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It's Getting Hot in Here: A Look into Whether Ocean Iron Fertilization is Legally Viable in the United States

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It's Getting Hot in Here: A Look into Whether Ocean Iron Fertilization is Legally Viable in the United States

*James Richards**

TABLE OF CONTENTS

I.	INTRODUCTION	74
II.	INTRODUCTION TO GEOENGINEERING	75
	A. Definition of Geoengineering	75
III.	OCEAN IRON FERTILIZATION	78
	A. Overview	78
	B. The Planktos Project	80
IV.	UNITED STATES LAW THAT APPLIES TO OIF	82
	A. United States Jurisdiction Over Vessels	82
	B. Marine Protection, Research, and Sanctuaries Act ...	84
	C. Clean Water Act	86
	D. Endangered Species Act	88
	E. Marine Mammal Protection Act	90
	F. National Environmental Policy Act	91
	G. Magnuson-Stevens Act	91
V.	INTERNATIONAL LAW THAT GOVERNS OIF	93
	A. International Law Introduction	93
	B. Treaties	94
	1. United Nations Framework Convention on Climate Change	95
	2. Convention on Biological Diversity	96
	3. Environmental Modification Convention	98
	4. London Convention and London Protocol	98
	5. United Nations Convention on the Law of the Sea	100
	C. International Customary Law	102
	1. Duty to Prevent Transboundary Harm	102
	2. Duty to Perform Environmental Impact Assessment	103
	3. Precautionary Principle	104
VI.	WHERE DO WE GO FROM HERE?	104
VII.	CONCLUSION	107

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I. INTRODUCTION

"It's not global warming, it's cooking."¹ As Earth's societies grow and develop, the atmosphere continues to feel the effects of climate change resulting from increased deforestation, greenhouse gas (GHGs) emissions, and decreased albedo caused by increasing agriculture and the melting of ice caps and glaciers.² In order to combat climate change, many climatologists believe that an intricate, inter-governmental regulatory approach, aimed at curtailing emissions at the production stage, is the only solution.³ By reducing the anthropogenic sources of GHGs, climatologists suggest that climate change can be mitigated or even avoided altogether.⁴ However, in light of global leaders' inability to either enhance or extend the Kyoto Protocol, or to adopt a new GHG regulatory framework, the global model is quickly doing nothing to combat the climate change crisis.⁵ Many researchers and policymakers now believe that a plan B needs to be developed to better address the climate change crisis given that current regulatory framework does not keep GHGs below the threshold limit.⁶

This leaves the 500 pound gorilla in the room begging the question: What can be done while policy makers are bickering with each other and not getting anywhere? Many researchers believe the answer lies in utilizing technology to mitigate climate change by manipulating the environment to reduce global temperature, a process known as geoengineering.⁷ Within that context, there exist varying regulatory frameworks, on both a national and international level, that currently aim at the development and implementation of geoengineering.

Geoengineering includes a myriad of different strategies, e.g., undertaking ocean iron fertilization (OIF) to encourage growth of carbon capturing phytoplankton, releasing sulfur dioxide into the stratosphere to increase global albedo, engaging in reforestation to capture carbon dioxide in plant matter, and placing mirrors in outer space to reflect a portion of the sunlight that would enter Earth's atmosphere to name a few.⁸ Each strategy is affected

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1. *Robin Williams: Weapons of Self Destruction* (HBO 2009).
 2. Eric W. Orts, *Climate Contracts*, 29 VA. ENVTL. L.J. 197, 199 (2011).
 3. *Id.*
 4. *Id.* at 203.
 5. Cinnamon P. Carlame, *Arctic Dreams and Geoengineering Wishes: The Collateral Damage of Climate Change*, 49 COLUM. J. TRANSNAT'L L. 602, 603 (2011).
 6. Tracy D. Hester, *Remaking the World to Save It: Applying U.S. Environmental Laws to Climate Engineering Projects*, 38 ECOLOGY L.Q. 851, 858 (2011).
 7. *See infra* Section II.A.
 8. Ralph Bodle, *Climate Law and Geoengineering*, in CLIMATE CHANGE AND THE LAW 447, 447 (Erkki J. Hollo et al. eds., 2012) [hereinafter Bodle, *Climate Law and Geoengineering*].

by applicable state, as well as international law, because the implementation of each strategy results in consequences that transcend state boundaries.

This article will analyze the legal status of OIF in order to shed light on whether this strategy could be legally viable. To date, there have been over ten OIF experiments conducted worldwide, including a controversial OIF experiment conducted by Planktos, Inc. (Planktos).⁹ In order to fully analyze the legal implications of OIF, it is important to understand the purpose and process of OIF. To that end, Part II will introduce the broad concept of geoengineering and the surrounding debate. Part III will explore OIF, focusing on the Planktos scenario. Part IV will examine United States laws applicable to OIF, and Part V will analyze applicable international laws.¹⁰ Part VI will hypothesize other alternative solutions regarding the development and implementation of OIF.

II. INTRODUCTION TO GEOENGINEERING

“Humans have been disrupting the Earth’s climate for hundreds of thousands of years.”¹¹ Historically, the atmosphere has been altered through development and progress. However, this development and progress is drowning us. As the problem magnified, the solution was to look towards technology; thus, geoengineering was born.

A. Definition of Geoengineering

In order to understand geoengineering, it helps to have a working definition of the term. Geoengineering is generally defined as the “deliberate intervention in the planetary environment of a nature and scale intended to counteract anthropogenic climate change and/or its impacts through, inter alia, solar radiation management or removing greenhouse gases from the atmosphere.”¹² In other words, “geoengineering is the study of how to mess with the planet even more than we already have, with the hope of moving the global climate back in the other direction.”¹³ Most definitions include three

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9. Planktos, Inc. is a U.S. corporation that looked to capitalize on the economic incentives created by OIF by using OIF to sell carbon credits to companies that were subjected to the Kyoto Protocol. Planktos and the economic incentives involved will be addressed more fully *infra* Section III.B.
 10. Section V is meant only to look at the applicable law, not to discuss the enforcement of international law. Discussing the enforcement of international laws is beyond the scope of this article.
 11. Max G. Bronstein, *Readily Deployable Approaches to Geoengineering: Cool Materials and Aggressive Reforestation*, 10 SUSTAINABLE DEV. L. & POL’Y 44, 44 (2010).
 12. Bodle, *Climate Law and Geoengineering*, *supra* note 8, at 447–48.
 13. Melissa Eick, *A Navigational System for Uncharted Waters: The London Convention and London Protocol’s Assessment Framework on Ocean Iron Fertilization*, 46 TULSA L. REV. 351, 353 (2010) (internal citations omitted).

main elements: that manipulation (1) is intentional, (2) is of the climate, and (3) is made in an effort to mitigate the effects of anthropogenic sources of GHGs.¹⁴ An unofficial, and optional, fourth element is that the manipulation is conducted through the use of technology.¹⁵

Geoengineering is typically grouped into two broad umbrella categories: carbon sequestration (CS) and solar radiation management (SRM).¹⁶ CS is a two-step process that (1) removes carbon dioxide (CO₂) from the atmosphere; and (2) stores the captured CO₂ in order to remove it from the atmosphere for a climatically relevant period¹⁷ in an attempt to cool the Earth.¹⁸ In contrast, SRM attempts to cool the Earth, not by addressing GHG emissions, but by reducing the amount of energy in the atmosphere.¹⁹ This is typically accomplished by reflecting the sun's rays back into space through a variety of techniques—from mirrors in space to injecting sulfate aerosols into the atmosphere.²⁰

B. The Pros and Cons of Geoengineering

Geoengineering is a nascent and controversial concept that constitutes a “fringe topic” in the global warming debate.²¹ Many scientists, policymakers, and private entities tout the benefits of geoengineering and they push for the continuation of responsible research to prove its viability. These parties promote geoengineering as the most economically feasible option to the war on climate change available to policymakers given the complexity of implementing another alternative emission reduction scheme.²² Economic feasibility allows developing countries to participate in the implementation of a global geoengineering project, thus promoting global participation and acceptance of any adopted plan.²³ Additionally, geoengineering could be used as a kind of insurance policy, buying time for policymakers to develop and

14. Hester, *supra* note 6, at 865–66.

15. Not every technique uses technology, e.g. reforestation.

16. Bodle, *Climate Law and Geoengineering*, *supra* note 8, at 450.

17. *Id.* at 452.

18. Eick, *supra* note 13, at 354.

19. Bodle, *Climate Law and Geoengineering*, *supra* note 8, at 452.

20. *Id.* at 451. This article will not cover SRM techniques because those techniques are only theoretical and will not be ready for development for at least another few years.

21. Eick, *supra* note 13, at 355.

22. Rafael Leal-Arcas & Andrew Filis-Yelaghotis, *Geoengineering A Future for Humankind: Some Technical and Ethical Considerations*, 2 CARBON & CLIMATE L. REV. 128, 132 (2012).

23. *Id.* at 129.

implement a comprehensive emission regulation scheme.²⁴ Finally, geoengineering can be implemented unilaterally, which could, in the presence of political grandstanding and inactivity, allow states the opportunity to mitigate the effects of climate change even in the absence of an international regulatory scheme.²⁵ Unilateral implementation could be quickly initiated in the face of a climate emergency, and could produce relatively rapid results.²⁶ In contrast, GHG emission regulation would require politically cumbersome, multilateral agreements and require a long lead time until a significant effect would be realized.²⁷

Geoengineering doubters, however, point to the paucity of scientific literature on the subject to emphasize geoengineering's major weaknesses: extreme risk and pervasive uncertainty.²⁸ They express concern that using technology to manipulate the Earth's natural processes is akin to playing God.²⁹ This large-scale manipulation also raises concerns about severe adverse environmental side effects,³⁰ such as "unexpected effects on precipitation patterns, atmospheric quality, and ecosystems."³¹

These doubters also point to political concerns.³² They fear that policymakers may turn a blind eye to their "moral" duty to solve the climate crisis if geoengineering proves successful.³³ For example, there is concern that, if geoengineering is successful, the legislative and executive branches would cease to address global warming, both locally and internationally. These parties reason that the diminution of global warming symptoms would hide the issue from public view, effectively sweeping it under the rug. Critics also point out that the success of geoengineering may promote the restructuring of climate change mitigation policy because geoengineering would falsely appear to be solving the problem.³⁴ In this regard, there is a fear that United States policymakers will adopt policies that remove GHG regulation as the goal, and instead implement policies that focus solely on geoengineering as band aid solution. Critics further argue that a decrease in GHG regulation policies would eventually leave Earth's atmosphere as GHG-ridden as Ve-

24. Eick, *supra* note 13, at 354.

25. Hester, *supra* note 6, at 871.

26. Eick, *supra* note 13, at 355.

27. *Id.*

28. *Id.*

29. Leal-Arcas & Filis-Yelaghotis, *supra* note 22, at 132.

30. Eick, *supra* note 13, at 354.

31. Albert C. Lin, *Revamping Our Approach to Emerging Technologies*, 76 BROOK. L. REV. 1309, 1321 (2011).

32. Leal-Arcas & Filis-Yelaghotis, *supra* note 22, at 132–33.

33. *Id.* at 132.

34. *Id.*

nus's. Finally, critics emphasize that there may be a shift of power to those who support geoengineering, which could also change the socio-political nature of the international political scene.³⁵ For instance, if China were able to successfully implement geoengineering techniques that allowed countries to continue to increase their GHG emissions—while hiding the effect of climate change—China could gain enough international political support to supplant the United States as the world's premier power. China's allies, such as North Korea, could also gain political power in such a scenario, essentially establishing them as the drivers of international policy determinations.

III. OCEAN IRON FERTILIZATION

A. Overview

Ocean Iron Fertilization (OIF) is a form of geoengineering that involves carbon sequestration.³⁶ Currently, OIF is the most researched, plausible, and economically feasible CS technique available.³⁷ More importantly, it is the most regulated geoengineering technique currently available.³⁸ OIF is a technique used to stimulate phytoplankton blooms by introducing specific trace nutrients, usually iron sulfate, into the water column.³⁹ This technique was inspired by the observation that iron-rich dusts blown into the ocean trigger phytoplankton blooms.⁴⁰ The purpose of creating a phytoplankton bloom is simple: growing phytoplankton removes CO₂ from the atmosphere,⁴¹ and when the phytoplankton dies that CO₂ is stored in the depths of the ocean.⁴² CO₂ is stored in the ocean in one of three ways: (1) on the ocean floor in dead phytoplankton, which consume and store CO₂ during photosynthesis; (2) in fecal material of organisms that graze on carbon sequestering phytoplankton; or (3) in the food web, as carbon sequestering phytoplankton and their grazers are eaten by larger organisms.⁴³

35. *Id.* at 128.

36. Till Markus & Harald Ginzky, *Regulating Climate Engineering: Paradigmatic Aspects of the Regulation of Ocean Fertilization*, 4 CARBON & CLIMATE L. REV. 477, 477 (2011).

37. *Id.* at 477–78.

38. *Id.* at 478; Bodle, *Climate Law and Geoengineering*, *supra* note 8, at 453.

39. K. Russell LaMotte, *Legal Posture of Ocean Iron Fertilization Under International Law*, 13 ABA AGRIC. MGMT. COMM. NEWSL. 2 (ABA, Chicago, IL), Feb. 2009, at 9.

40. *Id.*

41. Markus & Ginzky, *supra* note 36, at 478.

42. Hugh Powell, *Fertilizing the Ocean with Iron: Should We Add Iron to the Sea to Help Reduce Greenhouse Gases in the Air?*, 46 OCEANUS MAG. 1, Jan. 2008, at 5.

43. Eick, *supra* note 13, at 357.

OIF is the current target of a moratorium, recommended by the 9th Conference of the Parties to the Convention on Biological Diversity⁴⁴ due to the technique's contradictory results and potential risks.⁴⁵ In spite of this, OIF may be gaining favor.⁴⁶ The London Convention/London Protocol Consultative Meeting's Resolution, adopted on October 31, 2008, promoted OIF research.⁴⁷ Supporters of OIF highlight that the scientific community has benefitted from OIF research because it has provided an increased understanding of marine processes.⁴⁸ Additionally, supporters argue that continued OIF experimentation is necessary because of OIF's potential to improve phytoplankton and fish stocks, which are both dwindling because the increase in CO₂ has caused ocean acidification.⁴⁹ Finally, supporters point to the fact that OIF, unlike other geoengineering proposals, is based on natural processes.⁵⁰

However, OIF is not unanimously heralded. OIF's critics fear that manipulating the foundation of the food chain may have far-reaching consequences.⁵¹ These potential consequences include: (1) nullification of any OIF benefit, as phytoplankton may produce GHGs worse than CO₂, such as methane; (2) ocean acidification caused by increased CO₂ levels from the physiologic respiration of larger numbers of phytoplankton and their grazers; (3) increased uptake of other necessary nutrients by phytoplankton, affecting the ecosystem up the food chain; (4) potential toxic phytoplankton blooms, composed of phytoplankton that are toxic to marine mammals; and (5) "higher surface water temperature, which would both increase global warming and diminish OIF experiments' effectiveness" caused by increased amounts of phytoplankton absorbing sunlight.⁵²

Further, there is debate as to how effective OIF could be in actually sequestering CO₂,⁵³ because the relocation of CO₂ to the ocean floor, instead of releasing it in the top 500 meters, only removes it for a couple of de-

44. See discussion *infra* Part V.B.2.

45. LaMotte, *supra* note 39, at 8, 10–11.

46. Eick, *supra* note 13, at 355–56.

47. See discussion of how and to what extent the LC/LP promoted OIF research *infra* Part V.B.4.

48. Markus & Ginzky, *supra* note 36, at 478.

49. Eick, *supra* note 13, at 357.

50. *Frequently Asked Questions About Ocean Fertilization*, CLIMOS, <http://www.climos.com/faq.php> (last visited Nov. 2, 2015).

51. Eick, *supra* note 13, at 357–58.

52. *Id.* at 358.

53. *Id.* at 357.

acades.⁵⁴ Results from about half of the OIF expeditions show that only a marginal amount of CO₂, fifteen percent or less, is sequestered and settled in the ocean depths.⁵⁵ The remaining CO₂ is released back into the water column within the top 500 meters by grazing zooplankton respiration. It then re-enters the atmosphere within only a couple of decades.⁵⁶ In other words, anywhere from eighty-five to ninety-nine percent of the carbon sequestered is released back into the atmosphere, which in turn contributes to the climate change problem within a relatively short time period. Fifteen percent of sequestered oceanic CO₂ represents between ten and twenty-five percent of the annual global CO₂ emissions.⁵⁷ For OIF to effectively mitigate climate change, it is imperative that the CO₂ reach the oceans' depths. Only then will it remain sequestered for hundreds, if not thousands, of years, due to both slow metabolic and decomposition processes at that depth,⁵⁸ and the length of time it takes for compounds in deep water to reach the "mixed-layer" ⁵⁹ via the global conveyor belt and upwelling. ⁶⁰

B. The Planktos Project

In 2008, the U.S.-based company Planktos, Inc.⁶¹ aimed to capitalize on OIF by selling the potential CO₂ sequestration as carbon credits to companies that were subject to the Kyoto Protocol.⁶² Planktos proposed to under-

54. Randall S. Abate & Andrew B. Greenlee, *Sowing Seeds Uncertain: Ocean Iron Fertilization, Climate Change, and the International Environmental Law Framework*, 27 PACE ENVTL. L. REV. 555, 56–70 (2010).

55. *Id.*

56. *Id.*

57. *Id.* at 562.

58. Brad A. Seibel & Jeffrey C. Drazen, *The Rate of Metabolism in Marine Animals: Environmental Constraints, Ecological Demands, and Energetic Opportunities*, 362 PHIL. TRANSACTIONS, 2061, 2065 (Nov. 29, 2007), <http://rstb.royalsocietypublishing.org/content/royptb/362/1487/2061.full.pdf>.

59. The ocean's mixed layer maintains a relatively uniform density due primarily to wind and wave action, which act as agitators. *See generally Mixed-layer: definition*, EARTH AND SPACE RESEARCH, http://www.esr.org/outreach/glossary/mixed_layer.html (last visited Oct. 19, 2015).

60. Jennifer Horton, *How Ocean Currents Work*, HOW STUFF WORKS, <http://science.howstuffworks.com/environmental/earth/oceanography/ocean-current3.htm> (last visited Oct. 19, 2015).

61. Planktos, Inc. was the first U.S.-based company to plan an OIF project for commercial purposes.

62. Abate & Greenlee, *supra* note 54, at 558. OIF could also be regulated through treaties, like the Kyoto Protocol, or the parties to a treaty could expressly determine that OIF may be used as a carbon sink for carbon credit purposes. *See discussion infra* Part VI.

take this endeavor in the Galapagos Islands, of all places.⁶³ During the preparation stage of the Galapagos project, Planktos received a letter from the EPA alleging possible violations of the Ocean Dumping Ban Act of 1988.⁶⁴ In response to the EPA's concerns, Planktos's ceased the use of U.S. flagged vessels.⁶⁵ The project ultimately failed due to lack of funding,⁶⁶ but it raised an important question: What legal constraints might arise against a similar project undertaken by a United States corporation in the future, with or without federal funding?

Before discussing the legal status of OIF, it is important to understand why a corporation like Planktos is interested in conducting OIF activities. Surely it is not for the purely altruistic reason of saving the world for future generations. Corporations typically choose to undertake this kind of project when an economic incentive exists. Here, Planktos sought to capitalize on the high profits that might result through the sale of carbon credits, created through OIF, to companies that are subject to the Kyoto Protocol. For a back of the envelop calculation of the profitability of OIF use the following information; iron powder can be purchased for between \$500–\$6000 per ton depending on the powder size and purity,⁶⁷ and carbon credits were valued at over \$30 per credit in 2008.⁶⁸ Further, laboratory results suggest that one ton of iron added to the ocean could cause a phytoplankton bloom that would sequester 1000 tons of carbon from the atmosphere.⁶⁹ Using \$6000 per ton of carbon, one voyage distributing one hundred tons of iron, 1000 tons of carbon sequestered per ton of iron used, the standard of one ton of carbon equals one carbon credit, and \$30 per carbon credit; the profit that could be realized by one voyage to add iron into the ocean could be \$2,400,000 on the conservative end. Of course, this figure does not account for the cost of the vessel, crew, and other fixed costs associated with dispersing iron powder into the ocean, but it is obvious that OIF has the potential to yield large profits.

63. LaMotte, *supra* note 39, at 9–10.

64. Abate & Greenlee, *supra* note 54, at 558.

65. *Id.*; see discussion *infra* Part IV.A. (explaining the importance of not using a U.S. flagged vessel).

66. *Id.*

67. Iron-Powders.com, <http://www.iron-powder.com/> (last visited Oct. 14, 2015).

68. Stanley Reed & Mark Scott, *In Europe, Paid Permits for Pollution are Fizzling*, N.Y. TIMES (Apr. 21, 2013), http://www.nytimes.com/2013/04/22/business/energy-environment/europes-carbon-market-is-sputtering-as-prices-dive.html?pagewanted=all&_r=0 (last visited Oct. 14, 2015).

69. Oceanus, *Fertilizing the Ocean with Iron; Should We Add Iron to the Sea to Help Reduce Greenhouse Gases in the Air?* (Nov. 13, 2007), <https://www.whoi.edu/oceanus/viewArticle.do?id=34167>.

IV. UNITED STATES LAWS APPLICABLE TO OIF

A. United States Jurisdiction Over Vessels

On March 10, 1983, President Ronald Reagan executed Presidential Proclamation 5030, allowing the United States to assert “sovereign rights over natural resources and related jurisdiction” located in the Exclusive Economic Zone (EEZ).⁷⁰ The EEZ extends two hundred nautical miles⁷¹ from the baseline, and is used to establish the territorial seas.⁷² The EEZ, created by the United Nations Convention on the Law of the Sea, permits the use and exploitation of both living and non-living resources contained in waters located within the zone.⁷³ A nation that expressly exercises its rights over the EEZ is granted sovereignty over the regulation of

exploring and exploiting, conserving and managing the natural resources,⁷⁴ whether living or non-living, of the waters superjacent to the sea-

70. Proclamation No. 5030, 48 Fed. Reg. 10,605 (Mar. 14, 1983).

71. A nautical mile is equal to 1.151 land miles. *Nautical Mile vs. Mile*, DIFFEN, http://www.diffen.com/difference/Mile_vs_Nautical_Mile (last visited Oct. 19, 2015).

72. Proclamation No. 5030, *supra* note 71. Territorial seas run from a baseline determined by international law to a distance of twelve nautical miles, established pursuant Presidential Proclamation 5928. *See* Proclamation No. 5928, 54 Fed. Reg. 777 (Jan. 9, 1989). Until the United Nations Convention on the Law of the Sea, the territorial seas were only three nautical miles from the baseline. Three miles was the distance that a canon could fire, and therefore was the distance that a country could realistically defend. However, this distance has increased because of advances in warfare technology. *See generally The United Nations Convention on the Law of the Sea (A Historical Perspective)*, UNITED NATIONS DIVISION FOR OCEAN AFFAIRS AND THE LAW OF THE SEA (2012), http://www.un.org/depts/los/convention_agreements/convention_historical_perspective.htm. Some statutes, such as the Clean Water Act, that were created prior to Presidential Proclamation 5928 have language that continues to limit the territorial seas to only three nautical miles from the baseline. *See* 33 U.S.C. § 1362(8) (2014). The Contiguous Zone once stretched from the baseline to twelve nautical miles, but in 1999 was expanded to stretch twenty-four nautical miles past the baseline. This zone was established so that states could enforce their customs. *See* Proclamation No. 7219, 64 Fed. Reg. 48701 (Sept. 8, 1999).

73. Third United Nations Conference on the Law of the Sea, Montego Bay, Dec. 10, 1982, *United Nations Convention on the Law of the Seas*, art. 56, U.N. Doc. A/CONF 62/122 (Dec. 10, 1982) [hereinafter UNCLOS]. *See* discussion *infra* Part V.B.5.

74. Even though the United States has not ratified the United Nations Convention on the Law of the Sea, the United States argues that the provisions that make up the convention are customary international law or have become customary law that it can enforce against parties to the convention. This is evidenced by the Presidential Proclamations that expanded the territorial seas and contiguous zone and that established the EEZ. Proclamation No. 5030, *supra* note 71;

bed and of the seabed and its subsoil, and with regard to other activities for the economic exploitation and exploration of the zone, such as the production of energy from the water, currents and winds.⁷⁵

Further, the coastal state has jurisdiction over marine scientific research including the protection and preservation of marine environments.⁷⁶ Therefore, when the United States, pursuant to Presidential Proclamation 5030, expressed its rights to the EEZ, it acquired the ability to create and enforce regulations that affect the exploitation or conservation of the natural resources and environments found within the EEZ.⁷⁷ The United State's reach under the EEZ includes all vessels, regardless of their state of origin, which are physically present.⁷⁸ Therefore, if the vessel "belong[s] in whole or in part to the United States or any citizen thereof, or to any corporation created by or under the laws of the United States, or of any State, Territory, District, or possession thereof," the vessel and the people on board are in U.S. jurisdiction and subject to U.S. law.⁷⁹ Therefore, if a U.S. vessel travels outside of the EEZ and violates a U.S. law—such as dumping waste into the ocean—the vessel would still fall under the jurisdiction of the U.S. and thus would still be subject to any applicable statute. Also, if a U.S. vessel is required to have a permit to conduct an activity in either territorial seas or the EEZ, the U.S. vessel would require the same permit on the high seas. Thus, one can see that by informing the EPA that it would no longer use a United States flagged vessel, Planktos attempted to remove itself from EPA jurisdiction. Indeed, after a non-national vessel leaves the EEZ of the U.S., it is no longer under U.S. jurisdiction,⁸⁰ even if there is a violation of U.S. law, regardless of the presence of an applicable statute.⁸¹ Therefore, any U.S. corporation undertaking the implementation of Planktos' project can circumvent U.S. regulation if the project is conducted on a non-U.S. flagged vessel, as long as no international laws prohibit an OIF expedition.⁸²

Proclamation No. 5928, *supra* note 74; Proclamation No. 7219, *supra* note 74. The adoption of the Magnuson-Stevens Act is further evidence because it recognizes the United States' authority over highly migratory fish populations, a provision that was established in the Convention. *See* 16 U.S.C. § 1851(a) (2007).

75. UNCLOS, *supra* note 74, art. 56(1)(a).

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

77. *See id.* art 55, 58; Proclamation No. 5030, *supra* note 71.

78. *Id.*

79. 18 U.S.C. § 7 (2001).

80. Abate & Greenlee, *supra* note 54, at 558.

81. *See* 18 U.S.C. § 7(1).

82. *See* discussion of international obligations *infra* Part V.

B. Marine Protection, Research, and Sanctuaries Act

Unlike other U.S. statutes, the Marine Protection, Research, and Sanctuaries Act (MPRSA), also known as the Ocean Dumping Act, has already been called upon to challenge an OIF project.⁸³ As noted above, MPRSA could have required Planktos to obtain a permit for their OIF project if the project either took place in U.S. waters or was conducted using a U.S. flagged vessel.⁸⁴ MPRSA is relevant to OIF regulation because it implements the United States' obligations under the London Convention, which restricts dumping of material into the high seas.⁸⁵

MPRSA "regulate[s] the dumping of all types of materials into ocean waters and [] prevent[s] or strictly limit[s] the dumping into ocean waters of any material which would adversely affect human health, welfare, or amenities, or the marine environment, ecological systems, or economic potentialities,"⁸⁶ by requiring a permit whenever an individual: (1) transports material from the United States for the purpose of ocean dumping; (2) transports material from anywhere for the purpose of ocean dumping by U.S. agencies or U.S. flagged vessels; or (3) dumps material transported from outside the United States into the U.S. territorial sea or into the contiguous zone to the extent that it may affect the territorial sea or the territory of the United States.⁸⁷ This prevents the dumping of any material by a U.S. agency or U.S. flagged vessel in any part of the ocean without a permit. MPRSA also prevents foreign vessels from dumping within the territorial seas or the U.S. contiguous zone. Given the express extraterritorial reach of the statute, MPRSA may provide a strong platform to regulate OIF or any other oceanic geoengineering strategy that lies outside of other U.S. statutes.⁸⁸ Dumping is defined under the MPRSA as "a disposition of material."⁸⁹ Material is defined as

matter of any kind or description, including, but not limited to, dredged material, solid waste, incinerator residue, garbage, sewage, sewage sludge, munitions, radiological, chemical, and biological warfare agents, radioactive materials, chemicals, biological

83. Hester, *supra* note 6, at 886.

84. *Id.*

85. *Id.*

86. 33 U.S.C. § 1401(b) (2014).

87. 33 U.S.C. § 1401(c).

88. Hester, *supra* note 6, at 887.

89. The following three activities do not constitute "dumping": (1) the creation of an effluent subject to the Clean Water Act, (2) construction of a fixed structure, and (3) deposit of materials to promote fishery resources. If the Clean Water Act is applicable, then MPRSA is not applicable; and if MPRSA is applicable, then the Clean Water Act cannot be applicable jurisdictionally. 33 U.S.C. § 1402(f) (2014).

and laboratory waste, wreck or discarded equipment, rock, sand, excavation debris, and industrial, municipal, agricultural, and other waste.⁹⁰

Because iron is “matter,” putting the iron into the oceans is a “disposition” that the MPRSA regulates.⁹¹ But two questions remain: First, is iron fertilization dumping, or applying with a purpose? Second, are “dumping” and “applying with a purpose” two distinct concepts identified as such by MPRSA? These questions have not been answered, and they demonstrate the EPA’s potential motivation in requiring Planktos to obtain a permit for their OIF. But in order to require a permit, the EPA would have to determine whether the OIF “will not unreasonably degrade or endanger human health, welfare, or amenities, or the marine environment, ecological systems, or economic potentialities.”⁹² In order to make this determination, specific criteria need to be considered.⁹³ However, the status of OIF under MPRSA is still uncertain because the EPA has not yet fully considered these issues. In the future, it will only take one OIF project to force the EPA to consider the applicability of MPRSA to OIF.

If EPA looked into the issue more closely, MPRSA would cover OIF. OIF is brought under the statute through two jurisdictional hooks. First, OIF requires a “dumping” of material, namely iron.⁹⁴ Second, iron is a type of “matter or any kind” and does not fall within the exceptions for sewage from a vessel and oil.⁹⁵ Therefore, no OIF activities can be undertaken without a MPRSA permit. In order to obtain a permit, an EPA Administrator considers the effect that the project will have on human health and welfare, marine ecosystems, and alternative uses of the ocean.⁹⁶ However, conclusive data on these effects is not yet available. Therefore, without further research into the effects of OIF, it is possible that the Administrator will not issue permits for OIF activities, relying on an inability to determine how the project will affect human health and welfare and marine ecosystems. However, if more conclusive positive results become available, the Administrator will likely grant the required permit. Thus, until more information becomes available, OIF as a commercial enterprise will remain grounded.

90. *Id.* § 1402(c).

91. *See id.* § 1402(c), (f).

92. 33 U.S.C. § 1412(a) (2007).

93. *Id.*

94. *See* 33 U.S.C. § 1402(f).

95. *See id.* § 1402(c).

96. *See* 33 U.S.C. § 1412.

C. Clean Water Act

Under the Clean Water Act (CWA), the discharge of a pollutant from a point source is unlawful, unless subject to a federally mandated permit.⁹⁷ The CWA applies to any activity undertaken by a “person”⁹⁸ where there is a discharge of any pollutant from a point source into a navigable water.⁹⁹ While the amount of discharge deemed unlawful is not statutorily defined, EPA has adopted a net addition analysis in which a net increase of a pollutant, even if that pollutant is already present in the body of water, a discharge is found.¹⁰⁰ Thus, a pollutant is almost anything that can be added into the water.¹⁰¹

A “point source” is any “discernible, confined and discrete conveyance,” a definition that includes vessels.¹⁰² However, an exception exists for vessels if they add pollutants to the ocean outside of navigable waters.¹⁰³ “Navigable waters” means the waters of the United States, including the territorial seas but not the contiguous zone, EEZ, or high seas.¹⁰⁴ Therefore, the CWA may apply to vessels that are engaged in an OIF project only if the vessel is within the territorial seas.

Establishing the jurisdictional question is further complicated by CWA 403 regulations, which “establish guidelines for issuance of National Pollutant Discharge Elimination System (NPDES) permits for the discharge of pollutants from a point source into the territorial seas, the contiguous zone, and the oceans.”¹⁰⁵ These guidelines allow for a point source to discharge if the Administrator determines that the discharge will not cause an “unreasonable degradation of the marine environment.”¹⁰⁶ Essentially, after determining how much of the pollutant may be discharged, the permit is assigned a limit. However, the permit does not allow a pollutant discharge if the Administrator is unable to determine the extent and reasonableness of the degrada-

97. 33 U.S.C. § 1311.

98. A “person” is any “individual, corporation, partnership, association, State, municipality, commission, or political subdivision of a State, or any interstate body.” 33 U.S.C. § 1362(5) (2014).

99. *Id.*

100. JEFFREY M. GABA, ENVIRONMENTAL LAW 90 (4th ed. 2009).

101. 33 U.S.C. § 1362(6).

102. *Id.* § 1362(14).

103. *Id.* § 1362(12)(A).

104. *Id.* § 1362(7). The CWA defines the territorial seas as three nautical miles from the base line. 33 U.S.C. § 1362(8). This limit was not automatically increased after Presidential Proclamation 5928. *See* Proclamation No. 5928, *supra* note 74.

105. 40 C.F.R. § 125.120 (2000).

106. 40 C.F.R. § 125.122 (2013).

tion. Thus, an OIF could be regulated under the CWA in two ways: (1) an administrative determination that possible negative effects of OIF are likely to occur; or (2) an administrative determination that there is insufficient scientific data to show that the negative effects would be minimal. In the first scenario, the administrator would regulate, or ban, OIF ventures by prohibiting any discharge of iron based on the “degradation of waters” determination.¹⁰⁷ In the second scenario, no discharge may occur unless various criteria are met.¹⁰⁸ Further, the discharging vessel is required to meet the “Best Available Technology” standard followed by all other discharges.¹⁰⁹ Moreover, if the CWA requires vessels to carry discharge permits in United States waters, a U.S. vessel would require a permit in the EEZ as well as in the open ocean. However, if the entire discharge activity took place beyond the territorial seas, no NPDES permit is required. Therefore, because OIF activities take place outside of the territorial seas, no NPDES permit is required. Regardless, we will continue and analyze all elements.

The next issue is also jurisdictional, specifically whether intentionally placing an identified substance into navigable waters for a beneficial purpose is different than discharging effluent. This issue is not settled. For instance, in *Weinburg v. Romero Barcelo*, the Supreme Court ruled that intentionally dropping bombs into the ocean triggered the permit requirement of the CWA.¹¹⁰ Indeed, the CWA does list “munitions” as pollutants that need to be regulated.¹¹¹ The Court determined that it was this designation—and not intent—that triggered the permit requirement. Therefore, if iron is classified as a pollutant, this element is satisfied. Similarly, in *National Cotton Council of America v. EPA*, the Court addressed whether the addition of a pesticide to a navigable water requires a permit.¹¹² The Court held that if a substance that could be considered waste is used for its intended purpose, then it itself is not waste,¹¹³ but any portion remaining is considered a pollutant requiring a permit.¹¹⁴ Thus, if iron is classified as a pollutant or if the list of pollutants contained in the CWA is not exhaustive or narrowly interpreted,¹¹⁵ then it is possible that a permit would be required for any iron discharge above the level the Administrator deems necessary to fulfill the purpose of the iron discharge. In that case a company like Planktos would be able to undertake OIF activities, as long as it does not discharge in excess of the Administra-

107. 40 C.F.R. § 125.123 (2000).

108. *Id.*

109. 33 U.S.C. § 1311(b)(2)(F).

110. *Weinberger v. Romero-Barcelo*, 456 U.S. 305, 329 (1982).

111. 33 U.S.C. § 1362(6).

112. *Nat’l Cotton Council of Am. v. EPA*, 553 F.3d 927, 929–30 (6th Cir. 2009).

113. *Id.* at 936.

114. *Id.*

115. *Id.* at 935–36.

tor's determination and does not trigger other permit requirements.¹¹⁶ It is important to remember that if Planktos undertakes the OIF activities beyond the statutory three mile territorial seas, then no permit would be required at all. Therefore, an OIF project may still fall outside of the purview of the CWA, even when all other elements are established, if the OIF activities are conducted well beyond the territorial seas. Importantly, however, because OIF is regulated under MPRSA, the CWA would not control because both statutes cannot regulate the same activity.

D. Endangered Species Act

The Endangered Species Act (ESA) was adopted to facilitate the conservation of threatened and endangered species¹¹⁷ and their habitats.¹¹⁸ The ESA applies to any person subject to the jurisdiction of the United States upon the high seas.¹¹⁹ Therefore, this statute applies to any corporation using a U.S. flagged vessel, and thus, OIF could be regulated by the ESA. But what would the ESA regulate?

The ESA prohibits the taking of a protected species.¹²⁰ Specifically, a person subject to the authority of U.S. law may not "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect [a listed species], or to attempt to engage in any such conduct."¹²¹ "Harm," within the definition of "take," encompasses any "act which actually kills or injures wildlife."¹²² These types of acts include "significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding or sheltering."¹²³ In other words, if an OIF project could be shown to actually injure a listed species by modifying its environment, OIF may be prohibited. For instance, assume that an increase in phytoplankton does acidify the oceans, and that this can be

116. *See id.*

117. *See* 50 C.F.R. § 17.11 (2015) (listing threatened and endangered species). This list includes not only animals found within the borders of the United States, but every threatened or endangered animal on the planet. The list includes sea turtles, many species of whale, corals, crustaceans, and many other marine species. These species may potentially inhabit every nook and cranny of the planet, including the open and coastal oceans.

118. 16 U.S.C. § 1531 (2014).

119. 16 U.S.C. § 1538(a)(1)(C) (2015).

120. 16 U.S.C. § 1538(a)(1)(B).

121. 16 U.S.C. § 1532(19) (2015).

122. 50 C.F.R. § 17.3 (2006).

123. *Id.*

linked to OIF. This acidification, which damages krill embryos,¹²⁴ will drastically reduce the numbers of krill that grow during the year. Because krill are the staple food of all baleen whales, which includes right, blue, and gray whales and which are listed as endangered, the reduction of krill could starve these large animals. Thus OIF would constitute a taking under the ESA because it would affect the feeding behaviors or cause the death of whales.¹²⁵

Further, the ESA requires every agency to “insure that any action authorized, funded, or carried out by such agency . . . is not likely to jeopardize the continued existence” of a critical habitat¹²⁶ of any listed species.¹²⁷ It is important to remember that the “not likely to jeopardize” requirement mandates that every federal agency review every action it undertakes for compliance with the ESA. Therefore, if the issuance of an OIF permit or license pursuant to another statute is funded at least in part by an agency program, one must consider the impact to listed species that may result.¹²⁸ If the action will adversely affect the listed species, reasonable and prudent alternatives may be offered or the action may be postponed indefinitely.¹²⁹

However, there are two exceptions that a company may utilize in an attempt to avoid the ESA’s taking prohibition. First is an exception for scientific purposes.¹³⁰ Research that would help develop the knowledge base of OIF, analyze its benefits and/or detriments, or help to shape the scientific and legal understanding of this strategy qualifies under this exception. The second exception applies to activities that are “incidental to, and not the purpose of, the carrying out of an otherwise lawful activity.”¹³¹ Assuming that OIF is a lawful activity, the entity requesting the exception submits: a conservation plan identifying the impact of the taking, the minimization and mitigation steps to be taken, the viability of potential alternative actions considered, and any other measures required by the Secretary of the Interior.¹³² However, there is a hindrance to this process. After an exception request is submitted, the public must be given the opportunity to comment and be heard.¹³³ This may obstruct the granting of an exception, and essentially a permit, if the public is against OIF.

124. *Krill Face Deadly Cost of Ocean Acidification*, OCEAN ACIDIFICATION BLOG (Oct. 10, 2010), <http://oceanacidification.wordpress.com/2010/10/14/krill-face-deadly-cost-of-ocean-acidification/>.

125. *See* 50 C.F.R. § 17.3 (2006).

126. *See* 50 C.F.R. § 17.95 (2008) (listing the critical habitat for all listed species).

127. 16 U.S.C. § 1536 (2015).

128. *See* 50 C.F.R. § 402.01 (1986).

129. 16 U.S.C. § 1536.

130. 16 U.S.C. § 1539 (2015).

131. *Id.*

132. *Id.*

133. *Id.*

To summarize, OIF would be subject to the ESA. However, the public's views aside, it appears that OIF would be able to satisfy the requirements of the ESA, at least through the statutory exceptions. For example, it could be argued that a non-commercial OIF project would be conducted for scientific purposes, making any taking merely incidental to the activity. This interpretation removes ESA application and permits the undertaking of OIF projects. Therefore, as long as a MPRSA permit is required, the permitting agency is required to evaluate the project and determine its potential to jeopardize any listed marine species. In other words, the taking requirement would apply at all times. Thus, it would be prudent for a company to fully research the effects of the project prior to applying for an incidental-taking permit.

E. Marine Mammal Protection Act

The Marine Mammal Protection Act (MMPA) imposes a moratorium¹³⁴ on the "taking" of any marine mammal by a "person subject to the jurisdiction of the United States or any vessel or other conveyance subject to the jurisdiction of the United States"¹³⁵ on the high seas.¹³⁶ Under the MMPOA, a taking occurs when a person harasses, hunts, captures, collects, or kills any marine mammal or attempts any of the aforementioned actions.¹³⁷ The "harm" element of the ESA is noticeably absent here. This omission drastically limits the types of activities that are restricted by the MMPA, especially concerning OIF. Even if a species is "harmed" under the ESA, by disrupting, for instance, the feeding behavior of a listed whale, that same activity does not fall under the purview of the MMPA. Therefore, because an OIF project would not include any activities that would constitute a taking under the MMPA,¹³⁸ the statute would not govern any OIF projects. Additionally, in this case, no scientific research exception is necessary because an OIF project only involves travel on the high seas and there are no MMPA license requirements for oceanic travel.¹³⁹

134. 16 U.S.C. § 1371 (2003).

135. See 50 C.F.R. § 18.3 (2005) (listing marine mammals covered, which includes polar bears, sea otters, walruses, etc.); 16 U.S.C. § 1372(f) (2015) (providing protections for all whales by imposing an outright ban on any whaling activities).

136. 16 U.S.C. § 1372.

137. 50 C.F.R. § 18.3.

138. 16 U.S.C. § 1371 (2003); A taking for MMPA purposes does not include harm or any critical habitat considerations as the CWA does, which removes the activity from the statute. See *id.*

139. See 50 C.F.R. § 18.13 (2005) (discussing the unlawful transportation of marine mammals).

F. National Environmental Policy Act

The National Environmental Policy Act (NEPA) imposes environmental obligations solely on the government. This Act obligates the government to perform an environmental impact statement (EIS) for any major federal action that will significantly affect the quality of the human environment.¹⁴⁰ The EIS must include the environmental impacts of the proposed action including all adverse effects, any possible alternative actions, and all commitments of resources that would be involved in the proposed action.¹⁴¹ Yet, because the obligation rests solely on the federal government and federally funded projects Planktos would not be subject to the NEPA unless they were subject to another federal permit.¹⁴² To weaken the statute's proverbial bite even more, the U.S. Supreme Court decided that NEPA's EIS requirement is solely a procedural hurdle intended to make those parties required to produce an EIS seriously consider their pending action and the resulting consequences. However that requirement does not require parties to provide an environmentally friendly or scientifically sound solution to the potential problem.

Applied to OIF, if the project was funded in part or undertaken by a federal agency, the agency is required to prepare an EIS.¹⁴³ Although this process might delay the OIF project, this statute has no other impact on the project because the agency would not have to take the findings into consideration, nor would they have to investigate into the possibility alternative solutions.

G. Magnuson-Stevens Act

The Magnuson-Stevens Act (MSA) was adopted in an effort to conserve essential fish habitats and to protect domestic fish stocks, as well as highly migratory fish species.¹⁴⁴ The MSA prohibits the fishing of any species of fish by any vessel, U.S. flagged or non-U.S. flagged, that has a fishery management plan beyond the limits granted to the vessel pursuant to a permit.¹⁴⁵ The extent of fishing permitted under the MSA depends on the type of fish one seeks to harvest. For example, the fishing of anadromous species is permitted throughout the species' entire migratory range, excluding the part of the range that is under a foreign country's sovereignty.¹⁴⁶ Further, the United

140. 42 U.S.C. § 4332(2)(C) (2012).

141. *Id.*

142. *Id.*

143. *Environmental Impact Statement*, U.S. DEP'T OF TRANSP., <https://www.environment.fhwa.dot.gov/projdev/docueis.asp> (last visited Oct. 19, 2015).

144. 16 U.S.C. § 1801 (2015).

145. 16 U.S.C. § 1853(a) (2015).

146. 16 U.S.C. § 1811(b)(1) (2015).

States has extended fishery management authority over all continental shelf fishery resources.¹⁴⁷

Whether MSA has jurisdiction over OIF is uncertain. “Fishing” is defined as: “(A) the catching, taking, or harvesting of fish; (B) the attempted catching, taking, or harvesting of fish; (C) any other activity which can reasonably be expected to result in the catching, taking, or harvesting of fish; or (D) any operations at sea in support of, or in preparation for, any activity described in subparagraphs (A) through (C).”¹⁴⁸ “Taking” is not defined in the MSA and there is no case law or secondary source that attempts to interpret the meaning of the term. It is unclear whether the MSA’s use of “take” is more similar to the ESA definition—which includes harming a species through habitat modification—or the MMPA definition, which does not require harm. If the MSA definition of “take” does include harm, then it could potentially regulate OIF; but if it does not include harm, then OIF is outside of the MSA’s jurisdiction. However, it is unlikely that OIF would fall under the MSA’s jurisdiction because a connection between fishing and placing iron in the oceans is tenuous at best. However an argument can be made for MSA’s applicability if it is demonstrated that the OIF would diminish the fish’s food source and indirectly “take” the fish. Thus, if OIF does fall within the MSA’s jurisdiction, the MSA would apply to both private entities and governmental entities.¹⁴⁹

Regardless of whether OIF falls under the MSA, if OIF requires a permit under any statute, the MSA requires an assessment of each fishery and the identification of an Essential Fish Habitat (EFH) in a fishery management plan.¹⁵⁰ Essentially, the plan will state the applicable regulations for each fishery and identify the positive and negative impacts that might affect the fishery.¹⁵¹ Identical to the ESA requirement to review every governmental action for possible effects on an endangered species, the MSA requires review of every “action authorized, funded, or undertaken, or proposed to be authorized, funded, or undertaken” by the federal agency in order to determine how the project affects the EFH.¹⁵² Again, this requirement does not mandate a change in the project’s operation, just a consultation. In essence, it is just a procedural hurdle to force the actor to seriously consider the resulting consequences. Therefore, if a United States company is subject to a review by EPA, it requires a permit in addition to a MPRSA permit. This will require an analysis into the project’s potential impact to the EFHs in the area.

147. *Id.*

148. 16 U.S.C. § 1802(16) (2015).

149. 16 U.S.C. § 1802(36).

150. 16 U.S.C. §§ 1852(h), 1855(b).

151. 16 U.S.C. § 1853(a).

152. *Id.*

However, if the project was outside of the EEZ, it is unlikely that there would be an effect on any EFH, and therefore MSA would not apply.

V. INTERNATIONAL LAW THAT GOVERNS OIF

As noted above, OIF activities will take place on the high seas. Because the high seas are beyond any one country's jurisdiction, the applicable international law should be addressed to fully understand any regulations a U.S. company might be under when conducting OIF activities. This section will address relevant international laws.

A. International Law Introduction

There are two primary sources of international law: treaties and customary law.¹⁵³ Treaties, like the Kyoto Protocol, are legal obligations that a state takes upon itself to effect a particular outcome.¹⁵⁴ The negotiated terms of the treaty are only binding on the countries that sign and ratify it.¹⁵⁵ For the United States, treaties become binding once the signed treaty is ratified by a two-thirds majority of the Senate.¹⁵⁶ The obligations agreed to by the President become binding on a citizen automatically if the treaty is self-executing or upon the enactment of legislation by Congress for non-self-executing treaties.¹⁵⁷

Contrary to treaties, customary law is one that is broadly applied without being expressly stated in any document.¹⁵⁸ Customary law is broken into two categories. First is hard customary law, which has a two-pronged formation mechanism. The first prong is state action. State action is "what a state says and what a state does" with a focus on all branches of the state's government because the action must be pervasive in that state, and it must be prevalent in the international community.¹⁵⁹ The second prong is *opinio juris*, or "the assertion of a legal right."¹⁶⁰ This prong of hard law is the subjective prong, meaning the state action is conducted because the state believes it has

153. Hiram E. Chodosh, *An Interpretive Theory of International Law: The Distinction Between Treaty and Customary Law*, 28 VAND. J. TRANSNAT'L L. 973, 977 (1995).

154. Christopher Greenwood, *Sources of International Law: An Introduction*, AUDIVISUAL LIBRARY OF INT'L L. (2014), http://legal.un.org/avl/lis/Greenwood_IL.html (follow "English" link).

155. *Id.*

156. U.S. CONST. art. II, § 2, cl. 2.

157. *Medellin v. Texas*, 552 U.S. 491, 525–26 (2008).

158. Chodosh, *supra* note 153, at 977–98.

159. *Id.*

160. *Id.*

an obligation to do so.¹⁶¹ While hard law creates legal obligations within the international community, soft customary law is made up of principles that are aspirational in nature.¹⁶² For instance, the precautionary principle and duty to protect the environment are principles that every country should aspire towards, but, should a state breach the principle, there is no monetary remedy for the affected country.¹⁶³ It is important to note that with regards to customary law, a country does not have responsibility for a private citizen's actions unless those actions were sanctioned by the state.¹⁶⁴ Thus, if a company undertook an OIF activity and harmed another country, the harmed country could not sue the United States unless the action was taken on behalf of the state.

There is a third "source" of international law, but it is very narrow in scope and applicability. That source is the International Court of Justice (ICJ) opinions.¹⁶⁵ The purpose of the ICJ is to apply treaties and customary law to the parties at bar.¹⁶⁶ However, unlike U.S. courts—which create binding law with every opinion that is handed down—the ICJ's opinions are only binding on the parties involved and apply only to that dispute.¹⁶⁷ Therefore, if two parties have a dispute that is factually identical to a dispute previously decided by the ICJ, regardless of whether they are the same parties to the previous dispute or two entirely new parties, the previous resolution does not constitute precedent for the new dispute.¹⁶⁸ Thus, at best, a principle used or developed by the ICJ is advisory in nature and can be disregarded as a state sees fit. In other words, the ICJ does not create any law that is binding on any party outside of the decision at bar. It is not a "source" like treaties and customary law and should only be considered as advisory.

B. Treaties

The scope of a treaty is readily ascertainable. Like U.S. statutes, there is a preamble that will specify exactly for what purpose the treaty was drafted. But unlike U.S. statutes, many treaties do not impose any legal obligations or prohibitions upon the parties that are subject to them. For example, the United Nations Framework Convention on Climate Change (UNFCCC) ad-

161. *Id.*

162. Catherine Tinker, *Responsibility for Biological Diversity Conservation Under International Law*, 28 VAND. J. TRANSNAT'L L. 777, 804 (1995).

163. Bodle, *Climate Law and Geoengineering*, *supra* note 8, at 456–57.

164. RESTATEMENT (SECOND) OF FOREIGN RELATIONS LAW § 183 (1965).

165. *Statute of the Court*, INT'L COURT OF JUSTICE, http://www.icj-cij.org/documents/index.php?p1=4&p2=2&p3=0#CHAPTER_II (last visited Oct. 19, 2015).

166. *Id.*

167. *Id.*

168. *Id.*

dresses climate change directly, but its wording is so overly general that, despite signing the Convention, the 192 signatory parties have not adopted any legal obligations.¹⁶⁹ This is the case with many treaties. This section will look at the treaties that most directly apply to OIF and analyze whether those treaties are applicable to a company based in the United States or if the treaty's wording removes any legal bite.

1. United Nations Framework Convention on Climate Change

Negotiations for what became the UNFCCC began in December 1990.¹⁷⁰ The Convention was completed and adopted on May 9, 1992.¹⁷¹ It entered into force on March 21, 1994, after obtaining the requisite fifty-state ratifications.¹⁷² Currently, there are 192 parties to the UNFCCC, including the United States.¹⁷³ These parties have come together in an attempt "to limit average global temperature increases and the resulting climate change, and to cope with whatever impacts" there will be.¹⁷⁴ The primary focus of the UNFCCC is the global regulation of GHG emissions, not geoengineering or OIF specifically. In fact, the UNFCCC is deafeningly silent on the topic of OIF.¹⁷⁵ At most, the UNFCCC could be read to authorize, but not require, use of OIF as part of a state's plan to mitigate the effects of climate change and to enhance GHG sinks and reservoirs.

Section 3.1 states that parties should "protect the climate system for the benefit of present and future generations . . . in accordance with their common but differentiated responsibilities and respective capabilities,"¹⁷⁶ but gives no guidance as to whether OIF could be considered as a legal option. On the one hand, a party could argue that "protecting the climate system" includes OIF, which would legally protect and promote OIF, but on the other hand, another party could interpret that language to mean that geoengineering should be excluded because of the possible adverse effects OIF may cause.

169. *Status of Ratification of the Kyoto Protocol*, UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE, http://unfccc.int/kyoto_protocol/status_of_ratification/items/2613.php (last visited on Oct. 19, 2015).

170. *Issues in the Negotiating Process*, UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE, <http://unfccc.int/cop7/issues/briefhistory.html> (last visited on Oct. 19, 2015).

171. *Id.*

172. *Id.*

173. *See* ICJ, *supra* note 165.

174. *Background on the UNFCCC*, UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE, http://unfccc.int/essential_background/items/6031.php (last visited on Oct. 19, 2015).

175. Bodle, *Climate Law and Geoengineering*, *supra* note 8, at 456.

176. Framework Convention on Climate Change § 3.1, May 9, 1992, 1771 U.N.T.S. 107 [hereinafter UNFCCC].

Article 4, which contains the few obligations that the signatory parties agreed to abide by, uses vague and general language that may or may not impact the legality of geoengineering. Section 4.1 applies to all parties regardless of their development.¹⁷⁷ In its totality, Section 4.1 follows the document's theme of providing no direction as to whether OIF should be considered legally viable.¹⁷⁸ Some of the parties' accepted obligations include: inventorying sources of anthropogenic GHGs, sharing technology used in GHG emission control, cooperating in the preparation for adaptation, and if necessary, to participate in research.¹⁷⁹ None of these obligations indicate whether OIF is valid. However, Section 4.1(f) does require that parties consider climate change in their national environmental policies and adopt appropriate methods, like an environmental impact assessment, when undertaking any project that may be used to mitigate climate change.¹⁸⁰ This provision also requires that parties consider techniques, including OIF, that might prove useful in the event of a climate change emergency.¹⁸¹ In other words, the signatory parties may consider OIF's effects in their environmental policies, but that is all that is required under Section 4.1(f); no more, no less.

The final provision that may legally pertain to geoengineering, but not OIF specifically, is Section 4.2(a), which requires developed countries to adopt policies to mitigate climate change by protecting and enhancing their GHG sinks and reservoirs.¹⁸² However, this requirement only mandates that each state determine the implications of their policies.¹⁸³ If the state determines that OIF is too detrimental to the Earth's climate, the state is not obligated to utilize OIF.¹⁸⁴ Conversely, if the state determines that OIF is a safe and viable option in the war against climate change, the state can still elect not to utilize OIF. These requirements do not prohibit OIF from assisting in a nation's mitigation strategy, nor does it impose it as a requirement. Thus the UNFCCC does not directly regulate OIF.

2. Convention on Biological Diversity

The Convention on Biological Diversity (CBD) has taken the most definitive stance and created the most comprehensive regulatory scheme for geoengineering to date. Inspired by the international community's growing commitment to sustainable development, the CBD calls its signatory parties

177. *Id.* § 4.1.

178. *Id.*

179. *Id.*

180. *Id.* § 4.1(f).

181. *Id.*

182. UNFCCC, *supra* note 176, § 4.2(a).

183. *Id.*

184. *Id.*

to develop plans for the sustainable use of biological diversity.¹⁸⁵ Initially, these plans called for states to set aside areas of undeveloped land that were essential to protecting biological diversity, rehabilitate and restore degraded ecosystems, and manage development by releasing genetically modified organisms, among other requirements.¹⁸⁶

The CBD entered into force on December 29, 1993,¹⁸⁷ and currently has 193 signatory parties.¹⁸⁸ The United States signed but has not yet ratified the treaty.¹⁸⁹ In 2008, the CBD parties adopted Resolution IX/16,¹⁹⁰ which requests that all governments “ensure that ocean fertilization activities do not take place until there is an adequate scientific basis on which to justify such activities, including assessing associated risks, and a global, transparent and effective control and regulatory mechanism is in place for these activities; with the exception of small scale scientific research studies within coastal waters.”¹⁹¹ This resolution places a quasi-moratorium directly on any commercial or large-scale research project. However, it does not define what qualifies as a large or small-scale research project. The Resolution does however provide that small scale research studies “should only be authorized if justified by the need to gather specific scientific data, and should also be subject to a thorough prior assessment of the potential impacts of the research studies on the marine environment, and be strictly controlled, and not be used for generating and selling carbon offsets or any other commercial purposes.”¹⁹² However, because the United States never ratified the convention,¹⁹³ this quasi-moratorium would not regulate Planktos directly. The United States Legislature would have to pass a bill for CBD to regulate Planktos.

185. Convention on Biological Diversity art. 6, June 5, 1992, 1771 U.N.T.S. 79 [hereinafter CBD].

186. *Id.* art. 8.

187. *Introduction*, CONVENTION ON BIOLOGICAL DIVERSITY, <http://www.cbd.int/intro/default.shtml> (last visited on Oct. 19, 2015).

188. *List of Parties*, CONVENTION ON BIOLOGICAL DIVERSITY, <http://www.cbd.int/convention/parties/list#tab=0> (last visited on Oct. 19, 2015).

189. *Id.*

190. A resolution to CBD is a recommendation to the signatory parties. There are no binding legal obligations created by the resolution, although the parties may heed them. However, for a legal obligation to be imposed on a signatory party there must be legislation passed by the party; otherwise, the resolution is merely advisory.

191. CBD Decision IX/16, para. C(4), U.N. Doc. UNEP/CBD/COP/DEC/IX/16 (Oct. 9, 2008), <http://www.cbd.int/decision/cop/default.shtml?id=11659>.

192. *Id.*

193. *List of Parties*, CONVENTION ON BIOLOGICAL DIVERSITY, <https://www.cbd.int/information/parties.shtml> (last visited Oct. 19, 2015).

3. Environmental Modification Convention

The Convention on the Prohibition of Military or Any Other Hostile Use of Environmental Modification Techniques (ENMOD) was the first treaty to deal directly with geoengineering. ENMOD prohibits the hostile use of “environmental modification techniques,” which include “changing—through the deliberate manipulation of natural processes—the dynamics, composition or structure of the Earth, including its biota, lithosphere, hydrosphere and atmosphere, or of outer space.”¹⁹⁴ Although “environmental modification techniques” could include OIF, the Convention focuses on activities taken during time of war or that are intentionally hostile to another state.¹⁹⁵ Although the term “hostile” is not defined in the document, its common usage suggests that it involves any activity directed at an enemy, or activity that is adverse to another state.¹⁹⁶ Both definitions indicate that an action taken against the wishes of another state could be hostile, even if it is scientific in nature or intended to be beneficial. However, Article III of ENMOD provides that states should not be restrained from peaceful use.¹⁹⁷ This indicates that for an activity to be hostile, there must be a hostile intent. Further, ENMOD calls for parties to contribute to “international economic and scientific co-operation,” if they are able.¹⁹⁸ This implies that commercial and scientific use of geoengineering activities would be peaceful. Thus, commercial or research OIF projects would likely fall outside the scope of the Convention.¹⁹⁹

ENMOD’s limit on hostile environmental modification techniques suggests that the drafters and signatory parties anticipated permitting peaceful use of technology to manipulate the environment, which would include OIF. The only requirement for peaceful geoengineering is that the parties contribute to the exchange of scientific information.²⁰⁰ This gives the parties discretion as to whether, and how, to use geoengineering techniques.

4. London Convention and London Protocol

The London Convention (LC), and London Protocol (LP) “have established themselves as the competent international body for the regulation of

194. Convention on the Prohibition of Military or Any Other Hostile Use of Environmental Modification Techniques art. I–II, October 5, 1978 31 UST 333, 1108 U.N.T.S. 152 [hereinafter ENMOD].

195. *Id.*

196. *Hostile*, MERRIAM-WEBSTER DICTIONARY, <http://www.merriam-webster.com/dictionary/hostile> (last visited on Oct. 19, 2015).

197. ENMOD, *supra* note 194, art. III.

198. *Id.*

199. Ralph Bodle, *Geoengineering and International Law: The Search for Common Legal Ground*, 46 TULSA L. REV. 305, 312 (2010) [hereinafter Bodle, *Geoengineering and International Law*].

200. ENMOD, *supra* note 194, art. III.

[OIF].”²⁰¹ The LC was established in 1975 to protect the oceans, primarily through its prohibition on ocean dumping.²⁰² The LP was developed as the LC’s successor, but the LP and LC essentially work together as one unit.²⁰³ Even though the two documents are similar, there are differences.²⁰⁴ For example, “[t]he [LC] requires Contracting Parties (CP) control and prevent the pollution of the sea by the dumping of waste, while the [LP] employs stronger language, requiring CPs to prevent, reduce and where practicable eliminate pollution caused by dumping.”²⁰⁵ The LP currently has less than half the number of contracting parties as the LC.²⁰⁶ The United States ratified the LC, but has not yet ratified the LP.²⁰⁷

OIF may be regulated by the LC/LP, even though at first impression it seems like it may lie outside of the treaty’s scope.²⁰⁸ The original wording of the LC/LP prevents “dumping” of material, but OIF researchers are not dumping iron for disposal purposes.²⁰⁹ Rather, they are placing it in the ocean for a specific purpose, and this implication removes OIF from the scope of the LP/LC’s anti-dumping prohibition.²¹⁰ To address this uncertainty, in October 2008, the contracting parties to the LC/LP adopted a non-binding resolution stating that: (1) OIF falls within the scope of the LC/LP; (2) OIF research activities fall within the placement exception and will not be considered mere disposal; (3) using the soon-to-be-developed assessment framework, each research project will be assessed to determine whether the research project furthers the objectives of the LC/LP; and (4) large scale commercial OIF projects should be prohibited.²¹¹ Further, the resolution expressly forbids all OIF, other than legitimate scientific research, stating that such projects do not qualify for any exemptions.²¹² In addition, in 2010 the parties also adopted a non-binding resolution that establishes the OIF “as-

201. Eick, *supra* note 13, at 352.

202. *Id.* at 364–65.

203. *Id.* at 364.

204. *Id.*

205. *Id.* at 365 (internal quotation citations omitted).

206. *Id.*

207. *Parties to the London Convention and London Protocol*, IMO, <http://www.imo.org/en/OurWork/Environment/LCLP/Documents/Map%20of%20Parties%20Sept%202014.pdf> (last visited Oct. 19, 2015).

208. *Id.*; see also *Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter*, IMO, <http://www.imo.org/en/OurWork/Environment/LCLP/Pages/default.aspx> (last visited Oct. 19, 2015).

209. See Markus & Ginzky, *supra* note 36, at 479.

210. See *id.* at 480.

211. I.M.O. Res. annex 6, U.N. Doc. LC30/16, (Oct. 31, 2008).

212. Markus & Ginzky, *supra* note 36, at 480.

assessment framework,” which requires the acting party to perform a scientific quality check and environmental impact assessment.²¹³

Because both of these resolutions are not legally binding, a country may take these provisions under advisement and does not have to comply with their express requirements.²¹⁴ Therefore, even though the LC and LP directly address OIF and lay out a regulatory framework that promotes research that seeks to determine whether OIF is a viable mitigation technique, the signatory parties have no obligations to follow and implement its requirements. Instead, these provisions provide a list of advisory comments and actions that parties may consider as they develop their own environmental policies.

5. United Nations Convention on the Law of the Sea

The United Nations Convention on the Law of the Sea (UNCLOS) is regarded as the “constitution for ocean governance.”²¹⁵ Adopted in 1982, this Convention codified customary international law, which is binding on all states—including non-signatory states—requiring states to: “(1) prevent, reduce and control pollution of the marine environment, (2) prohibit the transfer of damage or hazards from one area to another, and (3) protect rare and fragile ecosystems, as well as the habitat of depleted, threatened, or endangered species from pollution.”²¹⁶ Currently, there are 167 signatory parties.²¹⁷ However, the United States has not ratified UNCLOS.²¹⁸

UNCLOS’s purpose, broadly stated, is “to protect and preserve the marine environment.”²¹⁹ In order to accomplish this purpose, Article 194 requires states to “take all necessary measures to ensure that [activities] under their jurisdiction or control are so conducted as not to cause damage by pollution to other States and their environment.”²²⁰ Specifically, states are required, individually or jointly, to “prevent, reduce, and control pollution of the marine environment from any source, using any for this purpose the best practicable means at their disposal and in accordance with their capabilities, and they shall endeavor to harmonize their policies in this connection.”²²¹ In evaluating these measures, states should not transfer damage from one area

213. *Id.* at 481.

214. *Id.*

215. Abate & Greenlee, *supra* note 54, at 572.

216. *Id.* at 573.

217. See UNCLOS, *Chronological Lists of Ratifications*, UNITED NATIONS, http://www.un.org/Depts/los/reference_files/chronological_lists_of_ratifications.htm (last visited on Oct. 19, 2015).

218. *Id.*

219. UNCLOS, *supra* note 73, art. 192.

220. *Id.* art. 194.

221. *Id.*

to another or from one form to another²²² and should instead create international rules and regulations for the “protection and preservation of the marine environment, taking into account characteristic regional features.”²²³

UNCLOS brings OIF into its scope through the use of a very broad definition of pollution.²²⁴ UNCLOS defines pollution as:

[T]he introduction by man, directly or indirectly, of substances or energy into the marine environment . . . which results or is likely to result in such deleterious effects as harm to living resources and marine life, hazards to human health, hindrance to marine activities, including fishing and other legitimate uses of the sea, impairment of quality for use of sea water and reduction of amenities.²²⁵

This definition will continue to include OIF until research—which can only be conducted in the states’ territorial seas—²²⁶ demonstrates an absence of “deleterious effects” on any living resource. ²²⁷ Living resources include, but are not limited to: the use of nutrients by the phytoplankton that reduces growth potential of other organisms, acidification of the marine environment, and eutrophication.²²⁸ Because of these possible deleterious effects, OIF at least on the large scale, must be prevented, reduced, and controlled by every state.²²⁹

Additionally, an OIF project can directly violate Article 195 of UNCLOS.²³⁰ OIF is an attempt to pull CO₂ from the atmosphere and place it in the depths of the ocean.²³¹ By removing CO₂ from the atmosphere, where it is causing mayhem and may cause acidification, there is a transfer of harm from one “area” to another.²³² In other words, the harm CO₂ causes in the atmosphere, namely climate change, is transferred to the oceans, where the resulting acidification destroys coral reefs and harms marine life.²³³

UNCLOS requires that states, internationally or regionally, create rules and regulations to preserve the marine environment.²³⁴ This goal has been

222. *Id.* art. 195.

223. *Id.* art. 196.

224. *Id.* art. 1.

225. UNCLOS, *supra* note 73, art. 1(1)(4).

226. *See id.* art. 193.

227. *See id.* art. 1(1)(4).

228. *See* Abate & Greenlee, *supra* note 54, at 566–69.

229. *See* UNCLOS, *supra* note 73, art. 194.

230. *Id.* art. 195.

231. Abate & Greenlee, *supra* note 54, at 560–61.

232. *See* UNCLOS, *supra* note 73, art. 195.

233. *See id.*

234. *See id.* art. 197.

partially accomplished in the international arena through the LC/LP.²³⁵ However, because the LC/LP is not legally binding, it does not fully meet UNCLOS's requirement.²³⁶ However, through the passage of MPRSA, rules and regulations implemented locally in the United States have done a better job at meeting UNCLOS's requirements.²³⁷ However, without more specific and legally binding rules and regulations, UNCLOS remains rather impotent in prohibiting OIF, even with the current framework in place.

C. International Customary Law

The scope of international customary environmental law, which exists in the absence of a treaty obligation, is uncertain. However, there are a variety of customary international law concepts that may be relevant in assessing the legality of geoengineering actions.²³⁸ Still, these principles may not establish any effective legal obligations because they are not recognized or because they are too general to provide any uniformity or certainty in their application.

1. Duty to Prevent Transboundary Harm

The duty to prevent transboundary environmental harm is a cornerstone of international environmental law and has generally been recognized as an "enforceable" obligation under international law.²³⁹ This duty requires states to prevent activities within its jurisdiction or mitigate any harm that occurs to the environment of other states.²⁴⁰ A state in breach of this duty could be compelled to cease the activity, guarantee that the activity will not happen again, pay damages, or return the harmed state to its previous condition.²⁴¹

In order for a state to breach this duty when utilizing geoengineering, the complaining state must prove that: (1) the state in question actually performed the activity;²⁴² (2) the activity caused the harm alleged; and (3) the state in question failed to apply due diligence, if applicable.²⁴³ However, the

235. See Eick, *supra* note 13, at 365.

236. See Markus & Ginzky, *supra* note 36, at 480.

237. See Hester, *supra* note 6, at 886–87.

238. See Bodle, *Geoengineering and International Law*, *supra* note 199, at 306.

239. See *id.* at 306.

240. *Id.*

241. *Id.*

242. G.A. Res. 56/83, U.N. GAOR, 53rd Sess., U.N. Doc. A/56/49 (Vol. I)/Corr.4, art. 4 (Dec. 12, 2001), http://legal.un.org/ilc/texts/instruments/english/draft_articles/9_6_2001.pdf ("An activity can be attributed to the state if a representative of the state conducted the activity; this would include agency or agency funded activities. If the project was conducted solely by a private party the activity would not be considered to be conducted by the state.").

243. Bodle, *Geoengineering and International Law*, *supra* note 199, at 306–07.

amount of diligence required is determined on a case-by-case basis, leaving quite a bit of legal uncertainty.²⁴⁴ Thus, strict liability is not imposed for any damage caused by OIF. Further, the state in question may assert “necessity” as an affirmative defense, if it is able to show that a climate crisis necessitated the use of a particular geoengineering activity.²⁴⁵ The main shortcoming to the duty to prevent transboundary harm is that this obligation is retrospective in nature and, therefore, has very little ability to enjoin a state from acting in a manner that may be considered a breach.²⁴⁶

2. Duty to Perform an Environmental Impact Assessment

Recently scholars have suggested that the duty to perform an environmental impact assessment be given legal force by the ICJ, places a duty on every state, not just the signatory parties to the UNFCCC.²⁴⁷ The duty requires states to

[t]ake climate change considerations into account, to the extent feasible, in their relevant social, economic and environmental policies and actions, and employ appropriate methods, for example impact assessments, formulated and determined nationally, with a view to minimizing adverse effects on the economy, on public health and on the quality of the environment, of projects or measures undertaken by them to mitigate or adapt to climate change.²⁴⁸

In this regard, the ICJ is recognizing that this common practice amounts to “a requirement under general international law to undertake an environmental impact assessment where there is a risk that the proposed industrial activity may have a significant adverse impact in a transboundary context, in particular, on a shared resource.”²⁴⁹ The ICJ did not provide the required data and analysis to be included in the assessment. However, the ICJ did state that an assessment involves “having regard to the nature and magnitude of the proposed development and its likely adverse impact on the environment as well as to the need to exercise due diligence in conducting such an assessment.”

²⁵⁰ Further, the assessment must be conducted and produced before the activ-

244. *Id.* at 307.

245. *Id.* at 308.

246. *Id.*

247. *See id.* at 311.

248. UNFCCC, *supra* note 176, § 4(1)(f).

249. *Pulp Mills on the River Uruguay (Arg. v. Uru.)*, Judgment, 2010 I.C.J. 14, ¶ 204 (Apr. 20, 2010), <http://www.icj-cij.org/docket/files/135/15877> [hereinafter *Pulp Mills*].

250. *Id.* at ¶ 205.

ity is carried out.²⁵¹ Finally, there must be continuous monitoring to track the environmental effects of the activity.²⁵²

3. Precautionary Principle

The precautionary principle is becoming part of international customary law, and although not completely established, it has been invoked in many instances.²⁵³ The precautionary principle, codified at UNFCCC section 3.3, states that “[w]here there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason for postponing such measures.”²⁵⁴ OIF risks are assessed depending on: “(1) in relation to a scenario with substantial mitigation as well as; [and] (2) in relation to a scenario of unmitigated climate change, the precautionary principle embodies the core arguments both for and against” OIF.²⁵⁵ On the one hand, due to the risks associated with OIF, one could argue that the principle forbids the implementation of geoengineering because of its possible severe consequences.²⁵⁶ On the other hand, the precautionary principle could be used to call for and legalize OIF strategies because it states that parties should attempt to “mitigate [climate change’s] adverse effects” without letting a “lack of full scientific certainty . . . be used as a reason for postponing such measures.”²⁵⁷ While the precautionary principle is ambiguous as to the legality of OIF, it places the burden of showing the harmfulness of the activity on the acting party when there is a breach of another law.²⁵⁸

VI. WHERE DO WE GO FROM HERE?

OIF remains enveloped in controversy.²⁵⁹ It could provide time for policymakers to create and implement a comprehensive plan to reduce emissions and reverse the current path towards a climate crisis.²⁶⁰ However, it also could potentially destroy the marine environment.²⁶¹ With some regulatory frameworks that could be applied with some modification and with the need to figure out a plan so that this climate crisis does not hit while the

251. *Id.*

252. *Id.*

253. Bodle, *Geoengineering and International Law*, *supra* note 199, at 309–11.

254. UNFCCC, *supra* note 176, § 3(3).

255. Bodle, *Climate Law and Geoengineering*, *supra* note 8, at 464.

256. *Id.* at 459.

257. UNFCCC, *supra* note 176, § 3(3).

258. Bodle, *Climate Law and Geoengineering*, *supra* note 8, at 459.

259. Eick, *supra* note 13, at 354.

260. *Id.*

261. *Id.*

world is twiddling its thumbs, the question must be asked: What needs to be done in order to effectively regulate OIF?

One way to regulate OIF would be through the treaties. For instance, Planktos was attempting to use OIF to generate carbon credits that it could sell to companies that were subject to the Kyoto Protocol. One way to regulate this type of OIF use is to state in the treaty the specific manner that specifies how OIF must be conducted in order to qualify as a carbon credit. This would incentivize companies to engage in OIF to comply with regulations and realize their profits. Similarly, a state that is subject to the Kyoto Protocol could, in its implementation plan, regulate OIF through the same mechanism. This second option would be a piecemeal approach, but would have the same effect as the first. Either option probably requires that parties obtain permits, and would also impose a reporting requirement so as to verify that OIF activities comply with regulations. These requirements would place conditions on OIF activities that could prevent a misuse of this strategy. If a company was not in compliance, the credits generated would not be sold on the market, effectively allowing the market to dictate the viability of this strategy. If OIF regulations were working, as they should, the market would demand more; if not, OIF would fade into the night.

From a policy perspective, one must recognize that OIF requires that a plan contemplate whether—in the face of substantially insufficient and contradictory scientific data—one should act or refrain from acting. This consideration is made in addition to having to tackle the onerous task of creating a comprehensive regulatory framework, while aiming to garner the cooperation of nation states.²⁶² Further, these considerations are made in light of the need for a regulatory framework at experimental phase, along with the fact that at any time a single nation state could decide to unilaterally implement OIF—realizing the gravity of the OIF conundrum.²⁶³

To create a regulatory framework for OIF a few fundamental questions must be addressed. First, which of the following norms frame the debate: “precaution, intergenerational equity, permanent sovereignty over natural resources, sustainable development, common concern of mankind, common heritage of mankind” or another?²⁶⁴ Second, what questions will the framework answer? For instance, “what types of impact assessment are required prior to deployment, how will state sovereignty be balanced with global oversight, how will cases of transboundary harm be dealt with, what type of dispute-settlement system is needed, [and] who has the veto power?”²⁶⁵ Third, while the regulatory framework is being debated and created by politicians, what system will be in place to promote a transparent program that facilitates the sharing of results of research conducted between nation states?

262. Leal-Arcas & Filis-Yelaghotis, *supra* note 22, at 134.

263. *Id.*

264. Carlarne, *supra* note 5, at 659.

265. *Id.*

²⁶⁶ Fourth, the system must be able to address the effects that will inevitably follow implementation of OIF.²⁶⁷

Addressing these fundamental questions will provide clarity as to the structure of the framework, which requires: a multilateral, top-down response based on the intergenerational and transboundary nature of the problem.²⁶⁸ This approach should be guided by a set of principles: (1) OIF should be regulated as a public good, based on the argument that, while the involvement of the private sector in the delivery of a geoengineering technique should not be prohibited and may indeed be encouraged, regulation of such techniques should be undertaken in the public interest by the appropriate bodies at the state and/or international levels; (2) geoengineering decision making should be informed wherever possible by public participation, including a duty to notify, consult, and, ideally, obtain the prior informed consent of those affected by the research activities; (3) research plans for geoengineering should be completely disclosed and results should be openly published; (4) the impacts of geoengineering research should be conducted by an independent body of a regional and international character where techniques are likely to have a transboundary impact; and (5) robust governance structures should be put in place before any technologies are deployed and should make use of existing rules and institutes wherever possible.²⁶⁹

These principles should guide the creation of guiding axioms, which in turn will provide a multigenerational commitment.²⁷⁰ Further, the framework must be viewed “as a complement to adaptation and the building of resilience in that it might prevent the worst impacts, and . . . act as an insurance policy against the very worst impacts.”²⁷¹ However, the axioms that create the OIF regulatory framework must be self-executing so that they create legally binding obligations and prohibitions immediately on U.S. entities. The framework must also be able to enforce the regulations so that these controversial strategies do not compound the issues. Finally, it must be able to prevent a

266. *See id.*

267. *See id.*

268. *Id.*

269. SCIENCE AND TECHNOLOGY COMMITTEE, BRIEF MEMORANDUM ON DRAFT PRINCIPLES FOR THE CONDUCT OF GEOENGINEERING RESEARCH FROM PROFESSOR STEVE RAYNER ET AL. TO THE HOUSE OF COMMONS SCI. & TECH. COMM. ENQUIRY INTO THE REGULATION OF GEOENGINEERING, 2009, H.C., at ¶¶ 17–21, <http://www.sbs.ox.ac.uk/centres/insis/Documents/regulation-of-geoengineering.pdf>.

270. Carlarne, *supra* note 5, at 668.

271. Michael C. MacCracken, *Beyond Mitigation: Potential Options for Counter-Balancing the Climatic and Environmental Consequences of the Rising Concentrations of Greenhouse Gases* 34 (The World Bank, Policy Research Working Paper No. 4938, May 2009).

rogue nation state from sending every individual on planet Earth into oblivion.

VII. CONCLUSION

OIF has the potential to help mitigate the effects of climate change, and the rewards for this planet could be economically large. But OIF also could potentially increase the existing damage to this planet. Without a better understanding of what will result when this geoengineering strategy is implemented, there needs to be a strong international regulatory framework in place to monitor and control how much and when the activities take place. Currently, MPRSA would be an avenue of regulation, as would the LC/LP. Since MPRSA is the United States embodiment of LC/LP, we are left with MPRSA as the sole regulatory body on U.S. companies and governments that may attempt to conduct OIF activities. Right now, that is enough. However, the international community needs to find a way, through a treaty or through piecemeal adoption of regulations by the parties to the treaty, to regulate OIF so that the potential for disaster is never realized.

Comments

