas, sulfur, or produced water.³²⁰ Currently, however, the regulations do not provide for the issuance of rights-of-way for carbon dioxide pipelines.

FINDING 26: Carbon dioxide pipelines must be authorized by ACE, through a permit, and DOI, through an easement or ROW.

Pipeline Design

The DOI is authorized, under the OCSLA, to regulate the design and construction of pipelines on the OCS for the purpose of “assuring environmental protection by utilization of the best available and safest technologies.”³²¹ Regulations with respect to pipeline construction on the OCS may also be adopted by the DOT.³²² To avoid duplication of effort, the DOI and DOT have entered into a memorandum of understanding (“MOU”), dividing responsibility for pipeline regulation.³²³ The MOU puts “production pipelines under DOI responsibility and . . . transportation pipelines under DOT responsibility.”³²⁴ As noted in part 6.2.1.1 above, pipelines serving offshore carbon dioxide injection wells are unlikely to be considered production lines, but rather transportation lines. The pipelines would, therefore, fall within the regulatory responsibility of the DOT’s PHMSA. The PHMSA imposes the same regulations on OCS pipelines as are imposed on pipelines located onshore and in state waters.³²⁵

FINDING 27: Carbon dioxide pipelines in federal waters must be designed and constructed in accordance with PHMSA regulations.

³¹⁹ 43 U.S.C. § 1334(e).

³²⁰ 30 C.F.R. § 250.105 (defining “pipeline” to mean piping and associated equipment installed to transport oil, gas, sulphur, and produced water).

³²¹ 43 U.S.C. § 1334(e). *See also* 30 C.F.R. Pt. 250, Subpt. J.

³²² *See* 49 C.F.R. Pt. 195.

³²³ Memorandum of Understanding between the Department of Transportation and the Department of the Interior Regarding Outer Continental Shelf Pipelines, December 10, 1996.

³²⁴ *Id.* *See also* 30 C.F.R. § 250.1000(c)(9).

³²⁵ For a discussion of the regulations, see *supra* pt. 0.

Prior to installing a new carbon dioxide pipeline on the OCS the developer should consult BOEM maps showing the location of existing pipes and other facilities in the area of installation and take steps to avoid disturbing those facilities.³²⁶

FINDING 28: Care should be taken to avoid damaging or otherwise interfering with existing facilities when installing carbon dioxide pipelines on the OCS.

6.2.1.3 Pipeline Construction on the High Seas

Whereas domestic law applies to pipeline construction in U.S. waters, on the high seas, construction is regulated under the principles of international law. The key principles are set out in UNCLOS, which authorizes the installation of “submarine . . . pipelines on the bed of the high seas.”³²⁷ Under UNCLOS, when installing a submarine pipeline, the owner must pay due regard to any existing pipeline or cable on the seabed and notify the owner of such pipeline or crossing in the event of any crossing.³²⁸ Beyond this, however, UNCLOS does not impose any other requirements for pipeline installation.

FINDING 29: Carbon dioxide pipelines may be constructed on the land underlying the high seas. No permit or other authorization is required for such construction.

6.2.2 Ship Transportation

Due to the cost and complexity of developing offshore pipelines, during the demonstration project, carbon dioxide is likely to be transported to the well site by ship. Tank vessels could be used to transport carbon dioxide in bulk. Carbon dioxide could also be transported in non-bulk

³²⁶ The maps are available at BOEM, *Maps and GIS Data*, <https://perma.cc/7SRV-GZDG> (last visited Apr. 3, 2017).

³²⁷ UNCLOS, *supra* note 8, at 112(1).

³²⁸ *Id.* at 79(5) & 112(2). For a discussion of this issue, see Mišo Mudrić, *Rights of States Regarding Underwater Cables and Pipelines*, 29 AUSTL. RESOURCES & ENERGY LAW J. 235, 252 (2010).

containers (e.g., cylinders) by other vessels. In both cases the vessel would be loaded at a port in the U.S. and travel through U.S. and possibly international waters before reaching the well site.

6.2.2.1 Transporting Carbon Dioxide in U.S. Waters

Vessels transporting carbon dioxide in state and federal waters are subject to regulation by the U.S. The U.S. applies different regulatory frameworks to vessels engaged in bulk and non-bulk transportation.

Bulk transportation vessels are regulated by the USCG under its Safety Standards for Self-Propelled Vessels Carrying Bulk Liquefied Gases (“Safety Standards”).³²⁹ Under the Safety Standards, liquefied carbon dioxide may only be transported in bulk through U.S. waters if the transporter holds a certificate issued by the USGS, which has been endorsed for the carriage of carbon dioxide.³³⁰ To be certified by the USCG, the vessel must meet various design and other requirements, including:

- *Cargo tank design*: Vessels may be equipped with integral,³³¹ membrane,³³² semi-membrane,³³³ or independent³³⁴ cargo tanks. Each tank must be made of steel, unless it is intended to operate at very low temperatures, in which case aluminum must be used.³³⁵ Aluminum tanks must be enclosed by the vessel’s hull or a separate steel structure.³³⁶
- *Piping systems*: Each cargo tank must be equipped with a piping system. Only that system may be used to load and unload the tank.³³⁷ Loading and unloading must be supervised by a qualified person who has experience with the vessel and its cargo system and has received training in the hazards associated with the cargo and special procedures for its handling.³³⁸

³²⁹ 46 C.F.R. Pt. 154. The standards apply to “each self-propelled vessel that has on board bulk liquefied gases as cargo.” *Id.* § 154.5. For the purposes of the standards, the term “liquefied gases” is defined to mean “a cargo having a vapor pressure of 172 kPa (25 psia) or more at 37.8°C (100°F).” *Id.* § 154.7. Liquefied carbon dioxide falls within that category.

³³⁰ *Id.* §§ 154.1801 & 154.1802. See also *Id.* §§ 154.9 – 154.24.

³³¹ *Id.* §§ 154.418 – 154.421.

³³² *Id.* §§ 154.425 – 154.432.

³³³ *Id.* §§ 154.435 – 154.436.

³³⁴ *Id.* §§ 154.437 – 154.453.

³³⁵ *Id.* §§ 154.610 – 154.620.

³³⁶ *Id.*

³³⁷ *Id.* § 154.1834.

³³⁸ *Id.* §§ 154.1831(a)(2)-(4). See also 33 C.F.R. §155.710.

- *Safety devices*: Each cargo tank must be equipped with a pressure gauge that monitors the vapor space³³⁹ and have one or more pressure relief devices.³⁴⁰ The vessel must have a high pressure alarm that activates before any cargo tank exceeds the maximum pressure and triggers operation of the pressure relief device.³⁴¹
- *Warning signs*: A vessel transporting liquid carbon dioxide must display a warning sign while at any dock or port.³⁴² The vessel must carry documentation specifying the amount of carbon dioxide on board and the cargo tank(s) in which it is stowed.³⁴³ It must also carry a cargo information card containing general information about carbon dioxide.³⁴⁴

FINDING 30: Ships transporting carbon dioxide in bulk through state and/or federal waters must obtain a certificate from the U.S. Coast Guard and comply with all safety standards issued thereby.

The above requirements only apply to ships transporting liquid carbon dioxide in bulk. Ships engaged in non-bulk transportation are subject to different requirements, established through regulations adopted by the PHMSA under the HMTA.³⁴⁵ The HMTA regulations do not apply to small vessels of fifteen gross tons or less (“small operators”).³⁴⁶

Under the HMTA regulations, persons engaged in non-bulk transportation of carbon dioxide by ship, except small operators, must register annually with the PHMSA.³⁴⁷ The registration process is the same as that for persons transporting carbon dioxide by road or rail.³⁴⁸ Like road and rail operators, a registered ship can transport liquid carbon dioxide in metal

³³⁹ 46 C.F.R. § 154.1335I(a).

³⁴⁰ *Id.* § 154.801.

³⁴¹ *Id.* § 145.1335(b).

³⁴² *Id.* § 145.1830.

³⁴³ *Id.* § 154.1820.

³⁴⁴ A cargo information card must include the following information about the cargo: name, appearance, odor, safe handling procedures, procedures to follow in the event of spills, leaks, or uncontrolled release, procedures to be followed if a person is exposed to the cargo, and firefighting procedures. *Id.* § 154.1814.

³⁴⁵ 49 C.F.R. Pt. 176.

³⁴⁶ *Id.* § 176.5(b)(3).

³⁴⁷ *Id.* § 171.2. *See also Id.* Pt. 107, Subpt. G.

³⁴⁸ *See supra* pt. 6.1.2.

cylinders that are clearly marked, and have a green “NON-HAZARDOUS GAS” label.³⁴⁹ The cylinders may be stored on the ship’s weather deck or in a hold or compartment below it (except on certain passenger vessels,³⁵⁰ which may only store cylinders below deck).³⁵¹ While the cylinders are on board, the ship must carry a dangerous cargo manifest, including details of their content, design, and location.³⁵² Other documentation, similar to that required for road and rail transport, is also required where carbon dioxide cylinders are transported by ship.³⁵³

FINDING 31: Ships engaged in non-bulk transportation of carbon dioxide through state and/or federal waters must be registered with the PHMSA.

6.2.2.2 Transportation on the High Seas

When outside U.S. waters, on the high seas, vessels transporting carbon dioxide are subject only to regulation by the country in which they are registered. Vessels registered in the U.S. must comply with the USCG’s Safety Standards if transporting carbon dioxide in bulk³⁵⁴ or the PHMSA’s HMTA regulations if engaged in non-bulk transportation of carbon dioxide.³⁵⁵

FINDING 32: Ships transporting carbon dioxide on the high seas must be registered in accordance with UNCLOS. Each ship will be subject to regulation by the country in which it is registered.

6.3 Storage During Transportation

Carbon dioxide may need to be stored on a temporary basis during transportation to the injection site. The development of new storage facilities will be subject to local zoning and other

³⁴⁹ 49 C.F.R. § 176.1. See also *Id.* §§ 172.301, 172.302, 172.328, 172.330, 172.400, 172.400a & 172.415.

³⁵⁰ The exception applies to passenger vessels carrying more than 25 passengers or one passenger per three meters of overall vessel length (whichever is larger). See *Id.* § 176.101(k)(2) & Table 176.101.

³⁵¹ *Id.* § 176.63. See also *Id.* § 176.101(k)(1)-(2) & Table 176.101.

³⁵² *Id.* § 176.30. The dangerous cargo manifest must specify the name, official number, and nationality of the vessel, shipping name, identification number, and hazard classification of each hazardous material on board, the number and description of packages containing hazardous materials, and the stowage location of the packages.

³⁵³ *Id.* § 176.24.

³⁵⁴ 46 C.F.R. Pt. 154. See *supra* pt. 6.2.2.1.

³⁵⁵ 49 C.F.R. Pt. 176. See *supra* pt. 6.2.2.1.

ordinances. Developers must, for example, ensure that their facilities are located in an appropriately zoned area and comply with any rules for development in the zone (e.g., setbacks, land coverage, building heights, etc.). A building permit may need to be obtained from the relevant local government. Depending on the location of the facility, various state and federal environmental permits may also be needed, as shown in Table 3 and Table 4 above.

Once operational, storage facilities may be subject to reporting requirements under the Emergency Planning and Community Right-to-Know Act (“EPCRA”),³⁵⁶ depending on their size. The EPCRA applies to certain facilities handling large amounts of hazardous chemicals. For the purposes of the EPCRA, the term “hazardous chemical” is defined to include an element, compound, or mixture of elements, classified as a physical hazard or health hazard.³⁵⁷ Physical hazard chemicals include gases under pressure – i.e., gases maintained a pressure of twenty-nine pounds per square inch or more – such as high-pressure liquefied gases which have a critical temperature between -58°F and 149°F.³⁵⁸ This would include carbon dioxide.

Under the EPCRA, facilities handling 10,000 pounds (five tons) or more of carbon dioxide at any one time are subject to two reporting requirements, namely:

- *One-off Reporting*: The facility owner / operator must file a report within three months of becoming subject to the EPCRA. The report must consist of a list of each hazardous chemical(s) present at the facility at or above the threshold level or a safety data sheet (“SDS”) for each such chemical.³⁵⁹ The SDS must include:
 - information about the chemical (e.g., its name, physical and chemical properties, and stability and reactivity data);
 - details of the physical, health, and environmental hazards posed by the chemical;
 - guidelines for safe handling, storage, and disposal of the chemical; and
 - recommendations for dealing with chemical releases (e.g., first aid measures, fire-fighting techniques, and spill responses procedures).³⁶⁰

³⁵⁶ 42 U.S.C. § 11001 et seq.

³⁵⁷ 40 C.F.R. § 370.2. *See also* 29 C.F.R. §§ 1910.1200(c) & 1910.1450.

³⁵⁸ *Id.* § 1910.1200(c) & Appendix B.

³⁵⁹ 40 C.F.R. § 370.30(a).

³⁶⁰ See Occupational Safety and Health Administration, *Hazard Communication Standard: Safety Data Sheets*, <https://perma.cc/5Y9J-D5P4> (last visited Mar. 13, 2017).

- *Inventory Reporting*: The facility owner / operator must file annual reports, by March 1 of each year, on any hazardous chemical that was present at the facility at or above the threshold level during the previous calendar year.³⁶¹ The report must specify:
 - the maximum, and average daily, amount of the chemical present at the facility;
 - the maximum number of days that the chemical was present at the facility; and
 - the general location of the chemical within the facility.³⁶²

The one-off and inventory reports must be filed with the State Emergency Response Commission for the state in which the facility is located (or, if there is no Commission, the state's Governor), as well as the relevant Local Emergency Planning Committee and local fire department.³⁶³

FINDING 33: Storage facilities handling 10,000 pounds or more of carbon dioxide at any one time must report to the State Emergency Response Commission, Local Emergency Planning Committee, and local fire department.

³⁶¹ 42 U.S.C. § 11022; 40 C.F.R. §370.40.

³⁶² *Id.* § 370.41.

³⁶³ *Id.* §§ 370.32 & 370.44

7. INJECTING CARBON DIOXIDE AT THE WELL SITE

Following delivery to the well site, carbon dioxide will be injected into the seabed, either as is or mixed with seawater. After injection the well will be closed and then monitored for leaks. This part outlines the regulatory framework governing carbon dioxide injection and post-injection well closure and monitoring. A diagram summarizing the regulations is included in Appendix C.

KEY FINDINGS

- Injection operations in federal waters and on the high seas must be permitted by EPA if:
 - the carbon dioxide to be injected will be transported from the U.S.; or
 - the carbon dioxide will be transported from another location by a U.S. registered vessel.
- If injection is permitted by EPA, the injectate must contain no more than trace amounts of oil, organohalogen, mercury, cadmium, or known or suspected carcinogens, mutagens, or teratogens. The amount of benzene and other substances that are immiscible with or slightly soluble in seawater must not exceed their solubility limit.
- Information regarding the composition of the injectate and the times and locations of injection must be provided in biannual reports filed with EPA. If injection occurs in federal waters, annual greenhouse gas emissions reports must also be filed with EPA.
- If injection occurs in federal waters, the operator must monitor the surrounding area until the carbon dioxide plume has stabilized. The operator must develop a monitoring plan and report annually on its implementation to EPA.
- There are no monitoring requirements for injection operations on the high seas. EPA could impose such requirements as a condition of any permit issued therefor.

7.1 Requirements for Carbon Dioxide Injection

Carbon dioxide injection operations in federal waters and on the high seas may be regulated by EPA pursuant to the MPRSA.³⁶⁴ In general and with some exceptions, the MPRSA prohibits any person dumping materials into ocean waters unless he/she/it is permitted by EPA.³⁶⁵

³⁶⁴ 33 U.S.C. § 1401 et seq.

³⁶⁵ *Id.* § 1412.

Notably however, EPA cannot permit the dumping of industrial waste, defined as “any solid, semi-solid, or liquid waste generated by a manufacturing or processing plant.”³⁶⁶ Whether this definition encompasses carbon dioxide is somewhat unclear and may ultimately depend on the source thereof.

The MPRSA does not define what constitutes a “manufacturing” or “processing” plant. In general parlance, a “manufacturing plant” is a facility where objects are produced by hand or machinery,³⁶⁷ while a “processing plant” is a facility where raw materials are prepared for use.³⁶⁸ Relying on these definitions a number of commentators have argued that power plants are not manufacturing or processing plants for the purposes of the MPRSA.³⁶⁹ Power plants are, however, often treated as manufacturing facilities under local zoning ordinances and other laws. EPA could take the view that power plants “manufacture” electricity, making the carbon dioxide they emit industrial waste. In any event, carbon dioxide emitted by industrial facilities (e.g., steel manufacturing plants) would almost certainly be considered industrial waste.

Assuming carbon dioxide generated by power plants is not considered industrial waste, it may be injected into the seabed with a permit from EPA. A permit is required whenever:

- carbon dioxide is transported from within the U.S., regardless of whether injection will occur in state or federal waters or on the high seas;³⁷⁰ and
- carbon dioxide is transported from outside the U.S., if:
 - transportation occurs on a vessel registered in the U.S.; or
 - injection will occur within twelve nautical miles of the U.S. coast.³⁷¹

³⁶⁶ *Id.* § 1414b.

³⁶⁷ The Collins Dictionary defines “manufacturing plant” to mean “a factory where goods are manufactured.” See Collins, *Definition of ‘manufacturing plant’*, <https://perma.cc/ACQ2-MG4N> (last visited Mar. 27, 2017). The term “manufacture” is defined to mean “the making of goods or articles by hand or, esp., machinery.” See Collins, *Definition of ‘manufacture’*, <https://perma.cc/365L-PRUZ> (last visited Mar. 27, 2017).

³⁶⁸ The Collins Dictionary defines “processing plant” as “a factory where raw materials are treated or prepared by a special method, esp. one where food is treated in order to preserve it.” See Collins, *Definition of ‘processing plant’*, <https://perma.cc/9TQ5-LAJ3> (last visited Mar. 27, 2017).

³⁶⁹ Ann Brewster Weeks, *Subseabed Carbon Dioxide Sequestration as a Climate Mitigation Option for the Eastern United States: A Preliminary Assessment of Technology and Law*, 12 OCEAN & COASTAL L.J. 245, 263 (2006).

³⁷⁰ 33 U.S.C. § 1411(a)(1) (prohibiting any person transporting from the U.S. material for the purpose of dumping it into ocean waters). See also *Id.* § 1402(b) (defining “ocean waters” to mean “those waters of the open seas lying seaward of the base line from which the territorial sea is measured”).

³⁷¹ *Id.* § 1411; 40 C.F.R. § 220.1(a).

Permit applications must be filed with the relevant EPA Regional Office.³⁷² The application must include details of the materials to be injected (e.g., physical and chemical description, amount, source etc.), information regarding the injection operation (e.g., injection site, date and time, method etc.), a statement of the need for injection,³⁷³ and an assessment of the environmental impact of injection.³⁷⁴

On receiving a permit application, EPA must issue a public notice.³⁷⁵ In response to that notice, any person may request a public hearing on the application.³⁷⁶ Based on the views expressed at the public hearing (if any) and the information in the original application, EPA may issue or refuse to issue a permit. A permit may only be issued if EPA determines that injection “will not unreasonably degrade or endanger human health, welfare, or amenities, or the marine environment, ecological systems, or economic potentialities.”³⁷⁷

FINDING 34: Carbon dioxide captured at power plants may be injected into offshore wells. If the carbon dioxide will be transported from the U.S. or on a U.S. registered vessel, the injection operation must be permitted by EPA, regardless of whether it occurs in federal waters or on the high seas.

7.1.1 Carbon Dioxide Purity

There are currently no specific regulatory requirements, under either U.S. or international law, with respect to the purity of carbon dioxide streams. U.S. and international law do not, for example, require that a certain percentage of the stream be carbon dioxide. There are more general requirements in the London Protocol which, as discussed in subpart 4.2 above, provides for the permitting of seabed injection of carbon dioxide streams.³⁷⁸ Under the Protocol, a permit may only

³⁷² *Id.* §§ 220.4(b) & 221.1.

³⁷³ The statement must include an evaluation of alternative means of disposing of the material. *Id.* § 221.1(j).

³⁷⁴ *Id.* § 221.1. A processing fee of \$1,000 to \$3,000 – i.e., depending on the location of the injection site – must be paid for each application. *Id.* § 221.5.

³⁷⁵ *Id.* § 222.3.

³⁷⁶ *Id.* § 222.4. See also *Id.* §§ 222.5 – 222.7 (outlining the hearing procedures).

³⁷⁷ 33 U.S.C. §1412(a).

³⁷⁸ London Protocol, Art. 4.1 & Annex 2.

be granted if the stream “consist[s] overwhelmingly of carbon dioxide.”³⁷⁹ The stream “may contain incidental associated substances derived from the source material and the capture and sequestration process,” but must not have any “wastes or other matter” added for the purpose of disposing of those wastes or other matter.³⁸⁰

While the London Protocol requirements have not been incorporated into U.S. law, in our view, they should be complied with as a matter of best practice. Additional legal requirements will apply to injection operations permitted under the MPRSA. Regulations adopted pursuant to that Act prevent permitted operators injecting materials containing:

- any amount of:
 - high-level radioactive waste;
 - substances produced or used for radiological, chemical, or biological warfare; or
 - persistent inert synthetic or natural substances which may float or remain in suspension in the ocean and thereby interfere with its use;³⁸¹
- more than “trace amounts” (i.e., defined as amounts that “will not cause significant undesirable effects”)³⁸²of:
 - organohalogen compounds;
 - mercury and mercury compounds;
 - cadmium and cadmium compounds;
 - any type of oil including, but not limited to, petroleum; or
 - known or suspected carcinogens, mutagens, or teratogens;³⁸³ or
- benzene, toluene, xylene, carbon disulfide, or other substances that are immiscible with or slightly soluble in seawater in concentrations exceeding their solubility limits.³⁸⁴

³⁷⁹ *Id.* Annex 2(4).

³⁸⁰ *Id.*

³⁸¹ 40 C.F.R. § § 227.5.

³⁸² *Id.* § 227.6(b) (providing that the “constituents will be considered to be present as trace contaminants only when they are present in materials otherwise acceptable for ocean dumping in such forms and amounts . . . that dumping of the materials will not cause significant undesirable effects, including the possibility of danger associated with their bioaccumulation in marine organisms”).

³⁸³ *Id.* § 227.6(a).

³⁸⁴ *Id.* § 227.7(a)

To the extent that these substances are found in a carbon dioxide stream, they will need to be entirely or substantially removed before offshore injection.

FINDING 35: Carbon dioxide streams to be injected offshore should consist overwhelmingly of carbon dioxide and be treated to remove regulated impurities such as cadmium and mercury.

7.1.2 Conduct of Injection Operations

Injection operations in federal waters or on the high seas that are permitted under the MPRSA must be conducted in accordance with any terms and conditions specified in the permit.³⁸⁵ All permits must specify the times at which injection shall occur.³⁸⁶ Permits may also include other requirements for injection that EPA determines to be necessary or appropriate.³⁸⁷ An indication of the requirements which may be imposed is provided by EPA's UIC Program.³⁸⁸ That program establishes rules for injection operations onshore and in state waters.³⁸⁹ Key requirements in the rules include:

- *Injection Pressure:* The injection pressure must not exceed ninety percent of the fracture pressure of the geologic formation(s) (i.e., the pressure above which fluid injection will cause the formation to crack).³⁹⁰
- *Well Monitoring:* Continuous recording devices must be used to monitor key parameters, including the injection pressure and the rate, volume and/or mass, and temperature of the carbon dioxide stream.³⁹¹

³⁸⁵ As noted in subpart 7.1 above, offshore injection operations must be permitted under the MPRSA if: (1) the carbon dioxide injected was transported from a location within the U.S.; or (2) the carbon dioxide was transported from another location by an entity registered in the U.S. or will be injected within twelve n.m. of the U.S. coast.

³⁸⁶ 40 C.F.R. § 223.1(a)(7).

³⁸⁷ *Id.* § 223.1(a)(10).

³⁸⁸ For a discussion of the program, see *supra* pt. 4.1.

³⁸⁹ 40 C.F.R. Pt. 145, Subpt. H.

³⁹⁰ *Id.* § 146.88(a).

³⁹¹ *Id.* § 146.88(e)(1).

- *Well Shut-off*: The operator must use automatic shut-off systems that are capable of shutting in the well when operating parameters (e.g., injection rate or pressure) diverge from permitted ranges.³⁹²

The UIC Program rules do not apply to injection operations in federal waters or on the high seas.³⁹³ Such operations could, however, be required to comply with the same or similar rules as a condition of their MPRSA permit.

FINDING 36: Carbon dioxide injection operations must be conducted in accordance with any requirements in the MPRSA permit issued by EPA. Such requirements may be based on those developed by EPA for its UIC Program and deal with matters such as injection pressure, well monitoring, and shut-off.

7.2 Reporting on Injection

Complete records must be maintained with respect to all MPRSA permitted injection operations in federal waters and/or on the high seas. The records must include details of the material injected, such as its physical and chemical characteristics, as well as the time(s) and location(s) of injection.³⁹⁴ This and any other information required to be collected under the permit must be reported every six months to EPA.³⁹⁵

FINDING 37: Biannual reports must be filed with EPA on each injection operation permitted under the MPRSA. The reports must include details of the material injected and the time(s) and location(s) of injection.

7.2.1 Additional Requirements for Operations in Federal Waters

Injection operations undertaken in federal waters are subject to additional reporting requirements under EPA's Greenhouse Gas Reporting Program ("GHGRP").³⁹⁶ The GHGRP applies to facilities located on the OCS that, among other things, inject a carbon dioxide stream

³⁹² *Id.* § 146.88(e)(3).

³⁹³ *Id.* § 144.1(g)(2).

³⁹⁴ 40 C.F.R. § 224.1(a)-(b).

³⁹⁵ *Id.* §§ 224.1(c), 224.2.

³⁹⁶ *Id.* Pt. 98.

underground for long-term containment in geologic formations (“carbon sequestration facilities”).³⁹⁷ Notably however, there is an exemption for facilities engaged in a research and development project,³⁹⁸ defined as:

a project for the purpose of investigating practices, monitoring techniques, or injection verification, or engaging in other applied research, that will enable safe and effective long-term containment of a [carbon dioxide] stream in subsurface geologic formations, including research and short duration [carbon dioxide] injection tests conducted as a precursor to long-term storage.³⁹⁹

Unless covered by this exemption, each carbon sequestration facility must file annual reports with EPA, specifying the quantity of carbon dioxide:

- received during the year and the source⁴⁰⁰ of each receipt;⁴⁰¹
- injected into the subsurface during the year;⁴⁰²
- emitted as a result of movement of the injected carbon dioxide to the surface;⁴⁰³
- emitted as a result of equipment leaks and venting;⁴⁰⁴ and
- sequestered during the year and cumulatively over the life of the facility.⁴⁰⁵

FINDING 38: Persons injecting carbon dioxide on the OCS must file annual reports with EPA under the GHGRP.

7.2.2 Additional Requirements for Operations on the High Seas

Injection operations on the high seas are not subject to the requirements of the GHGRP. There are no other reporting requirements for such operations, except those established through the MPRSA and associated regulations.

³⁹⁷ *Id.* §§ 98.2(a) & 98.440(a).

³⁹⁸ *Id.* § 98.440(d).

³⁹⁹ *Id.* § 98.449.

⁴⁰⁰ Sources must be reported according to the following categories: carbon dioxide production well, electric generating unit, ethanol plant, pulp and paper mill, natural gas processing, gasification operations, other anthropogenic source, discontinued enhanced oil and gas recovery project, and unknown. *Id.* § 98.446(d).

⁴⁰¹ *Id.* § 98.442(a), 98.446(d).

⁴⁰² *Id.* § 98.442(b).

⁴⁰³ *Id.* § 98.442(d). *See also Id.* § 98.449.

⁴⁰⁴ *Id.* § 98.442(e)-(f).

⁴⁰⁵ *Id.* § 98.442(g)-(h). *See also Id.* § 98.446(e)-(f).

FINDING 39: No additional reporting requirements have been established, under either U.S. or international law, for injection operations on the high seas.

7.3 Post-Injection Site Closure and Monitoring

7.3.1 Operations in Federal Waters

Requirements for the monitoring of certain carbon dioxide injection operations have been established by EPA through its GHGRP. The monitoring requirements apply to injection wells on the OCS, except those associated with a research and development project (as defined above).⁴⁰⁶ The well owner or operator must monitor the area expected to contain the carbon dioxide, plus a half mile buffer zone (the “monitoring area”), until the plume has stabilized.⁴⁰⁷ The monitoring area must be identified in a plan developed by the well owner or operator.⁴⁰⁸ The plan must also:

- specify potential pathways through which injected carbon dioxide may move to the surface;
- assess the likelihood, magnitude, and timing of movement through those pathways; and
- outline a strategy for detecting and quantifying any such movement.⁴⁰⁹

The plan must be submitted to EPA within 180 days of approval of injection operations.⁴¹⁰

As well as developing a monitoring plan, the owner or operator of a well in federal waters must also prepare annual monitoring reports, and submit them to EPA as part of the GHGRP.⁴¹¹ Each report must contain:

- a narrative history of the monitoring efforts conducted over the previous year;
- a narrative history of any monitoring anomalies that were detected in the year and how they were investigated and resolved; and
- a description of any leakage resulting from the movement of carbon dioxide to the surface.⁴¹²

⁴⁰⁶ *Id.* § 98.440

⁴⁰⁷ *Id.* § 98.449.

⁴⁰⁸ *Id.* § 98.448(a)(1).

⁴⁰⁹ *Id.* § 98.448(a)(2)-(3).

⁴¹⁰ *Id.* § 98.448(b)(2).

⁴¹¹ *Id.* § 98.446(f)(12).

⁴¹² *Id.*

FINDING 40: Where injection operations are conducted in federal waters, other than as part of a research and development project, the operator must monitor the area for leaks. The operator must develop a monitoring plan and submit annual monitoring reports to EPA.

7.3.2 Operations on the High Seas

No monitoring or reporting requirements have been established with respect to carbon dioxide injection operations on the high seas. EPA could, however, impose such requirements as a condition of any permit issued for injection operations under the MPRSA.⁴¹³ The requirements could be based on those imposed on operations in federal waters under EPA's GHGRP. Alternatively, they be developed having regard to the requirements for wells in state waters, established through EPA's UIC Program. As part of that program, following the completion of injection operations, the owner or operator of a well in state waters must monitor the site for at least fifty years to show the position of the underground carbon dioxide plume⁴¹⁴ and pressure front⁴¹⁵ and demonstrate that underground sources of drinking water are not being endangered.⁴¹⁶

FINDING 41: There are currently no monitoring requirements applicable to injection operations on the high seas.

7.4 Controlling Leaks from Carbon Dioxide Injection Wells

In the event that carbon dioxide is found to be leaking from an injection well, the operator will likely be required to take remedial action. Such requirements may be imposed as a condition

⁴¹³ *Id.* § 223.1(a)(9) (stating that each permit “shall include . . . [s]uch monitoring relevant to the assessment of the impact of permitted dumping activities on the marine environment as [EPA] determine[s] to be necessary or appropriate”).

⁴¹⁴ The term “carbon dioxide plume” refers to “the extent underground, in three dimensions, of an injected carbon dioxide stream.” *Id.* § 146.81.

⁴¹⁵ The “pressure front” of a carbon dioxide plume refers to “the zone of elevated pressure that is created by the injection of carbon dioxide into the subsurface” where “there is a pressure differential sufficient to cause the movement of” fluids into an underground source of drinking water. *Id.* § 146.81.

⁴¹⁶ *Id.* § 146.93(b).

of any permit issued for wells in federal waters or on the high seas (e.g., under the MPRSA).⁴¹⁷ EPA adopts a similar approach when permitting wells onshore and in state waters under the UIC Program. The owner or operator of such a well is required to submit, with its permit application, an emergency and remedial response plan detailing the actions it will take to address the movement of carbon dioxide during injection or post-injection monitoring.⁴¹⁸ EPA may require implementation of that plan as a condition of the permit.⁴¹⁹ The permit holder must maintain sufficient insurance, bonds, and/or other financial instruments to cover the cost of remedial action.⁴²⁰

FINDING 42: EPA may require, as a condition of any MPRSA permit issued for CCS in federal waters or on the high seas, the development and implementation of a plan for managing leaks.

7.5 Decommissioning Offshore Installations

Following the completion of injection operations and associated activities, the operator must decommission offshore platforms and other installations on the OCS. Regulations adopted by BOEM under the OCSLA require persons leasing land on the OCS to:

within 2 years following termination of a lease or grant . . .

- (1) Remove or decommission all facilities, projects, cables, pipelines, and obstructions;
- (2) Clear the seafloor of all obstructions created by activities on [the] lease, including [the] project easement, or grant, as required by the BOEM.⁴²¹

All facilities must be removed to a depth of fifteen feet below the mud-line unless otherwise authorized by BOEM.⁴²² If facilities are not removed as required, BOEM may take enforcement action against the lessee,⁴²³ and any removal costs may be recovered from it.⁴²⁴ Any bond or other

⁴¹⁷ *Id.* § 223.1(a)(10) (indicating that a permit may include any terms and conditions that EPA determines to be necessary or appropriate).

⁴¹⁸ *Id.* § 146.94(a).

⁴¹⁹ *Id.*

⁴²⁰ *Id.* § 146.82(a)(1)-(2).

⁴²¹ 30 C.F.R. § 585.902(a).

⁴²² *Id.* § 585.910(a).

⁴²³ *Id.* § 585.913(c) (providing that, if a lessee fails to comply with its decommissioning obligations, “BOEM may take enforcement action”).

financial security provided by the lessee to guarantee performance of its obligations under the lease may also be retained by BOEM.⁴²⁵

In certain circumstances, BOEM may authorize a lessee to leave facilities in place for use in other activities, permitted under federal law.⁴²⁶ In determining whether to grant such authorization, BOEM must consider:

- potential impacts to the marine environment;
- competing uses of the OCS;
- impacts on marine safety and national defense;
- maintenance of adequate financial assurance; and
- other factors it considers relevant.⁴²⁷

If the request is granted, the lessee will remain liable for decommissioning the facility following the activities unless BOEM determines that another person has assumed that responsibility and secured adequate financial assurances.⁴²⁸

The above decommissioning requirements only apply to facilities on the OCS. There are no similar requirements for facilities on the high seas.⁴²⁹

⁴²⁴ *Id.* § 585.913(b) (providing that, if a lessee fails to comply with its decommissioning obligations, it shall “remain liable for removal or disposal costs”).

⁴²⁵ *Id.* § 585.913(a) (providing that, if a lessee fails to comply with its decommissioning obligations “BOEM may call for the forfeiture of [its] bond or other financial assurance”). For a discussion of the bonding requirements, see *supra* part 5.1.4.

⁴²⁶ *Id.* § 585.909(a).

⁴²⁷ *Id.* § 585.909(b).

⁴²⁸ *Id.* § 585.909(c).

⁴²⁹ International law requires the decommissioning of facilities on the EEZ, but does not establish any similar requirements for facilities on the high seas. See UNCLOS, *supra* note 8, at 60(3) (providing “[a]ny installations or structures [on the EEZ] which are abandoned or disused shall be removed to ensure safety of navigation, taking into account any generally accepted international standards established in this regard by the competent international organization. Such removal shall also have due regard to fishing, the protection of the marine environment and the rights and duties of other states”). UNCLOS does not require the decommissioning of structures on the high seas.

8. CONCLUSION

CCS can play an important role in reducing carbon dioxide emissions and thereby help to mitigate climate change. During CCS, carbon dioxide that would ordinarily be emitted by power plants and/or other facilities is captured and injected into underground geological formations, where it remains permanently sequestered. To date, CCS research has largely focused on the possibility of sequestering carbon onshore, e.g. in depleted oil and gas reservoirs. There is, however, growing interest in the possibility of offshore sequestration.

The regulation of any future offshore sequestration project will depend on its location. Under international law, each country’s regulatory authority is typically limited to the water and submerged land within 200 n.m. of its coast; areas beyond that are part of the high seas, over which no country has exclusive jurisdiction. In the U.S., authority over the 200 n.m. zone is shared between the coastal states, which regulate areas within three n.m. of their shores (or, in Texas and the west coast of Florida, nine n.m.) (i.e., state waters) and the federal government, which regulates areas further offshore (i.e., federal waters).

There is currently no comprehensive regulatory framework, under either U.S. or international law, specific to CCS in federal waters or on the high seas. CCS projects in those areas may, however, be regulated under general programs developed with other activities in mind. The most important of these is established under the MPRSA and requires persons transporting material from the U.S. or on a U.S. vessel for the purpose of dumping it at sea (i.e., whether in federal waters or on the high seas) to obtain a permit from EPA. For the purposes of the MPRSA, “material” is defined broadly to mean “matter of any kind or description,” as is “dumping” which means any “disposition of material” at sea. The Act would, therefore, appear to encompass the injection of carbon dioxide into the seabed.

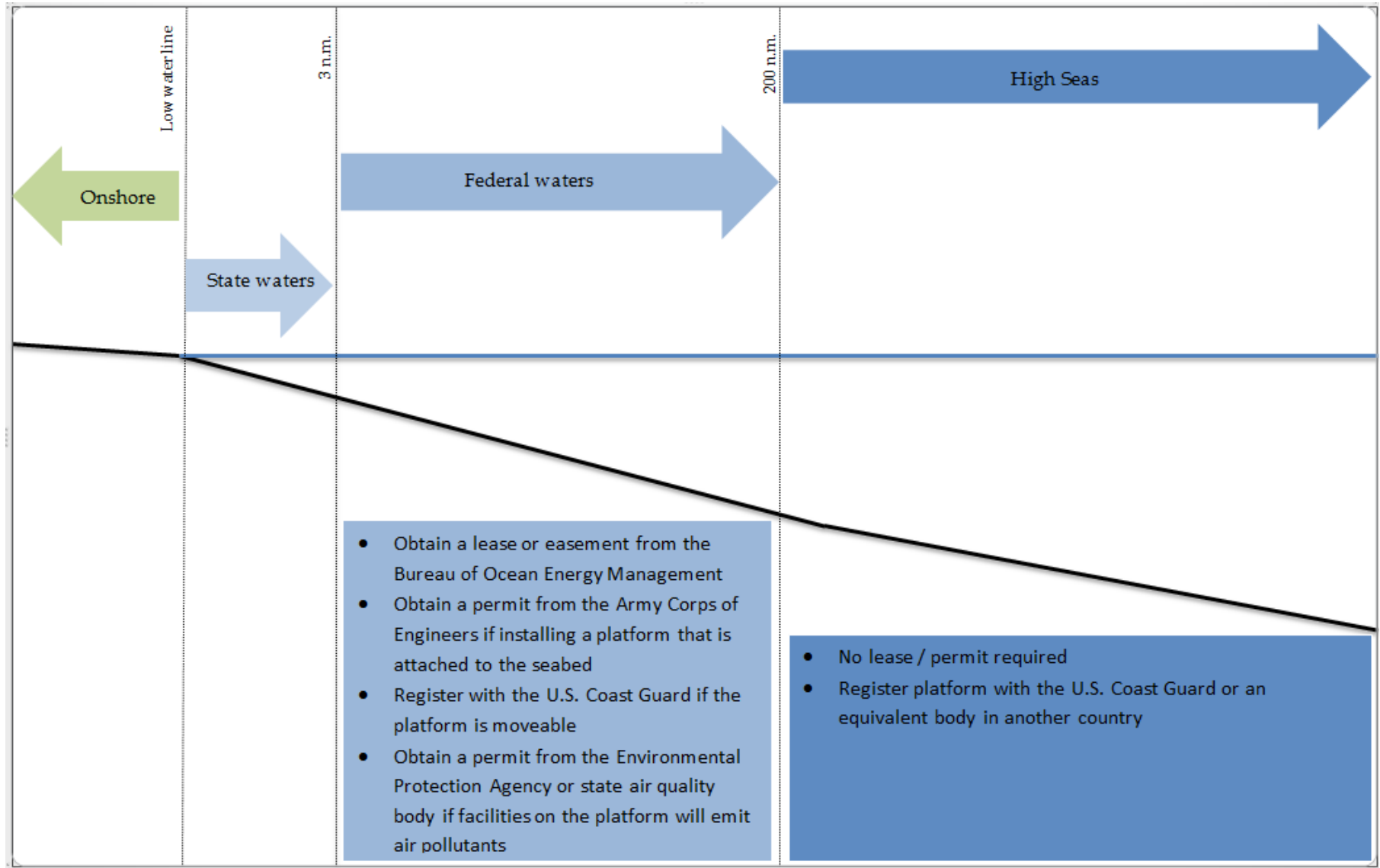
In addition to obtaining a permit from EPA under the MPRSA, persons injecting carbon dioxide into the seabed may require various other approvals. Those approvals will differ depending on the location of injection as shown in the table below.

Injection Operations in Federal Waters	Injection Operations on the High Seas
The operator must: <ul style="list-style-type: none">• obtain a lease or easement from BOEM before	Lease / easement not required for drilling. Permit not required to install drilling

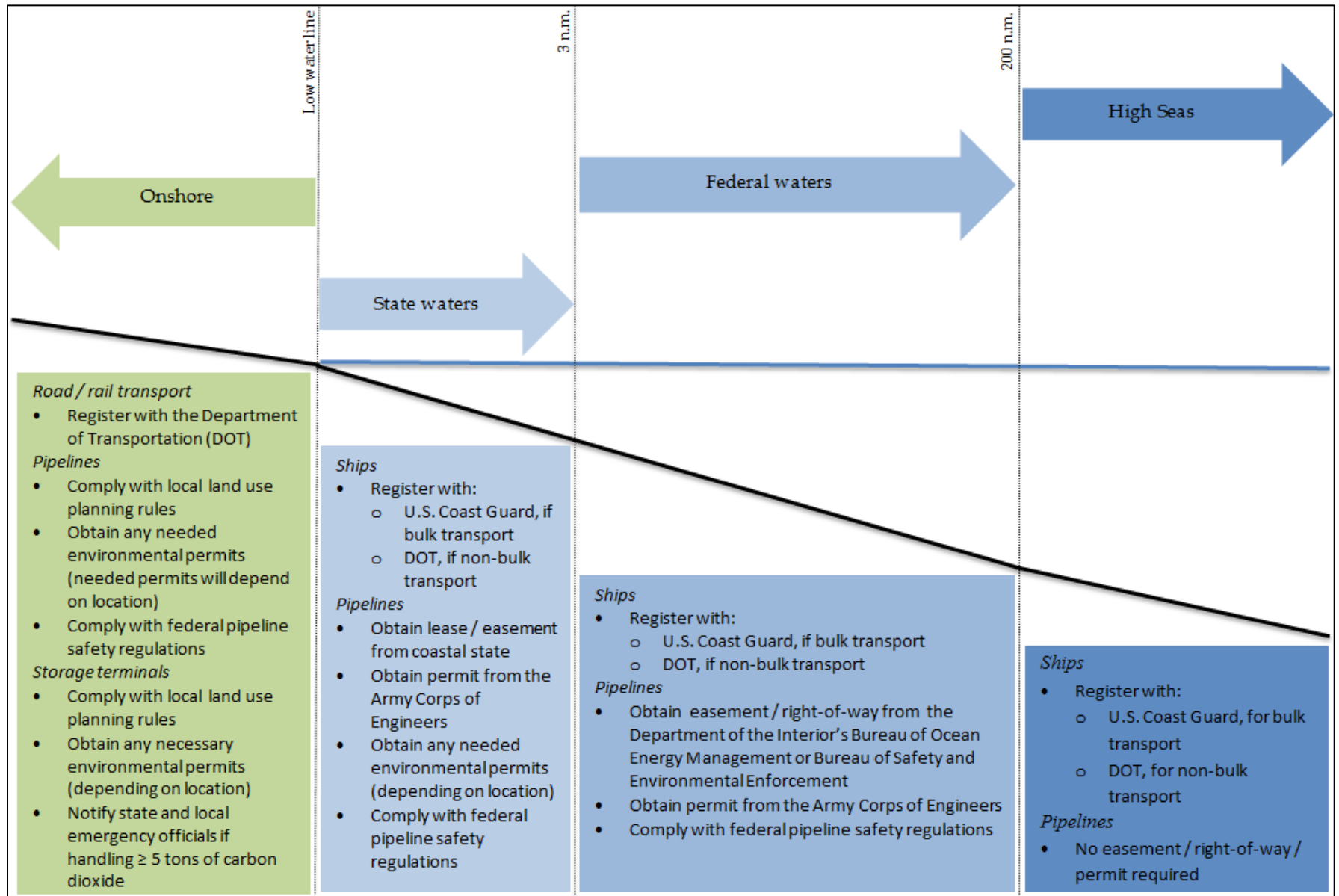
Injection Operations in Federal Waters	Injection Operations on the High Seas
<p>drilling an injection well;</p> <ul style="list-style-type: none"> • obtain a permit from ACE before installing a drilling platform that is attached to the seabed; • if the drilling platform is moveable, register the platform with the USCG; and • if the platform will be equipped with facilities that contribute significantly to air pollution, obtain a permit from EPA or a state authority. <p>When granting leases or other authorizations for offshore injection, federal agencies must conduct an environmental review under NEPA.</p>	<p>platforms. We recommend that platforms be registered with the USCG or an equivalent body in another country.</p>

Additional requirements may apply to the transport of carbon dioxide to the injection site. Where carbon dioxide is transported onshore via road or rail, the transporter must be registered with the DOT. Registration is also required for offshore transport via ship, with the DOT registering ships involved in non-bulk transportation, while the USCG registers bulk transportation ships. On and offshore pipelines may require various federal, state, and/or local government approvals depending on the route thereof. Such approvals may also be required for facilities storing carbon dioxide during transport.

APPENDIX A: REGULATORY FRAMEWORK FOR INJECTION WELL DRILLING



APPENDIX B: REGULATORY FRAMEWORK FOR CARBON DIOXIDE TRANSPORT



APPENDIX C: REGULATORY FRAMEWORK FOR CARBON DIOXIDE INJECTION

