ENVIRONMENTAL REGULATION AT THE FRONTIER: GOVERNMENT OVERSIGHT OF OFFSHORE OIL DRILLING NORTH OF ALASKA

BY

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The Arctic Ocean is one of the last great frontiers for energy production. The prospect of oil development in the region raises deep questions about the threat of a major oil spill, like the one that affected the Gulf of Mexico in 2010. A growing body of legal scholarship has explored the problem of catastrophic risks, in contexts ranging from natural disasters to nuclear power accidents. However, few studies have considered this problem in a frontier environment or focused on government oversight of Arctic offshore oil drilling specifically.

This Article fills the literature gap on the Arctic and addresses the more general problem of catastrophic risks in frontier environments. Using the lenses of principal–agent analysis and regulatory theory, this Article shows how the Arctic's profound uncertainties and lack of benchmarking opportunities challenge the efficacy of conventional regulatory models, such as the "risk-based" model that has seen application in other regulatory contexts. Addressing these problems requires greater transparency in government decision making, development of Arctic-specific regulations, and substantially delayed government approval—assuming it is not possible to ban oil drilling in U.S. Arctic waters altogether. The analytical framework and policy recommendations in this Article also offer insights for other risky industries operating at the technological frontier.

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I. INTRODUCTION

The April 2010 explosion and sinking of the *Deepwater Horizon* oil drilling rig in the Gulf of Mexico,[1] which claimed eleven lives and led to the

[1] At the time of its sinking and explosion, the *Deepwater Horizon* rig—a large, semi-submersible floating platform connected to the sea floor by pipeline—was drilling 49 miles off the coast of Louisiana. *See* NAT'L COMM'N ON THE BP DEEPWATER HORIZON OIL SPILL AND OFFSHORE DRILLING, DEEP WATER: THE GULF OIL DISASTER AND THE FUTURE OF OFFSHORE DRILLING viii (2011) [hereinafter NAT'L COMM'N REPORT]; RAWLE O. KING, CONG. RESEARCH SERV., R41320, DEEPWATER HORIZON OIL SPILL DISASTER: RISK, RECOVERY, AND INSURANCE IMPLICATIONS 11 n.25 (2010) (discussing the *Deepwater Horizon* design). The rig, owned by Transocean and operating for BP, was at the time drilling in the Macondo "prospect," the area from which the oil was extracted and that gives its name to the Macondo well used for extracting oil. *See* NAT'L COMM'N REPORT, *supra*, at viii. The rig exploded when methane gas rose from the well to the rig, via a "riser" connecting the two, and ignited on contact with air circulating with the rig's engine rooms. *See id.* at 1, 114. The methane gas rose because of excessive pressure inside the well and because safety measures that could have contained those pressures failed. *See id.* at 91, 115. Oil and gas continued gushing from the well until July 15, 2010, when BP capped the flow of oil, and

United States' largest ever offshore oil spill,[2] sparked reflection on the future of offshore oil drilling.[3] Among the critiques were that regulatory agencies failed to take account of an infrequent, catastrophic "fat-tail"[4] risk like the *Deepwater Horizon* disaster; that regulators did not understand oil drilling technologies well enough to properly regulate them; that the liability regime did not incentivize oil companies to take proper care; and that the Department of Interior's former Mineral Management Service (MMS)—the government entity primarily regulating offshore drilling—was corrupted by the industry it oversaw.[5] In response to these critiques, the federal government made reforms,[6] including dismantling MMS and establishing separate new agencies in its place.[7] Many other changes are underway.[8]

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the upward pressure was not controlled until August 3, 2010—more than three months after the disaster began. *Id.* at 170. *See generally id.* at 115–70 (providing a narrative of efforts to control the spill after the explosion).

2 *See* Robin Beckwith, *The Post-Macondo World: Two Years After the Spill*, J. OF PETROLEUM TECH., May 2012, at 40 (listing the *Deepwater Horizon* disaster as the fourth largest oil spill in world history and second largest in the United States, behind only the 1910–1911 "Lakeview Gusher" oil blowout in California's Central Valley); Petrissa Eckle et al., *Risk of Large Oil Spills: A Statistical Analysis in the Aftermath of Deepwater Horizon*, 46 ENVTL. SCI. & TECH. 13002, 13002 (2012) (discussing the size of the *Deepwater Horizon* oil spill and comparing it to other spills). Approximately 4.9 million barrels (206 million gallons) of oil spilled during the *Deepwater Horizon* disaster. NAT'L COMM'N REPORT, *supra* note 1, at 346 n.76. Before the disaster, the *Deepwater Horizon* rig was perhaps best known for drilling the world's deepest oil and gas well (not Macondo) 35,050 feet beneath the sea floor. *See* Deepwater Horizon *Drills World's Deepest Oil and GasWell*, BEACON: TRANSOCEAN IN THE SPOTLIGHT, Fall 2009, at 8, *available at* http://www.beaconmag.com/archives.html. The *Deepwater Horizon* was drilling a comparatively modest 13,000 feet below the sea floor at the time of the disaster. NAT'L COMM'N REPORT, *supra* note 1, at viii.

3 In the wake of the *Deepwater Horizon* disaster, President Barack Obama created the National Commission on the BP Deepwater Horizon Oil Spill and Offshore Drilling (National Commission) to study the causes of the disaster and to recommend future reforms. NAT'L COMM'N REPORT, *supra* note 1, at vi. This piece refers to the National Commission's 2011 report and two follow-up reports issued by Oil Spill Commission Action, an outgrowth of the National Commission. OIL SPILL COMM'N ACTION, ASSESSING PROGRESS: IMPLEMENTING THE RECOMMENDATIONS OF THE NATIONAL OIL SPILL COMMISSION 1 (2012) [hereinafter 2012 OIL SPILL COMM'N REPORT]; OIL SPILL COMM'N ACTION, ASSESSING PROGRESS: THREE YEARS LATER 1 (2013) [hereinafter 2013 OIL SPILL COMM'N REPORT].

4 The concept of fat-tail risks derives from statistics. *See* Carolyn Kousky & Roger Cooke, *Explaining the Failure to Insure Catastrophic Risks*, 37 THE GENEVA PAPERS (SPECIAL ISSUE) 206, 207 (2012). A related concept is rare but highly impactful events—so-called "black swans." The term derives from a Latin expression: "a rare bird in the lands, very much like a black swan." *See generally* NASSIM NICHOLAS TALEB, THE BLACK SWAN: THE IMPACT OF THE HIGHLY IMPROBABLE (2007); Brad Thomas, *Remembering William Carey: A Legendary Investor*, FORBES, Jan. 25, 2012, http://www.forbes.com/sites/investor/2012/01/25/remembering-william-polk-carey-a-legendary-black-swan-investor/.

5 *See infra* Part IV (discussing studies on agency capture in the oil drilling context).

6 For a summary of those reforms, *see, e.g.*, Sam Kalen, *Cruise Control and Speed Bumps: Energy Policy and Limits for Outer Continental Shelf Leasing*, 7 ENVTL. & ENERGY L. & POL'Y J. 155, 163 n.31 (2012).

7 A month after the *Deepwater Horizon* explosion, Interior Secretary Ken Salazar signed a Secretarial Order to divide MMS. *See* U.S. Dep't of the Interior Order No. 3299, Establishment of the Bureau of Ocean Energy Management, the Bureau of Safety and Environmental Enforcement, and the Office of Natural Resources Revenue (D.O.I. 2010); Reorganization of

As this review of what went wrong in the Gulf of Mexico continues, a new "last frontier" for offshore drilling[9] has emerged: the Beaufort and Chukchi Seas, two arms of the Arctic Ocean north of Alaska.[10] Inclement and ice covered for much of the year, these waters hold some of the largest untapped offshore oil reserves in the world.[11] Various factors long limited industry interest in the region,[12] but the calculus recently changed due to improved technologies for extracting difficult-to-reach oil, increased estimates of the resources available, and ice cover reductions from climate change.[13] As a result, private money and resources have poured into oil and

Title 30: Bureaus of Safety and Environmental Enforcement and Ocean Energy Management, 76 Fed. Reg. 64,432 (Oct. 18, 2011) (to be codified at 30 C.F.R. chs. II, IV). By October 2011, three entities had formed to replace MMS: the Bureau of Ocean Energy Management (BOEM), responsible for management of federally owned offshore oil and gas resources; the Bureau of Safety and Environmental Enforcement (BSEE), responsible for reviewing the environmental and safety effects of offshore drilling; and the Office of Natural Resources Revenue, responsible for revenue management, such as collection of royalties. *See generally* Bureau of Ocean Energy Management, *The Reorganization of the Former MMS*, http://www.boem.gov/About-BOEM/Reorganization/Reorganization.aspx (last visited July 26, 2014). I refer extensively to BOEM and BSEE in this piece.

8 *See generally* 2013 OIL SPILL COMM'N REPORT, *supra* note 3 (chronicling reforms and their current status); *infra* Part III (discussing the history of offshore drilling and noting recent efforts by BOEM to impose safety and environmental protection requirements on drilling activities).

9 *See* John M. Broder & Clifford Krauss, *New and Frozen Frontier Awaits Offshore Oil Drilling*, N.Y. TIMES, May 23, 2012, http://www.nytimes.com/2012/05/24/science/earth/shell-arctic-ocean-drilling-stands-to-open-new-oil-frontier.html?_r=0 (last visited July 26, 2014) ("Industry experts and national security officials view the Alaskan Arctic as the last great domestic oil prospect.").

10 The Beaufort Sea lies north of far northwestern Canada and northeastern Alaska (i.e., the Alaskan coast east of Point Barrow). The Chukchi Sea is due west of the Beaufort Sea and lies between far northwestern Alaska and far eastern Siberia.

11 U.S. GEOLOGICAL SURVEY (USGS), AN EVALUATION OF THE SCIENCE NEEDS TO INFORM DECISIONS ON OUTER CONTINENTAL SHELF ENERGY DEVELOPMENT IN THE CHUKCHI AND BEAUFORT SEAS, ALASKA 25 (2011) [hereinafter USGS, ARCTIC REPORT] (stating that "the Arctic continental shelves comprise one of the World's largest remaining prospective areas for petroleum hydrocarbons" and noting that 30% of the world's undiscovered gas and 13% of its undiscovered oil are in the Arctic); DONALD L. GAUTIER, OIL AND GAS RESOURCE POTENTIAL NORTH OF THE ARCTIC CIRCLE 4 (2011), *available at* http://ioscproceedings.org/doi/pdf/10.7901/2169-3358-2011-1-203 (noting that Arctic oil reserves may be "widespread and significant"). The Chukchi Sea alone has undiscovered, technically recoverable reserves of 15.38 billion barrels of oil and 76.77 trillion cubic feet of gas, more than any other U.S. offshore area except for the central Gulf of Mexico. BUREAU OF OCEAN ENERGY MGMT., ASSESSMENT OF UNDISCOVERED TECHNICALLY RECOVERABLE OIL AND GAS RESOURCES OF THE NATION'S OUTER CONTINENTAL SHELF (2011) [hereinafter BOEM, ASSESSMENT], *available at* http://www.boem.gov/National-Assessment-of-Oil-and-Gas-Resources-2011/ (map showing gas reserves in the U.S. Outer Continental Shelf). The Beaufort Sea's resource potential is 8.22 billion barrels of oil and 27.64 trillion cubic feet of gas, more than any other U.S. offshore area except for the Gulf of Mexico or Chukchi Sea. *Id.*

12 *See infra* Part II.A.

13 *Infra* note 146. For general discussion, see, for example, Nicola Jones, *Oil Exploration Ramps Up in U.S. Arctic*, NATURE, June 26, 2012, http://www.nature.com/news/oil-exploration-ramps-up-in-us-arctic-1.10882 (last visited July 26, 2014); Broder & Krauss, *supra* note 9 (noting that "Shell's audacious plan to drill in waters previously considered untouchable had gone from improbable to inevitable").

gas production.[14] One oil company, Shell, has spent more than $4.5 billion in preparation for oil exploration and development in the Beaufort and Chukchi Seas,[15] and it drilled new wells in 2012.[16] Interest is far from unique to Shell. Other oil companies have announced plans to drill in the Beaufort and Chukchi Seas,[17] and other countries, ranging from Canada to Norway to Russia, are pursuing opportunities in their own Arctic waters.[18]

To date, little legal scholarship has explored the implications of oil drilling in U.S. Arctic waters.[19] The lack of commentary is surprising because

14 *See infra* Part III.B (discussing renewed interest in Arctic oil drilling).

15 John M. Broder, *With 2 Ships Damaged, Shell Suspends Arctic Drilling*, N.Y. TIMES, Feb. 28, 2013, at B2.

16 *Infra* Part III.B.

17 *See* Clifford Krauss, *ConocoPhillips Suspends Its Arctic Drilling Plans*, N.Y. TIMES, Apr. 11, 2013, at B4 (discussing ConocoPhillips' and Statoil's leases in Alaskan Arctic waters).

18 For an overview of those countries' plans, see, for example, Quirin Schiermeier, *The Great Arctic Oil Race Begins*, 482 NATURE 13, 13 (2012); Chester Dawson, *Oil Giants Set Their Sights on Arctic Waters*, WALL ST. J., May 18, 2014; *infra* Part III. Some countries' plans have geopolitical dimensions. For example, in 2007, Russia planted a flag on the seabed of the North Pole to symbolically assert its claims over potential oil resources there. *See* C.J. Chivers, *Eyeing Future Wealth, Russians Plant Flag on the Arctic Seabed, Below the Polar Cap*, N.Y. TIMES, Aug. 3, 2007, at A8 (referring to the Russians' action as "an openly choreographed publicity stunt").

19 Several strands of research have addressed the legal framework for Arctic offshore drilling. First, at least two scholarly works consider regulation of the sector. *See* Andrew Hartsig, *Shortcomings and Solutions: Reforming the Outer Continental Shelf Oil and Gas Framework in the Wake of the* Deepwater Horizon *Disaster*, 16 OCEAN & COASTAL L.J. 269, 270 (2011); G. Alexander Robertson, *Avoiding the Next Deepwater Horizon: The Need for Greater Statutory Restrictions on Offshore Drilling off the Arctic Coast of Alaska*, 4 GEO. WASH. J. ENERGY & ENVTL. L. 107 (2013). Hartsig's work addresses the Arctic as part of a broader reflection on offshore drilling generally. *See* Hartsig, *supra*, at 270–71, 318–25. Robertson focuses on specific statutory reforms. *See* Robertson, *supra*, at 120–22 (recommending reforms that would require oil companies to have resources in place to pay for an Arctic oil spill and require oil companies to stop drilling sufficiently in advance of ice season to allow for the company to drill a relief well). This Article is distinct from Hartsig and Robertson's pieces because of its focus on regulatory theory. In addition, policy groups, think tanks, and university organizations have drafted white papers on the regulation of Arctic offshore drilling; these pieces tend to be explicitly policy-oriented. *See, e.g.*, KILEY KROH ET AL., CENTER FOR AMERICAN PROGRESS, PUTTING A FREEZE ON ARCTIC OCEAN DRILLING: AMERICA'S INABILITY TO RESPOND TO AN OIL SPILL IN THE ARCTIC 2–3 (2012); JEFF GOODYEAR ET AL., NATURAL RES. DEF. COUNCIL, ENVIRONMENTAL RISKS WITH PROPOSED OFFSHORE OIL AND GAS DEVELOPMENT OFF ALASKA'S NORTH SLOPE 1 (2012); NUKA RESEARCH AND PLANNING GROUP, LLC, OIL SPILL PREVENTION AND RESPONSE IN THE U.S. ARCTIC OCEAN: UNEXAMINED RISKS, UNACCEPTABLE CONSEQUENCES 1 (2010); WENDY B. JACOBS, ET AL., EMMETT ENVIRONMENTAL LAW & POLICY CLINIC, RECOMMENDATIONS FOR IMPROVED OVERSIGHT OF OFFSHORE DRILLING BASED ON A REVIEW OF 40 REGULATORY REGIMES 6–8 (2012) [hereinafter HARVARD ENVIRONMENTAL LAW CLINIC, RECOMMENDATIONS FOR OFFSHORE DRILLING]; THE PEW CHARITABLE TRUSTS, ARCTIC STANDARDS: RECOMMENDATIONS ON OIL SPILL PREVENTION, RESPONSE, AND SAFETY IN THE U.S. ARCTIC OCEAN 3 (2013) [hereinafter PEW REPORT]. As this Article was going to press, the National Academy of Sciences released a detailed report on oil spill response in the Arctic. NAT'L ACAD. OF SCIENCES, RESPONDING TO OIL SPILLS IN THE U.S. ARCTIC MARINE ENVIRONMENT (2014); *What Happens When Oil Spills in the Arctic?*, NAT'L GEOGRAPHIC, Apr. 23, 2014, http://news.nationalgeographic.com/news/energy/2014/04/140423-national-research-council-on-oil-spills-in-arctic/ (last visited July 26, 2014) (summarizing the National Research Council report and stating, with respect to Arctic oil drilling, "we're far from ready"). Furthermore, a few pieces of legal scholarship have analyzed Arctic offshore drilling in the context of issues other than regulation. *See, e.g.*, Brendan C.

regulation of the sector poses problems that are distinct from those facing offshore drilling generally and relevant for the regulation of other technological frontiers.

This Article aims to help fill the gap in scholarship. Drawing on a literature review of post-*Deepwater Horizon* scholarship, I develop a simple framework for examining offshore drilling and other industries causing catastrophic environmental harms. This framework is rooted in three concepts common in studies of public administration: asymmetric preferences between government and firms, asymmetric information between government and firms, and imperfections in government's ability to act as society's agent. Application of this framework leads to a specific set of debates about how to best mitigate catastrophic risks. I argue that those debates are reframed when, as here, the industry capable of causing the disaster is operating at the technological frontier.

With respect to Arctic offshore drilling, I identify two informational problems central to frontier regulation. The first problem is the *uncertainty*[20] of Arctic oil spills and spill response. Uncertainty is a near-ubiquitous feature of environmental regulation but takes on special prominence when, as here, the regulated activity is new and without ready analogues. It also differs from the classic challenge of asymmetrically held information because the information simply may not exist and firms may not be incentivized to develop it due to weaknesses in the liability regime. In the Arctic, uncertainty is considerable because scarcely any drilling has happened.[21] The second problem, also common to frontier environments, is

Selby, *Internal Agency Review, Authoritativeness, and Mead*, 37 HARV. ENVTL L. REV. 539, 545–49 (2013) (examining court review of permits issued by EPA for drillship emissions in the Arctic). *See generally* MICHAEL BURGER, THE LAST, LAST FRONTIER, *in* ROGERS WILLIAMS UNIVERSITY SCHOOL OF LAW LEGAL STUDIES RESEARCH PAPER SERIES (Ser. No. 140, 2013), *available at* http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2285702 (examining Shell's litigation to drill in the Arctic through the storylines and narratives that historically have framed the Arctic as a unique place); E.A. Barry-Pheby, *The Growth of Environmental Justice and Environmental Protection in International Law: In the Context of Regulation of the Arctic's Offshore Oil Industry*, 13 SUSTAINABLE DEV. L. & POL'Y 48 (2012) (discussing implications of Arctic offshore drilling for environmental justice in international law); M. David Kurtz, *Managing Alaska's Coastal Development: State Review of Federal Oil and Gas Lease Sales*, 11 ALASKA L. REV. 377 (1994) (arguing, before the *Deepwater Horizon* disaster, that the state of Alaska should take a more assertive role in offshore oil development).

20 *See* FRANK KNIGHT, RISK, UNCERTAINTY AND PROFIT 19–20, 197–232 (1964). Following Frank Knight's terminology, I use the word "uncertainty" to mean a lack of knowledge about what will occur, and distinguish it from "risk," which is the likelihood of an event occurring and the magnitude of that event. *Id.* at 20; *see also* James E. Krier & Clayton P. Gillette, *Risk, Courts, and Agencies*, 138 U. PA. L. REV. 1027, 1028 n.1 (1990) (employing Knight's distinction). For further discussion, see Daniel A. Farber, *Uncertainty*, 99 GEO. L.J. 901, 901 (2010); Todd S. Aagaard, *A Functional Approach to Risks and Uncertainties Under NEPA*, 1 MICH. J. ENVTL. & ADMIN. L. 87, 88 n.3 (2012).

21 *See* NAT'L COMM'N REPORT, *supra* note 1, at 21–53 (providing history of deepwater oil drilling). Arctic offshore drilling faces the challenges of extensive ice cover, cold temperatures, and limited daylight for much of the year. These conditions create unknowns that are in many respects greater than those in deepwater environments, where drilling has been underway since the 1970s and where oil spill response technologies were tested during the *Deepwater Horizon* disaster. *Id.*

the *lack of benchmarking* or comparative data accessible to regulators. Only one company, Shell, has drilled in the U.S. Arctic recently, and even with subsequent entry the total number of players is likely to be small. Other countries' experiences in the Arctic are arguably too limited or dissimilar to provide much guidance for U.S. regulators. Because U.S. regulators lack alternative frames of reference, the Arctic generates a heightened danger that oil companies will use their informational advantages to influence the regulatory choice that is ultimately made. Indeed, this lack of benchmarking may introduce behavioral bias into regulatory decision making.[22] Shell's 2012 experience in Arctic waters, which proved near disastrous, evidences the perils that lack of benchmarking creates.[23]

These two problems of frontier regulation, uncertainty and lack of benchmarking, reshape approaches to dealing with catastrophic risk. For example, one line of work has looked to the U.S. nuclear power experience with risk-based regulations that rely on quantitative indicators of previous accidents and near-accidents.[24] It may be difficult to devise such regulations for Arctic offshore drilling because much of the data do not exist. Moreover, regulatory tools designed to deal with environmental uncertainty, such as the adaptive management approach that has received considerable emphasis in environmental law, may be ill-adapted to environmental threats capable of causing disastrous harm.[25] In light of these problems, a ban on Arctic oil drilling may well be justified.[26] If a ban is not feasible, the Arctic's extraordinary conditions demand, at minimum, a different approach.

The approach that I propose looks to regulatory theory and administrative law to address the Arctic's problems of uncertainty and lack of benchmarking. One element is to substantially delay and better coordinate approval of drilling activities, at least until more industry players and countries enter the Arctic. Delay would enable U.S. regulators to use multiple firms as a tool for revealing information about offshore drilling risks and give other countries time to get up to speed. The benefits from delay may well outweigh whatever sacrifices in short-term revenue and innovation spillovers occur. Another element is to introduce greater transparency in oil spill response plans and other regulatory reviews, which until now have been largely immune from outside scrutiny. Transparency is

22 *See infra* Part IV.C.

23 *See* U.S. DEP'T OF INTERIOR, REVIEW OF SHELL'S 2012 ALASKA OFFSHORE OIL AND GAS EXPLORATION PROGRAM 16–32 (2013), *available at* http://www.doi.gov/news/pressreleases/upload/Shell-report-3-8-13-Final.pdf [hereinafter DEP'T OF THE INTERIOR, REPORT ON SHELL'S 2012 EXPLORATION PROGRAM] (evaluating Shell's 2012 offshore drilling in U.S. Arctic waters).

24 *See, e.g.*, Michael Barsa & David A. Dana, *Where the Extraction Frontier Meets the Safety Frontier: Deepwater Horizon, Safety Cases, and NEPA-As-Contract*, 6 ENVTL. & ENERGY L. & POL'Y J. 43, 46–50 (2011) (discussing the British adoption of a "safety case" approach to regulation in the aftermath of the Piper Alpha disaster, which killed 167 people in the North Sea in 1988).

25 *See* Craig A. Allen & Lance H. Gunderson, *Pathology, and Failure in the Design and Implementation of Adaption Management*, 92 J. ENVTL. MGMT. 1379, 1379–84 (2011); *infra* Part V.D.

26 *See infra* Part VI.

time consuming and costly but would provide a needed reality check and help legitimize the decision-making process. A third step is to instill greater regulatory expertise on offshore drilling and, potentially, to adopt a more prescriptive approach to Arctic regulation. Prescriptive regulation, though sometimes inflexible,[27] may be useful for risky, frontier industries that lack well-developed internal controls. This strategy—centered on the principles of caution and open government—brings with it policy trade-offs. But the strategy may play a useful role in mitigating the risk of Arctic oil spills and catastrophic risks in other industries operating at the frontier.[28]

This analysis makes several contributions to the legal literature. The Arctic is a microcosm for studying regulation of risky industries at the leading edge of technology.[29] Scholarship to date tends to focus either on catastrophic risks or on regulating at the frontier without considering the rich interplay between the two problems.[30] Thus, this Article, while focused on the Arctic, offers fresh insights for regulating other, similarly structured industries. The Arctic is also a vital topic for U.S. energy law, given the resources potentially recoverable from the region.[31] Therefore, the Arctic, while only a single case study, is worth examining with care.

This Article is organized as follows. Part II describes the laws governing offshore drilling, including those governing exploitation and oil spill response. Part III provides background on offshore drilling in the U.S. Arctic, recounting the history of failures there to date. Part IV moves from background to theory by surveying the legal scholarship regarding offshore drilling. Much of this scholarship arose in the wake of the *Deepwater Horizon* disaster and little of it addresses the Arctic specifically. Part V builds on this offshore drilling scholarship and lays out the quandaries of regulating catastrophic risks at the frontier, emphasizing the problems of uncertainty and lack of benchmarking. In response to these problems, Part VI offers a set of principles to guide regulatory reform of offshore oil drilling

27 Anne L. Hanson, *Offshore Drilling in the United States and Norway: A Comparison of Prescriptive and Performance Approaches to Safety and Environmental Regulation*, 23 GEO. INT'L ENVTL. L. REV. 555, 556–63 (2011) (discussing the United States' prescriptive approach to offshore regulatory development).

28 *See infra* Part VII. This piece emphasizes the limitations of any reform strategy and sounds a note of caution about long-term regulation of the Arctic. The *Deepwater Horizon* disaster occurred only four years ago, so regulatory and scholarly interest in offshore drilling is near a high-water mark. This interest is unlikely to endure. The irregularity of major oil spills and the Arctic's remoteness hinders sustained engagement from the public. Such inattention, in turn, creates a danger that the very problems contributing to the *Deepwater Horizon* disaster, such as industry lobbying and informational disadvantages, will recur. *Id.*

29 *See infra* Part V.

30 *See infra* Part V.A. The issue of catastrophic risk, in particular, has received substantial scholarly attention. *See, e.g.*, Daniel Farber, *Symposium Introduction: Navigating the Intersection of Environmental Law and Disaster Law*, 2011 BYU L. REV. 1783, 1788–98 (2011) (summarizing disaster law and citing such examples as the *Deepwater Horizon* disaster, Hurricane Katrina, and the tsunami that struck Japan in 2011).

31 *See* BOEM, ASSESSMENT, *supra* note 11 (estimating that undiscovered and technically recoverable U.S. Arctic reserves exceed 22 billion barrels of oil and 104.41 trillion cubic feet of natural gas).

in the Arctic. Part VII suggests theoretical and practical implications of this research. Part VIII concludes by speculating on the future of offshore drilling in the region.

II. OVERVIEW OF THE OFFSHORE DRILLING LEGAL FRAMEWORK

This analysis begins by summarizing the major laws governing offshore drilling.[32] Two features largely define the legal landscape. First, the Outer Continental Shelf Lands Act (OCSLA)[33] governs federal management of offshore oil and gas resources on the U.S. Outer Continental Shelf (OCS),[34] including those in U.S. Arctic waters.[35] OCSLA also triggers environmental review requirements under the National Environmental Policy Act (NEPA)[36] and Endangered Species Act (ESA).[37] The lead agency for enforcing much of OCSLA is the Bureau of Ocean Energy Management (BOEM), which rose from MMS's ashes following the *Deepwater Horizon* disaster.[38] Second, the

32 *See, e.g.*, Holly Doremus, *Through Another's Eyes: Getting the Benefit of Outside Perspectives in Environmental Review*, 38 B.C. ENVTL. AFF. L. REV. 247, 259–71 (2011); David Pettit & David Newman, *Federal Public Law and the Future of Oil and Gas Drilling on the Outer Continental Shelf*, ROGER WILLIAMS U. L. REV. 184, 188–96 (2012).

33 Outer Continental Shelf Lands Act, 43 U.S.C. §§ 1331–1356a (2006). OCSLA became effective in 1953 but was substantially amended in 1978; the act, as amended, shapes the contours of federal offshore oil and gas management today. *See* Kalen, *supra* note 6, at 161–62.

34 The OCS is the seabed and subsoil of the submarine areas extending beyond either "the natural prolongation of [a coastal nation's] land territory to the outer edge of the continental margin, or to a distance of 200 nautical miles from the baselines from which the breadth of the territorial sea is measured where the outer edge of the continental margin does not extend up to that distance." United Nations Convention on the Law of the Sea art. 76(1), Dec. 10, 1982, 1833 U.N.T.S. 397 [hereinafter Law of the Sea]. The OCS overlaps substantially with the Exclusive Economic Zone (EEZ), which also extends roughly 200 nautical miles from the shoreline. *See id.* art. 57. Sovereign states have exclusive jurisdiction over the exploitation and conservation of subsoil natural resources in the EEZ. *Id.* art. 56(1). Though it has not ratified the Law of the Sea, the United States has asserted jurisdictional claims that generally coincide with what the Law of the Sea would otherwise provide. ADAM VANN, CONG. RESEARCH SERV., RL33404, OFFSHORE OIL AND GAS DEVELOPMENT: LEGAL FRAMEWORK 2 (2011).

35 The federal government and Alaska split control over the U.S. Arctic OCS. The first three nautical miles off Alaska's OCS are under the exclusive control of Alaska. *See* 43 U.S.C. § 1301(b) (2006). From the edge of those three nautical miles and the end of the EEZ, federal law generally controls, though Alaska law may apply to the extent no conflict exists with federal law. *See* 43 U.S.C. § 1333(a)(1) (2006) (providing that state law applies to the extent no conflict exists).

36 National Environmental Policy Act of 1969, 42 U.S.C. §§ 4321–4347 (2006).

37 Endangered Species Act of 1973, 16 U.S.C. §§ 1531–1544 (2006). Vill. of False Pass v. Clark, 733 F.2d 605, 609 (9th Cir. 1984) ("[I]t is clear that OCSLA prescribes three distinct stages for offshore oil and gas activities: leasing, exploration, and development and production. ESA appears to apply equally to each stage of its own force and effect. Under OCSLA's general environmental provision, NEPA also applies to each stage of its own force and effect. OCSLA's specific references to NEPA at the leasing and development and production stages, however, provide additional impetus for its application.").

38 *See* Defenders of Wildlife v. Bureau of Ocean Energy Mgmt., Regulation, and Enforcement (BOEMRE), 680 F. Supp. 1312, 1318–19 (9th Cir. 2012) (discussing the *Deepwater Horizon* oil spill and its catastrophic effects on the Gulf of Mexico); *see also* BOEM, *OCS Lands Act History*, http://www.boem.gov/Oil-and-Gas-Energy-Program/Leasing/Outer-Continental-

Oil Pollution Act of 1990 (OPA),[39] enacted shortly after another disastrous oil spill—the *Exxon Valdez* in 1989[40]—imposes liability and planning requirements for oil spills. The lead agency for implementing these requirements and enforcing companies' safety and environmental compliance is the Bureau of Safety and Environmental Enforcement (BSEE), another entity sprung from MMS.[41] In addition to OPA and OCSLA, other federal environmental laws not unique to offshore drilling, such as the Marine Mammal Protection Act,[42] have major effects on the sector. I review OCSLA, OPA, and these other environmental laws in turn.

A. The Outer Continental Shelf Lands Act

OCSLA sets a four-stage process for federal government management of offshore oil and gas resources.[43] At the first stage, the Secretary of the Interior, acting through BOEM, prepares a five-year program for leasing publicly owned oil and gas resources throughout the OCS, including the Beaufort and Chukchi Seas.[44] The leasing program specifies the size, timing, and location of leasing activity.[45] The program's goal, tilted towards resource exploitation, is to "best meet national energy needs."[46] OCSLA's second stage

Shelf/Lands-Act-History/OCSLA-HIstory.aspx (last visited July 26, 2014) (discussing the Minerals Management Service history and reorganization into BOEMRE).

39 *See* Oil Pollution Act of 1990, 33 U.S.C. §§ 1251–1387 (2006) (modifying parts of the Clean Water Act). For simplicity, I generally refer to OPA when discussing OPA's modifications to the Clean Water Act.

40 *See, e.g.*, EXXON VALDEZ OIL SPILL TRUSTEE COUNCIL, EXXON VALDEZ OIL SPILL RESTORATION PLAN 2 (1994) *available at* http://docs.lib.noaa.gov/noaa_documents/NOAA_related_docs/oil_spills/EVOS_restoration_plan_1994.pdf (describing the 1989 *Exxon Valdez* catastrophe, where an oil tanker ran aground in Alaska's Prince William Sound and spilled roughly 260,000 barrels of oil (about 11 million gallons), contaminating 1,500 miles of Alaska's coastline, and causing widespread harm to wildlife). Congress passed OPA one year after the *Exxon Valdez* oil spill. *See* Michael P. Donaldson, *The Oil Pollution Act 1990: Reaction and Response*, 3 VILL. ENVTL. L.J. 283, 288 (1992).

41 *Compare* BSEE, *Fact Sheet*, http://www.bsee.gov/uploadedFiles/FACT%20SHEET%20BSEE(1).pdf (last visited July 26, 2014) (providing an overview of BSEE's responsibilities), *with* BOEM, *Fact Sheet*, http://www.boem.gov/uploadedFiles/A%20to%20Z%20Guide%20web%20version(1).pdf (last visited July 26, 2014) (providing an overview of BOEM's responsibilities).

42 Marine Mammal Protection Act of 1972, 16 U.S.C. § 1372(a)(1) (2006) (prohibiting "take" of "any marine mammal on the high seas" by any person, vessel, or other conveyance subject to United States jurisdiction); *see also* Ctr. for Biological Diversity v. Salazar, 695 F.3d 893, 898 (9th Cir. 2012) (discussing marine mammals protected under the Marine Mammal Protection Act of 1972 that live in the Chukchi Sea).

43 *See* Sec'y of the Interior v. California, 464 U.S. 310, 336–37 (1984) (laying out the four statutory stages); NAT'L COMM'N REPORT, *supra* note 1, at 61 (providing a flowchart of the four-stage process).

44 *See* Outer Continental Shelf Lands Act, 43 U.S.C. § 1344 (2006); *see also Sec'y of the Interior*, 464 U.S. at 337–38.

45 43 U.S.C. §§ 1344(a)(2)–(3) (2006).

46 *Id.* § 1344(a)(1). The OCSLA's directive to "meet national energy needs" is in some respects curious, given that oil is an internationally traded good. Nevertheless, such language is a common part of the energy law discourse. *See generally* Amy J. Wildermuth, *The Next Step: The Integration of Energy Law and Environmental Law*, 31 UTAH ENVTL. L. REV. 369, 380 (2011)

shifts from nationwide plans to individual leases covering smaller areas. At this stage, the Secretary of the Interior, again acting through BOEM, solicits bids from oil companies and issues leases through a competitive bidding process.[47] For the third stage, lessees wishing to conduct exploratory oil and gas activities[48] submit a publicly available Exploration Plan[49] detailing such information as the proposed exploratory activities—e.g., location of drilling sites, number of wells to be drilled—and other requested information—e.g., company resources to be deployed in the event of an oil spill.[50] OCSLA provides that the Secretary of the Interior must approve an Exploration Plan[51] before exploratory activities may occur,[52] though the grounds expressly provided for nonapproval are limited.[53] The fourth and final

(discussing the aims of U.S. energy law); Lincoln L. Davies, *Alternative Energy and the Energy-Environment Disconnect*, 46 IDAHO L. REV. 473, 478–84 (2010) (discussing energy law generally).

47 *See* 43 U.S.C. § 1337(a) (2006).

48 Oil exploration is aimed at predicting the presence, characteristics, and location of oil underground. *See* Peter A. Nolan & Mark C. Thurber, *On the State's Choice of Oil Company: Risk Management and the Frontier of the Petroleum Industry*, *in* OIL AND GOVERNANCE 121, 135 (David G. Victor et al. eds., 2012). Exploratory activities include drilling specialized wells that provide information on the reservoirs in which the oil and gas is found; and conducting seismic tests, such as reflected sound waves, to assess the geological environment near the oil formation. *See id.* Because the main purpose of exploration is to gather information on an oil formation, the amount of oil and gas extracted at this phase is much lower than at the subsequent stage of commercial development. *See id.* The amount may still be considerable, however: the *Deepwater Horizon* rig was doing exploratory drilling at the time of its disaster. *See* NAT'L COMM'N REPORT, *supra* note 1, at 4.

49 *See* 43 U.S.C. § 1340(c)(1) (2006).

50 *See id.* § 1340(c)(3). For examples of Exploration Plans covering Arctic waters, see Shell Offshore Inc., Revised Outer Continental Shelf Lease Exploration Plan, Camden Bay, Beaufort Sea, Alaska (2011) [hereinafter SHELL, BEAUFORT SEA EXPLORATION PLAN], *available at* http://www.boem.gov/uploadedFiles/BOEM/Oil_and_Gas_Energy_Program/Plans/Regional_Plans/Alaska_Exploration_Plans/2012_Shell_Beaufort_EP/Shell%202012%20Camden%20Bay%20Exploration%20Plan%20Public%20Copy.pdf; SHELL GULF OF MEXICO INC., REVISED OUTER CONTINENTAL SHELF LEASE EXPLORATION PLAN, CHUKCHI SEA, ALASKA (2011) [hereinafter SHELL, CHUKCHI SEA EXPLORATION Plan], *available at* http://www.boem.gov/uploadedFiles/BOEM/Oil_and_Gas_Energy_Program/Plans/Regional_Plans/Alaska_Exploration_Plans/2012_Shell_Chukchi_EP/CS-EP-Public.pdf.

51 OCSLA provides that the Secretary must approve an Exploration Plan within 30 days after it has been submitted. 43 U.S.C. § 1340(c)(1) (2006). The brief time period for review generated significant criticism in the wake of the *Deepwater Horizon* disaster. *See, e.g.*, NAT'L COMM'N REPORT, *supra* note 1, at 80; Hartsig, *supra* note 19, at 312.

52 *See* 43 U.S.C. § 1340(b) (2006).

53 The principal environmental ground for disapproval is if the exploratory activities would "probably cause serious harm or damage . . . to the marine, coastal, or human environment . . . ." *Id.* §§ 1334(a)(2)(A)(i), 1340(c)(1); *see also* Sec'y of the Interior v. California, 464 U.S. 312, 339 (1984) (providing further discussion of grounds for disapproving exploratory activities). OCSLA also provides for disapproval in the event an Exploration Plan is not consistent with state coastal zone management programs established under the Coastal Zone Management Act (CZMA). *See* 43 U S.C. § 1340(c)(2) (2006) (requiring consistency with state plans); CZMA, 16 U.S.C. §§ 1451–1466 (2006). This provision of OCSLA has historically lacked much force, however. *See, e.g.*, Kalen, *supra*, note 6, at 168–72 (discussing the limitations on state power over proposed lease sales as a matter of practice and law). In the Arctic, the provision has even less effect because the relevant state, Alaska, favors increased offshore drilling. *See* DEP'T OF THE INTERIOR, REPORT ON SHELL'S 2012 EXPLORATION PROGRAM, *supra* note 23, at 15 (noting that

OCSLA stage kicks in if a lessee seeks to move from exploration to commercial development—a move that may never materialize because exploration often comes to naught.[54] A lessee desiring commercial development must submit a publicly available Development and Production Plan (DPP) for most lease areas, including those in the Beaufort or Chukchi Seas.[55] In several respects, the law on DPPs mirrors that on Exploration Plans. A DPP must describe the work to be performed and other relevant information—e.g., environmental safeguards, safety standards[56]—and the Secretary of the Interior must approve the DPP before development activities may occur.[57]

At least three of the four OCSLA stages generate environmental review requirements under NEPA.[58] The three stages are the five-year program, lease sale, and DPP approval, where BOEM[59]—previously MMS—prepares a

Alaska's coastal zone management program expired in 2011 and has not been reauthorized as of March 2013).

54 During oil development, an oil company extracts oil from the ground for commercial purposes. *See* Nolan & Thurber, *supra* note 48, at 136–37. Oil development is much larger in scale than exploration and involves year-round activities for a period of several years (compared to several months per year, as may be the case of oil exploration). *See id.* at 132. Exploration often does not proceed to development because the information developed during exploratory drilling may reveal that the reservoir is smaller or more difficult to extract than anticipated. *See id.* at 135.

55 *See* 43 U.S.C. § 1351(a) (2006); 30 C.F.R. § 250.241 (2011) (discussing DPPs). OCSLA exempts development in the Western Gulf of Mexico from DPP requirements; development in that region proceeds according to "Development Operations Coordination Documents" that are subject to lesser environmental review. *See* 43 U.S.C. § 1351(a)(1) (2006); 30 C.F.R. § 250.201(a) (2011) (implementing regulations for Western Gulf of Mexico); NAT'L COMM'N REPORT, *supra* note 1, at 62 (discussing Western Gulf of Mexico exemption).

56 *See* 43 U.S.C. § 1351(c) (2006). By statute, a DPP covers more information than does an Exploration Plan. *Compare id.* § 1351(c), *with id.* § 1340(c)(3). However, OCSLA provides that the Secretary can require more information in an Exploration Plan (or DPP, for that matter) than provided in the statute. *Id.* §§ 1340(c)(3)(D), 1351(c)(6).

57 *Id.* § 1351(a). The grounds for disapproval vary. *See id.* § 1351(h). The DPP process parallels that for an Exploration Plan. *See id.* § 1351(h)(1)(D)(i) (providing for disapproval if implementation of a DPP "would probably cause serious harm or damage . . . to the marine, coastal or human environments"). The OCSLA also requires operators to apply for permission prior to drilling wells, pursuant to an Exploration Plan or, in most areas, a DPP. *Id.* § 1351(a)(1).

58 NEPA does not impose substantive requirements on projects but rather "ensure[s] that the agency, in reaching its decision, will have available, and will carefully consider, detailed information concerning significant environmental impacts; it also guarantees that the relevant information will be made available to the larger audience that may also play a role in both the decision[-]making process and the implementation of that decision." Robertson v. Methow Valley Citizens Council, 490 U.S. 332, 349 (1989).

59 BOEM conducts these environmental reviews despite also being the agency carrying out the leasing process, raising a potential conflict of interest concern. This concern is far from unique to BOEM. It is, in fact, common to agencies that sell or lease publicly owned resources. *See, e.g.*, Earth Island v. U.S. Forest Service, 442 F.3d 1147, 1178 (9th Cir. 2006) (noting the U.S. Forest Service's "substantial financial interest in the harvesting of timber in the National Forest" and stating, "We regret to say that in this case, . . . the [U.S. Forest Service] appears to have been more interested in harvesting timber than in complying with our environmental laws.").

lengthy[60] Environmental Impact Statement (EIS).[61] By contrast, OCSLA does not mandate preparation of an EIS at the Exploration Plan approval stage. Before the *Deepwater Horizon* disaster, MMS often categorically excluded[62] Exploration Plans from NEPA requirements altogether,[63] including the Exploration Plan in effect at the time of the disaster.[64] BOEM has since adopted a policy of not categorically excluding most Exploration Plans from NEPA,[65] though it may prepare a less extensive Environmental Assessment (EA) to determine whether an EIS is required,[66] as was the case for Shell's 2012 Exploration Plans for the Beaufort and Chukchi Seas.[67] Even when it is prepared, an EIS at a later stage in the OCSLA process may, and as a practical matter does, rely on the analysis conducted at previous stages.[68]

60 By way of context, the EIS prepared for the 2012–2017 OCS leading program is 2,057 pages. *See generally* BUREAU OF OCEAN ENERGY MGMT., OUTER CONTINENTAL SHELF OIL AND GAS LEASING PROGRAM: 2012–2017, FINAL PROGRAMMATIC ENVIRONMENTAL IMPACT STATEMENT (2012).

61 *See* 43 U.S.C. § 1331(p) (2006) (defining "major Federal action" for which NEPA requirements apply); *id.* § 1344(b)(3) (reference to NEPA EIS requirements in estimating appropriations needed to manage the five-year program); *id.* § 1346(a)(1) (implying that NEPA review is required at the lease sale stage); *id.* § 1351(e)–(h), (k) (defining an approved DPP as a major Federal action that requires an EIS); *see also Vill. of False Pass*, 733 F.2d at 609 (discussing NEPA requirements for OCSLA stages).

62 Categorical exclusions are "a category of actions which do not individually or cumulatively have a significant effect on the human environment . . . and for which, therefore, neither an environmental assessment nor an environmental impact statement is required." 40 C.F.R. § 1508.4 (2011).

63 *See* NAT'L COMM'N REPORT, *supra* note 1, at 81 (discussing the Department of the Interior's 1981 decision to categorically exclude Exploration Plans in the central and western Gulf of Mexico); *see also* 40 C.F.R. § 1508.4 (defining categorical exclusions under NEPA).

64 *See* Kalen, *supra* note 6, at 163.

65 *See* Defenders of Wildlife v. Bureau of Ocean Energy, 684 F.3d 1242, 1247 (11th Cir. 2012). *See generally* Gulf Restoration Network v. Salazar, 683 F.3d 158, 180–81 (5th Cir. 2012) (discussing criticism of the Department of the Interior's policy of categorically exempting Exploration Plans from NEPA review).

66 *See, e.g.*, *Defenders of Wildlife*, 684 F.3d at 1249 (rejecting challenge to the decision not to prepare an EIS); Ctr. for Biological Diversity v. Kempthorne, 588 F.3d 701, 712 (9th Cir. 2009) (holding that an EIS was not required because the agency relied on "reasonable predictions" in deciding to prepare only an EA, the existence of "some uncertainty" notwithstanding).

67 BUREAU OF OCEAN ENERGY MGMT., REGULATION AND ENFORCEMENT ALASKA OCS REGION, U.S. DEP'T OF THE INTERIOR, ENVIRONMENTAL ASSESSMENT, BEAUFORT SEA PLANNING AREA 1.1–.2 (2011) [hereinafter BOEM, BEAUFORT SEA ENVIRONMENTAL ASSESSMENT], *available at* http://www.boem.gov/uploadedFiles/BOEM/About_BOEM/BOEM_Regions/Alaska_Region/Environment/Environmental_Analysis/2011_039.pdf; BUREAU OF OCEAN ENERGY MGMT., REGULATION AND ENFORCEMENT ALASKA OCS REGION, U.S. DEP'T OF THE INTERIOR, ENVIRONMENTAL ASSESSMENT, CHUKCHI SEA PLANNING AREA 1.1–1.3 (2011) [hereinafter BOEM, CHUKCHI SEA ENVIRONMENTAL ASSESSMENT], *available at* http://www.boem.gov/uploadedFiles/2011_1214_FINAL_2012ChukchiSeaEA.PDF.

68 *Defenders of Wildlife*, 684 F.3d at 1251 ("Absent unique site-specific characteristics, BOEM is entitled to rely on broader prior analyses and tiering is specifically encouraged by NEPA regulations."); *see also* NAT'L COMM'N REPORT, *supra* note 1, at 260 (discussing purpose of tiering).

This process, known as "tiering,"[69] stirred widespread debate after the *Deepwater Horizon* disaster.[70]

In addition to NEPA, the ESA applies to several OCSLA stages.[71] Several circuits have held the lease sale and all later OCSLA stages are "agency actions"[72] triggering the ESA mandate[73] to consult[74] with the U.S. Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service (NMFS) on species and habitat effects.[75] The law is less settled with respect to the five-year program stage, but the D.C. Circuit holds it does not trigger ESA consultation requirements.[76]

Three other features of OCSLA merit attention. First, OCSLA authorizes the federal government to set prescriptive regulations for offshore drilling; before the *Deepwater Horizon* disaster, such regulation was minimal in several respects.[77] Second, before any drilling activities may take place under an approved Exploration Plan or DPP, BSEE[78] must approve a site-specific

69 40 C.F.R. § 1508.28 (2013) (defining "tiering"); *see also* 40 C.F.R. § 1502.20 (2013) (encouraging agencies "to tier their environmental impact statements").

70 *See infra* Part IV.C.

71 OCSLA does not make reference to the ESA specifically. *Vill. of False Pass*, 733 F.2d at 608 (discussing OCSLA's lack of reference to the ESA). Nevertheless, ESA requirements may apply because OCSLA does not modify the ordinary application of the ESA to relevant agency actions. *See id.* at 609.

72 An agency action, for purposes of the ESA, includes any action "that 'may affect' a listed species or its critical habitat." Ctr. for Biological Diversity v. Salazar, 695 F.3d 893, 909 (9th Cir. 2012); *see also* California Ex Rel. Lockyer v. U.S. Dep't of Agric., 575 F.3d 999, 1018 (9th Cir. 2009) (discussing threshold for invoking the ESA).

73 *See* Ctr. for Biological Diversity v. U.S. Dep't of the Interior, 563 F.3d 466, 483 (D.C. Cir. 2009) (stating each of the OCSLA stages after the five-year program stage imposes ESA requirements); N. Slope Borough v. Andrus, 642 F.2d 589, 609 (D.C. Cir. 1980); *Vill. of False Pass*, 733 F.2d at 609.

74 ESA consultation may be formal or informal. *See* 50 C.F.R. § 402.12(c) (2012) (providing directions for consultation); *id.* § 402.13 (specifying requirements for formal and informal consultation, with informal consultation determining whether formal consultation is required and whether action could be modified to avoid adverse effects). Informal consultation is the norm. LAWRENCE R. LIEBESMAN & RAFE PETERSEN, ENDANGERED SPECIES DESKBOOK 30 (2003).

75 In the event it is required, consultation leads to the preparation of a "biological opinion," and a finding that the proposed action would either jeopardize or cause no jeopardy to the listed species and critical habitat. 16 U.S.C. § 1536(b)(3)(A) (2006). If a "no jeopardy" biological opinion is issued, USFWS or NMFS prepares an "incidental take statement" specifying the amount and extent of the anticipated incidental take, or effect, on the listed species or critical habitat. 50 C.F.R. § 402.14(i) (2012). If a "jeopardy" biological opinion is issued, the biological opinion will identify "reasonable and prudent alternatives" to the action—if they exist—that would not jeopardize the listed species or habitat. *Id.* § 402.14(h)(3) (2012). For general discussion on the ESA's application in offshore oil and gas drilling, see Pettit & Newman, *supra* note 32, at 191–93. *See also* Kenneth M. Murchison, *Beyond Compensation for Offshore Drilling Accidents: Lowering Risks, Improving Response*, 30 MISS. C. L. REV. 277, 294–96 (2011) (noting the MMS allowed OCSLA lease sales to proceed while ESA consultation was ongoing).

76 *See Ctr. for Biological Diversity*, 563 F.3d at 483.

77 *See* NAT'L COMM'N REPORT, *supra* note 1, at 228 (stating that before the *Deepwater Horizon* disaster the government lacked meaningful regulations on some of the key issues causing that disaster, such as requirements for cementing a well, testing the cement used, and negative-pressure testing of the well's integrity).

78 *See* Native Vill. of Point Hope v. Salazar, 680 F.3d 1123, 1132 n.10 (9th Cir. 2012) (discussing BSEE's responsibilities).

Application for a Permit to Drill (APD).[79] The requirement of site-specific approval provides an additional layer of review that in part prevented Shell from carrying out most of its planned Arctic drilling in 2012.[80] Third, the Coast Guard must provide a Letter of Compliance before drilling ships may operate in the OCS.[81] This Coast Guard requirement also played an important role in Shell's 2012 drilling season.[82]

B. The Oil Pollution Act of 1990

Whereas OCSLA sets a process for exploitation of offshore resources, OPA, which modifies the Clean Air Act, is aimed at reducing exploitation risks.[83] OPA provides, among other things, that the party or parties responsible for an oil spill take a leading role in spill response.[84] To promote contingency planning, parties operating an offshore oil and gas facility must prepare an Oil Spill Response Plan (OSRP) before such operation may occur.[85] Among the subjects covered in an OSRP is a "worst case" scenario

79 *See* Outer Continental Shelf Lands Act, 43 U.S.C. § 1340(d) (2006) (providing that the Secretary of Interior may require a drilling permit for drilling under an approved Exploration Plan); 30 C.F.R. § 250.201 (2013) (implementing statutory authority); *id.* at § 250.410; Century Exploration New Orleans, LLC v. United States, 110 Fed. Cl. 148, 155 (2013) (explaining that the permit requirement applies to drilling activities under an approved Exploration Plan or DPP).

80 *See infra* Part III.C.

81 33 C.F.R. § 143.210 (2013).

82 *See infra* Part III.C.

83 See INHO KIM, RESTRUCTURING THE LIABILITY REGIME IN THE OIL POLLUTION ACT OF 1990 124–37 (2000) (on file with the Stanford Robert Crown Law Library) (discussing OPA regulations that seek to reduce exploitation risks); Jeffrey D. Morgan, *The Oil Pollution Act of 1990: A Look at Its Impact on the Oil Industry*, 6 FORDHAM ENVTL. L.J. 1 (1994); Daniel Kopec & H. Philip Peterson, *Crude Legislation: Liability and Compensation Under the Oil Pollution Act of 199*0, 23 RUTGERS L.J. 597 (1992).

84 *See* Oil Pollution Act, 33 U.S.C. § 2701(32) (2006) (defining "responsible party"). The justification for giving the responsible party authority over oil spill response is that "the responsible party may be in the best position to respond because of its knowledge or technical expertise related to the processes involved in its own facility." Nat'l Comm'n on the BP Deepwater Horizon Oil Spill and Offshore Drilling, *Decision-Making Within Unified Command* 11 (Staff Working Piece No. 2, 2010), *available at* http://www.washingtonpost.com/wp-srv/politics/documents/WorkingPaperUnifiedCommandForRelease.pdf [hereinafter Nat'l Comm'n Report on Unified Command]. BP filled this role during the *Deepwater Horizon* disaster, generating significant controversy. Policy advocates argued that BP used its position as "responsible party" to make important decisions while regulators played catch-up. *See id.* at 13–14 (analyzing and critiquing aspects of BP's control over the response).

85 Federal Water Pollution Control Act, 33 U.S.C. § 1321(j)(5)(A)(i) (2006); *see also* 30 C.F.R. §§ 254.1–254.9 (2013) (implementing regulations). The OSRP must be consistent with the National Contingency Plan (NCP) and Area Contingency Plans prepared by the U.S. Environmental Protection Agency. 33 U.S.C. § 1321(j)(5)(D)(i) (2006); 40 C.F.R. § 300.211 (2013). For an overview of the NCP system, see Gregg P. Macey, *Environmental Crisis and the Paradox of Organizing*, 2011 BYU L. REV. 2063, 2085–88 (2011). Regulations provide that the OSRP may cover more than one facility operated by the same lessee, in which case the OSRP is a "regional" OSRP. 30 C.F.R. § 254.6 (2013) (defining "regional response plan"). In addition, the State of Alaska imposes a planning requirement parallel to the OSRP for facilities located there, known as an "Oil Discharge Prevention and Contingency Plan" (ODPCP). ALASKA STAT. § 46.04.030(a) (2012). This requirement applies to facilities in the Beaufort and Chukchi Seas to

for an uncontrolled thirty-day oil discharge,[86] the planned use of chemical dispersants to break up oil slicks,[87] and any planned burning of oil on open waters[88]—known as "in-situ burning."[89] BSEE approves the OSRP in the first instance;[90] BOEM must also consider the OSRP before approving an Exploration Plan or DPP.[91]

Compared to an Exploration Plan or DPP, an OSRP is subject to little public or interagency review.[92] OSRP approval may not trigger NEPA or ESA requirements.[93] In approving an OSRP, BSEE is not required to solicit interagency input, invite public comments, or make the OSRP available to

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the extent it does not conflict with federal law. *See* 43 U.S.C. § 1333(a)(2)(A) (2006) (providing that, to the extent not inconsistent with federal law, the "laws of each adjacent State . . . are declared to be the law of the United States for that portion of the subsoil and seabed of the outer Continental Shelf . . . which would be within the area of the State if its boundaries extended seaward to the outer margin of the outer Continental Shelf").

86 30 C.F.R. § 254.26 (2013); *id.* § 254.47(b). Scholars have critiqued the 30-day requirement, since the Macondo well in the *Deepwater Horizon* disaster spewed oil for more than three months. *See, e.g.*, Murchison, *supra* note 75, at 298–99 (noting that the worst case planned before the *Deepwater Horizon* disaster "was much smaller than the one that actually occurred").

87 30 C.F.R. § 254.27 (2013). By breaking up oil slicks into smaller surface areas, chemical dispersants promote faster natural degradation of the oil by bacteria. However, dispersants introduce new contaminants into the ocean that raise other questions about environmental harm. For discussion of dispersants and unknowns regarding their use in Arctic waters, see USGS, ARCTIC REPORT, *supra* note 11, at 136–39; Christopher M. Iaquinto, *A Silent Spring in Deep Water?: Proposing Front-End Regulation of Dispersants After the* Deepwater Horizon *Disaster*, 39 B.C. ENVTL. AFF. L. REV. 419 (2012).

88 30 C.F.R. § 254.28 (2013).

89 *See generally* USGS, ARCTIC REPORT, *supra* note 11, at 133–36 (discussing in-situ burning generally and in the Arctic).

90 33 U.S.C. §§ 1321(j)(5)(F)(i)–(ii) (providing that the President shall approve OSRPs); Exec. Order No. 12,777, 56 Fed. Reg. 54,757, 54,761–62 (Oct. 22, 1991) (delegating this power to the Department of the Interior); 30 C.F.R. § 254.2(a) (2013) (delegating that power to BSEE). OSRPs must be revised to remain current over time. *See* 30 C.F.R. § 254.30 (2013). Scholars heavily criticized BP's OSRP for *Deepwater Horizon*. *See, e.g.*, REBECCA BRATSPIES ET AL., CENTER FOR PROGRESSIVE REFORM, FROM SHIP TO SHORE: REFORMING THE NATIONAL CONTINGENCY PLAN TO IMPROVE PROTECTIONS FOR OIL SPILL CLEANUP WORKERS 7 (2010) (calling BP's OSRP "much maligned"); Michael Barsa & David A. Dana, *Reconceptualizing NEPA to Avoid the Next Preventable Disaster*, 38 B.C. ENVTL. AFF. L. REV. 219, 223 n.28 (noting that BP's regional OSRP for the Gulf of Mexico in effect at the time of the *Deepwater Horizon* disaster "was full of errors").

91 30 C.F.R. §§ 250.219(a), 250.250(a) (2010).

92 *See generally* Gary Yoshioka et al., *Public Participation in U.S. Oil Pollution Planning and Preparedness Policy*, INT'L OIL SPILL CONF. 41 (2008) (discussing public participation in oil spill response planning).

93 In August 2013, the District of Alaska held that BSEE's approval of an OSRP did not implicate NEPA or ESA requirements. Shell Gulf of Mexico v. Ctr. for Biological Diversity, No. 3:12-CV-00048-RRB, at 29–36 (D. Alaska Aug. 5, 2013), *available at* http://earthjustice.org/sites/default/files/files/159Order-denying-MSJ.pdf [hereinafter District of Alaska, August 2013 Decision]. With respect to NEPA, the court reasoned that BSEE's approval affirms that an OSRP meets regulatory requirements but does not authorize a project or activity, as would be required for NEPA to apply. *Id.* at 29. As for the ESA, the court held no ESA consultation was required because, inter alia, BSEE's approval does not lead to oil spill response activities as those activities, should they occur, would be administered by other agencies, such as the Coast Guard. *Id.* at 34.

the public after approval.[94] The lack of outside involvement in the OSRP approval process has received criticism[95] and is a subject addressed further in Part VI of this piece. In addition, OPA gives the government authority to conduct unannounced inspections and monitoring of offshore oil facilities.[96] BSEE exercised this authority during Shell's 2012 drilling in the Arctic and uncovered serious concerns.[97]

OPA also imposes liability to incentivize oil companies to avoid oil spills. The party responsible for an oil spill[98] is strictly liable[99] for up to $75 million in damages unless that party commits gross negligence, willful misconduct, or violates certain federal regulations, in which case damages are unlimited.[100] OPA's liability cap became subject to withering criticism after the *Deepwater Horizon* disaster because $75 million in liability does not adequately deter against major spills or come anywhere close to providing adequate compensation.[101] (Other laws may provide more

94 *See* NAT'L COMM'N REPORT, *supra* note 1, at 266–67. In the case of the Arctic, BSEE made available and solicited public comment on the 2012 OSRPs for the Beaufort and Chukchi Seas. Bureau of Safety and Envtl. Enforcement, Fact Sheet: Shell Chukchi Oil Spill Response Plan, http://www.bsee.gov/BSEE-Newsroom/BSEE-Fact-Sheet/FACT-SHEET–Shell-Chukchi-Oil-Spill-Response-Plan-%28OSRP%29/ [hereinafter BSEE Fact Sheet] (last visited July 26, 2014); Bureau of Safety and Envtl. Enforcement, *BSEE Issues Approval for Shell Beaufort Sea Oil Spill Response Plan: Thorough Review Incorporates Interagency Comments and Lessons Learned*, http://www.bsee.gov/BSEE-Newsroom/Press-Releases/2012/BSEE-Issues-Approval-for-Shell-Beaufort-Sea-Oil-Spill-Response-Plan/ (last visited July 26, 2014); E-mail from Cindy Shogan, Exec. Dir., Alaska Wilderness League, et al., to James Watson, Dir., Bureau of Safety and Envtl. Enforcement (Mar. 25, 2013), *available at* http://earthjustice.org/sites/default/files/BSEE letterConocoSpillPlan.pdf. It is unclear if BSEE will repeat this step for future OSRPs. *See infra* Part V.B.

95 *See* NAT'L COMM'N REPORT, *supra* note 1, at 266–67 (recommending interagency review and public comment period prior to OSRP approval); Hartsig, *supra* note 19, at 314–15 (echoing recommendations in the National Commission report).

96 33 U.S.C. §§ 1321(j)(6), (7) (2006); *see also* 30 C.F.R. § 254.42(g) (2011) (implementing regulations).

97 *See infra* Part III.

98 OPA treats the holder of the permit to drill as the responsible party for liability purposes. 33 U.S.C. § 2701(32) (2006). OPA's mechanism for determining the responsible party, rather than forcing plaintiffs to figure it out, is known as "channeling." Mark A. Cohen et al., *Deepwater Drilling: Law, Policy, and Economics of Firm Organization and Safety*, 64 VAND. L. REV. 1853, 1888 (2011). Channeling helps plaintiffs avoid sifting through the complex web of relationships in the petroleum industry, where a major oil company often contracts out activities to other companies—as BP did with Transocean for the *Deepwater Horizon* rig. *Id.* at 1888–89. OPA's channeling mechanism does not prevent the responsible party from separately suing other parties, such as subcontractors, that may also be at fault for an oil spill. *Id.* at 1889.

99 A strict liability, rather than negligence, standard is often used in hazardous industries to simplify the litigation process and to ensure that industry limits the level of harm-causing activity. W. Kip Viscusi & Richard J. Zeckhauser, *Deterring and Compensating Oil-Spill Catastrophes: The Need for Strict and Two-Tier Liability*, 64 VAND. L. REV. 1717, 1745–46 (2011); Cohen et al., *supra* note 98, at 1889.

100 33 U.S.C. § 2704(a)(3), (c)(1) (2006); *see also* Cohen et al., *supra* note 98, at 1890 (discussing OPA liability regime). OPA does not preempt other federal or state laws, including state common law negligence regimes. *See id.* at 1891.

101 NAT'L COMM'N REPORT, *supra* note 1, at 245–46 (noting the liability cap has been set at $75 million for more than two decades); Viscusi & Zeckhauser, *supra* note 99, at 1721; Cohen et al., *supra* note 98, at 1890–92; NATHAN RICHARDSON, DEEPWATER HORIZON AND THE PATCHWORK OF

significant liability exposure but have their own limitations.)[102] To mitigate the "judgment proof" problem[103] and other liability escapes, OPA imposes certain financial responsibility requirements on owners and operators of offshore facilities.[104] These financial responsibility requirements are tied to the liability cap and, like that cap, suffer from major shortcomings.[105]

Lastly, OPA restructured the previously extant Oil Spill Liability Trust Fund.[106] Monies from this fund, which come from a per-barrel oil tax,[107] pay for federal government oil spill response and up to $1 billion in oil spill-related damages if the responsible party is unable to pay.[108] Though the fund

OIL SPILL LIABILITY LAW 3 (2010), *available at* http://www.rff.org/RFF/Documents/RFF-BCK-Richardson-OilLiability_update.pdf (noting that OPA's liability cap was an improvement over prior law). OPA's cap did not become an issue following the *Deepwater Horizon* disaster because the responsible party, BP, waived any defense that would have entitled it to protection under the cap. Viscusi & Zeckhauser, *supra* note 99, at 1741.

102 These laws include actions under the Clean Water Act, which provides for penalties for every barrel spilled; the Migratory Bird Treaty Act, which imposes penalties for harm to certain birds; and state common law negligence actions. Cohen et al., *supra* note 98, at 1892 n.173, 1889–90; Richardson, *supra* note 101, at 5. In January 2013 as part of a plea agreement for the *Deepwater Horizon* disaster, BP was sentenced to pay $4 billion in criminal fines and penalties. Press Release, U.S. Dep't of Justice, BP Exploration and Production Inc. Pleads Guilty, is Sentenced to Pay Record $4 Billion for Crimes Surrounding *Deepwater Horizon* Incident (Jan. 29, 2013), http://www.justice.gov/opa/pr/2013/January/13-ag-123.html (last visited July 26, 2014). Nevertheless, these fines and penalties may not compare to the social costs of the *Deepwater Horizon* disaster. ALAN KRUPNICK ET AL., UNDERSTANDING THE COSTS AND BENEFITS OF DEEPWATER OIL DRILLING REGULATION 28–29 (2011), *available at* http://www.rff.org/RFF/Documents/RFF-DP-10-62.pdf (applying willingness-to-pay damage models that were developed after the *Exxon Valdez* disaster, and estimating, based on those models, that the *Deepwater Horizon* disaster may have caused damages ranging from $105 billion to $239 billion); MARK A. COHEN, A TAXONOMY OF OIL SPILL COSTS: WHAT ARE THE LIKELY COSTS OF THE DEEPWATER HORIZON SPILL? 3 (2010), *available at* http://www.rff.org/rff/documents/RFF-BCK-Cohen-DH Costs_update.pdf (estimating social costs at up to $40 to $60 billion).

103 The judgment proof problem refers to the risk that some companies will circumvent paying the full cost of harm by declaring bankruptcy. Robert D. Cooter, *Economic Theories of Legal Liability*, J. ECON. PERSP., Summer 1991, at 25 (explaining that liability fails to provide efficient incentives in the event that a party can avoid liability via bankruptcy). Companies may strategically structure their operations to take advantage of the possibility of bankruptcy. Inho Kim, *Financial Responsibility Rules Under the Oil Pollution Act of 1990*, 42 NAT. RESOURCES J. 565, 567–58 (2002).

104 33 U.S.C. § 2716(a) (2006); 33 C.F.R. § 138.10 (2013).

105 Cohen et al., *supra* note 98, at 1893–95 (discussing the limitations of financial responsibility requirements); Viscusi & Zeckhauser, *supra* note 99, at 1739–40.

106 33 U.S.C. § 2712(a) (2006) (setting forth OPA provisions governing the fund); Omnibus Budget Reconciliation Act of 1986, Pub. L. No. 99-509, 100 Stat. 1874 (1986) (establishing the fund in 1986).

107 Hazardous Substance Response Revenue Act of 1980, 26 U.S.C. § 4611(a) (2006). From 1990 to 1994, OPA mandated that the oil industry pay a per-barrel excise tax on oil produced in or imported to the United States to pay for the fund. EPA, *Oil Spill Liability Trust Fund*, http://www.epa.gov/oem/content/learning/oilfund.htm (last visited July 26, 2014). The Energy Policy Act of 2005 reinstated the per-barrel tax. Energy Policy Act of 2005, Pub. L. No. 109-58, 119 Stat. 594 (2005).

108 Trust Fund Code of 1981, 26 U.S.C. § 9509(c)(2) (2006).

partly addresses inadequacies in OPA's liability regime, uncompensated losses would remain considerable in the event of a major oil spill.[109]

C. Other relevant federal laws

In addition to OCSLA and OPA, other federal environmental laws bear on the legal framework for offshore drilling. These laws include Clean Water Act[110] liability provisions[111] and restrictions on discharge of dredged and fill material[112] and certain "point source" pollutants—i.e., those from single identifiable sources;[113] Clean Air Act restrictions on hazardous contaminant emissions, such as from drilling rigs hovering above drilling sites;[114] prohibitions in the Marine Mammal Protection Act (MMPA)[115] against the "taking" of marine mammals;[116] Migratory Bird Treaty Act violations for the death of protected birds;[117] Coastal Zone Management Act (CZMA) requirements for consistency with state coastal zone management plans;[118] certification requirements by the Coast Guard;[119] and fishery protections under the Magnuson–Stevens Fishery Conservation and Management Act.[120] Several of these laws, in particular the Clean Water Act, affected oil

109 The Oil Spill Liability Trust Fund has been another target of scholarly criticism. *See, e.g.*, Viscusi & Zeckhauser, *supra* note 99, at 1740 (noting that harms from the *Deepwater Horizon* disaster "dwarfed" the money that could be allocated by the Oil Spill Liability Trust Fund).

110 These Clean Water Act provisions predate parts of the Clean Water Act that were modified by OPA. *See* Federal Water Pollution Control Act, 33 U.S.C. §§ 1251–1387 (2006) (containing OPA additions to Clean Water Act).

111 *See supra* note 101.

112 33 U.S.C. § 1344 (2006).

113 The Clean Water Act bars the discharge of point source pollutants into U.S. waters, except for those pollutants discharged in accordance with a National Pollutant Discharge Elimination System (NPDES) permit. 33 U.S.C. § 1311(a) (2006).

114 The Clean Air Act authorizes EPA to regulate airborne contaminants harmful to human health. *See* 42 U.S.C. §§ 7401–7431 (2006). Under the statute, major emitters of airborne contaminants must obtain a permit before such emissions may occur. 42 U.S.C. § 7661(a) (establishing permit system). EPA had authority to issue Clean Air Act permits for Shell's exploratory season, but BOEM will generally make future permitting decisions. *See* DEP'T OF THE INTERIOR, REPORT ON SHELL'S 2012 EXPLORATION PROGRAM, *supra* note 23, at 12 n.14.

115 16 U.S.C. §§ 1361–1423h (2006).

116 Taking includes the harassment, hunting, capture, and killing of marine mammals by any private or public party. 16 U.S.C. §§ 1362(13), 1371. NMFS and the USFWS, which share responsibility for MMPA implementation, may issue five-year Letters of Authorization (LOAs) or one-year Incidental Harassment Authorizations (IHAs) for operators incidentally taking marine mammals. *See* 16 U.S.C. § 1371(a)(5)(A)(i) (providing for five-year LOAs and annual site-specific authorizations); *id.* § 1371(a)(5)(D)(i) (providing for one-year IHAs).

117 16 U.S.C. §§ 703–712 (2006).

118 16 U S.C. §§ 1451–1466 (2006). See *supra* note 53, for analysis of CZMA in the context of OCSLA. See Doremus, *supra* note 32, at 258, for an explanation of how the CZMA empowers states to develop coastal zone management plans with which federal activities must generally be consistent. *See also* Kalen, *supra* note 6, at 170–71 (reviewing the limitations of CZMA).

119 46 U.S.C. §§ 3301–3318 (2006) (covering, among other things, offshore supply vessels and oil spill response vessels); 43 U.S.C. § 1333 (2006) (governing drilling installation permanently or temporarily attached to the seabed).

120 16 U.S.C. §§ 1801–1891(d) (2006).

company liability after the *Deepwater Horizon* disaster.[121] Others, such as the Clean Air Act and Coast Guard requirements, came into play during Shell's 2012 exploratory drilling season.[122]

As the above summary suggests, the medley of laws governing offshore drilling is multilayered and complex.[123] The legal framework provides for at least *some* liability, *some* regulatory oversight, and many points of engagement for resourceful groups opposed to offshore drilling. Nevertheless, it failed to prevent the *Deepwater Horizon* disaster from occurring. I consider how to improve upon the framework in subsequent Parts of this piece.

III. HISTORICAL BACKGROUND ON OIL DRILLING IN U.S. ARCTIC WATERS

Having sketched the law governing offshore drilling generally, this piece turns to the Arctic experience. I trace four phases in time: a period of minimal exploratory drilling during the 1980s and 1990s; renewed industry interest starting in 2005; Shell's 2012 exploratory drilling season; and projections for the future. For each phase, the Arctic's extreme conditions have presented obstacles.

A comparative note before proceeding: In addition to the United States, other countries have also dipped their toes in Arctic waters.[124] The two countries that have moved most aggressively are Russia and Norway. In Russia, following repeated delays, state-owned oil company Gazprom recently launched an Arctic commercial project.[125] The Gazprom project has an ice-resistant drilling platform, billed as the world's first ever.[126] Another Russian state-owned oil company, Rosneft, entered into a strategic agreement with ExxonMobil to develop additional offshore oil fields in the Russian Arctic.[127] In Norway, state-owned oil company Statoil has operated

121 *See supra* note 102.

122 *See infra* Part III.C.

123 *See* Hari M. Osofsky, *Multidimensional Governance and the BP Deepwater Horizon Oil Spill*, 63 FLA. L. REV. 1077, 1105–06 (2011) (discussing the complex nature of a fragmented and multigovernmental response to the oil spill); *see also* BRATSPIES ET AL., *supra* note 90 (discussing the federal government's multilayered response to the *Deepwater Horizon* spill, especially in the context of worker safety during the cleanup).

124 Other points of comparison include the waters near Antarctica, which remain free of offshore drilling to date. Protocol on Environmental Protection to the Antarctic Treaty, art. 7, Oct. 4, 1991, S. TREATY DOC. No. 102-22 (1992), 30 I.L.M. 1461.

125 *Gazprom Delays Arctic Oilfield Launch Again—Source*, REUTERS, Sept. 21, 2012, http://www.reuters.com/article/2012/09/21/gazprom-prirazlomnoye-idUSL5E8KL1LJ20120921 (last visited July 26, 2014) (discussing delays); Gazprom, *Alexey Miller: Gazprom Has Pioneered the Russian Arctic Shelf Development*, Dec. 20, 2013, http://www.gazprom.com/press/news/2013/december/article181251/ (last visited July 26, 2014).

126 *"Prirazlomnaya" To Launch a "Drilling Campaign" on the Russian Arctic Shelf*, OIL & GAS EURASIA, Sept. 21, 2012, http://www.oilandgaseurasia.com/en/tech_trend/%E2%80%9Cprirazlomnaya%E2%80%9D-launch-%E2%80%9Cdrilling-campaign%E2%80%9D-russian-arctic-shelf (last visited July 26, 2014); Gazprom, *supra* note 125.

127 Oil & Gas Journal Editors, *Rosneft, ExxonMobil Reach Milestones in Strategic Agreement*, OIL & GAS J., June 21, 2013, http://www.ogj.com/articles/2013/06/rosneft-exxonmobil-reach-milestones-in-strategic-agreement.html (last visited July 26, 2014) (outlining the

an offshore natural gas facility north of the Arctic Circle since 2007.[128] Unlike operations in U.S. Arctic waters, the Statoil facility is bathed by warmer Gulf Stream waters, free of ice year-round, and situated near significant population centers.[129] In June 2013, Norway agreed to license oil and gas exploration in a colder region—the eastern Barents Sea—but industry operations are several years away.[130] Also in the planning or licensing stages are offshore drilling projects in Canada,[131] Denmark (in Greenland), and Iceland.[132] These countries' experiences in the Arctic, brief as they are, inform the U.S. regulatory approach. With these comparative contexts in mind, this piece next details the U.S. Arctic experience specifically.

A. Initial U.S. Exploratory Activities

U.S. offshore drilling in the Beaufort and Chukchi Seas, though not wholly new, is a sporadic and recent phenomenon.[133] Following a major oil

companies' plans to develop offshore oil drilling projects in the Russian Arctic's Chukchi, Kara, and Laptev Seas); Zain Shauk, *Exxon Mobil Grows Arctic Reach in Russia*, FUEL FIX, Feb. 13, 2013, http://fuelfix.com/blog/2013/02/13/exxon-mobil-grows-arctic-reach-in-russia/ (last visited July 26, 2014).

128 The development project, named Snøhvit ("Snow White" in Norwegian), is operated by Statoil, Norway's state-owned oil company in the Arctic's Barents Sea. Statoil, *Snøhvit*, http://www.statoil.com/en/ouroperations/ explorationprod/ncs/snoehvit/pages/default.aspx (last visited July 26, 2014). In addition to Snøhvit, Statoil has done exploratory gas drilling in the surrounding Barents Sea. Statoil, *Successful Appraisal of the Skrugard Discovery*, http://www.statoil.com/en/NewsAndMedia/News/2012/Pages/06Mar_Skrugard_appraisal.aspx (last visited July 26, 2014).

129 Carol E. Dinkins et al., *United States: The Potential Effect of Environmental Regulations, Citizen Suits on the Costs of Doing Business in the Arctic: A Comparison of U.S. and Norwegian Approaches*, OIL, GAS & ENERGY L. INTELLIGENCE, Feb. 2012, at 1, 3, *available at* http://www.velaw.com/uploadedFiles/VEsite/Resources/PotentialEffectsEnvironmentalRegulationArctic.pdf; Joel Marshall, *Opportunity, Challenge Meet on Arctic Horizon*, J. OF PETROLEUM TECH., May 2012, at 56.

130 *Norway Opens More Arctic Waters to Oil Exploration*, REUTERS, June 19, 2013, http://www.reuters.com/article/2013/06/19/norway-exploration-idUSL5N0EU2RI20130619 (last visited July 26, 2014); Richard Milne, *Statoil Delays Key Arctic Project*, June 30, 2014, http://www.ft.com/cms/s/0/9d138654-003e-11e4-8aaf-00144feab7de.html#axzz36AOfll00 (last visited July 26, 2014).

131 *See Canada Reviews Arctic Drilling Safety*, U. PRESS INT'L, July 30, 2013, http://www.upi.com/Business_News/Energy-Resources/2013/07/30/Canada-reviews-arctic-drilling-safety/UPI-10051375184416/ (last visited July 26, 2014) (quoting Roland George, a member of the Canadian National Energy Board (NEB), as saying, "No applications for operations authorizations have yet been submitted to the NEB for arctic offshore drilling."); Dawson, *supra* note 18 (noting that a consortium of oil companies "has submitted a project description . . . and is engaged in preliminary consultations with various Canadian regulatory authorities").

132 DEP'T OF THE INTERIOR, REPORT ON SHELL'S 2012 EXPLORATION PROGRAM, *supra* note 23, at 7.

133 This account of Arctic offshore drilling differs from popular narratives on the subject. As Michael Burger explains, one narrative, the oil industry has painted drilling as a routine activity, while environmental groups characterize the Arctic as an untouched wilderness. *See* BURGER, *supra* note 19, at 11–23. These narratives have played out in litigation on offshore drilling and help frame the regulatory debate. *See infra* notes 153–155 and accompanying text.

discovery in northern Alaska in 1968,[134] the oil industry began drilling in the Beaufort and Chukchi Seas in 1981.[135] Companies drilled thirty-one exploratory wells through the mid-1990s[136] before nearly stopping drilling altogether.[137] (By comparison, the oil industry drilled 15,138 wells in the Gulf of Mexico OCS between 1971 and 2010.)[138] With the exception of some shallow-water projects immediately next to shore, none of the Arctic exploratory activities ever proceeded to development.[139]

This initial phase foundered for a variety of reasons. For one, exploration did not suggest the existence of commercially viable oil deposits, a risk common to such activities generally.[140] Another explanation

134 The discovery of the Prudhoe Bay field is the 18th largest in the history of the oil industry. *See* BP, FACT SHEET: PRUDHOE BAY 1 (2006), *available at* https://dec.alaska.gov/spar/perp/response/sum_fy06/060302301/factsheets/060302301_factsheet_PB.pdf. As a result of this discovery, the oil industry constructed an 800-mile pipeline from the Prudhoe Bay to Valdez, Alaska. ALEYESKA PIPELINE SERVICE CO., TRANS ALASKA PIPELINE SYSTEM FACTS 5, 31 (2013), *available at* http://www.alyeska-pipe.com/assets/uploads/pagestructure/NewsCenter_MediaResources_FactSheets_Entries/635078372894251917_2013AlyeskaTAPSFactBook.pdf. Two serious incidents have resulted from the transport of Prudhoe Bay oil: The *Exxon Valdez* ran aground in the Prince William Sound in 1989, and in 2006 a pipeline in Alaska's North Slope spilled oil. *See* NAT'L COMM'N REPORT, *supra* note 1, at 222 (discussing spills and the fines and restitution that followed). Another part of Alaska's North Slope has also been targeted for development: The Arctic National Wildlife Refuge (ANWR) east of the Prudhoe Bay area. *See* Elizabeth Shogren, *For 30 Years, a Political Battle over Oil and ANWR*, NAT'L PUB. RADIO, Nov. 10, 2005, http://www.npr.org/templates/story/story.php?storyId=5007819 (last visited July 26, 2014) (chronicling efforts to drill in ANWR). ANWR is home to a wide range of species, including the calving ground for approximately 170,000 caribou. FWS, *Caribou*, http://arctic.fws.gov/caribou.htm (last visited July 26, 2014). ANWR remains closed to oil and gas development at present. Nice Snow, *Watching Government: Alaska's ANWR Reminder*, OIL & GAS J., Mar. 24, 2014, http://www.ogj.com/articles/print/volume-112/issue-3c/general-interest/watching-government-alaska-s-anwr-reminder.html (last visited July 26, 2014).

135 Nat'l Comm'n on the BP Deepwater Horizon Oil Spill and Offshore Drilling, *The Challenges of Oil Spill Response in the Arctic* 3 (Staff Working Piece No. 5, 2010), *available* at http://permanent.access.gpo.gov/gpo179/Working%20Paper.Arctic.For%20Release_0.pdf [hereinafter Nat'l Comm'n Staff Report on the Arctic].

136 James B. Regg et al., *Operating Requirements for and Historical Operations of Arctic Offshore Drilling Systems in the United States*, 28 HYDROTECHNICAL CONSTRUCTION 161, 162 (1994) (noting that 31 Arctic wells had been drilled as of 1994); J.B. REGG & R.Y. KURANEL, MINERALS MANAGEMENT SERVICE REGULATION OF FLOATING DRILLING UNIT OPERATIONS IN THE BEAUFORT AND CHUKCHI OUTER CONTINENTAL SHELF (1992) (noting that 29 Arctic wells had been drilled as of 1992).

137 *See* DEP'T OF THE INTERIOR, REPORT ON SHELL'S 2012 EXPLORATION PROGRAM, *supra* note 23, at 8 ("Prior to [the 2012] summer, only three exploratory wells had been drilled in the Alaska OCS in the past 18 years . . . .").

138 BOEM, CHUKCHI SEA ENVIRONMENTAL ASSESSMENT, *supra* note 67, at A-10.

139 Regg et al., *supra* note 136, at 161; *see also* USGS, ARCTIC REPORT, *supra* note 11, at 20 (detailing the shallow-water projects in the Prudhoe Bay); Bureau of Ocean Energy Mgmt., *BP Exploration (Alaska) (BPXA) – Northstar*, http://www.boem.gov/About-BOEM/BOEM-Regions/Alaska-Region/Leasing-and-Plans/Plans/BP-North-Star.aspx (last visited July 26, 2014) (detailing one such project).

140 *See* DEP'T OF ENERGY, ALASKA NORTH SLOPE OIL AND GAS: A PROMISING FUTURE OR AN AREA IN DECLINE? 2-4 (2009) (noting that exploratory drilling was particularly unsuccessful in the Arctic, and that one such failed drilling well, or "dry well," is "the most expensive dry well ever

is the public relations fallout from the 1989 *Exxon Valdez* disaster in Alaska's Prince William Sound.[141] Difficult operating conditions in the Arctic also played a role.[142] Despite no major spills[143]—which is unsurprising in light of the few wells drilled and the relative infrequency of such events[144]—MMS repeatedly suspended exploratory activities because of ice floes, extreme weather, and migration of the endangered bowhead whale near drilling sites.[145]

B. Resurgence of Industry Interest

Following a long hiatus, the oil industry returned with vigor to the Arctic in the early 2000s.[146] A 2005 lease sale for the Beaufort Sea was the area's most successful in seventeen years,[147] and a 2008 lease sale for the Chukchi Sea netted $2.7 billion.[148] Shell acquired multiple leases during both lease sales, spending $2.1 billion on Chukchi Sea leases alone.[149] Also purchasing Chukchi Sea leases were ConocoPhillips, Repsol, and Statoil.[150]

drilled. . . ."); NAT'L COMM'N REPORT, *supra* note 1, at 36 (stating that in the 1980s and 1990s, "[e]verywhere operators drilled offshore Alaska . . . they came up empty").

141 *See* NAT'L COMM'N REPORT, *supra* note 1, at 36. Interestingly, the *Exxon Valdez* disaster dampened industry appetite for Arctic drilling even though the disaster occurred more than 500 miles south of the Arctic Circle.

142 *See id.* at 35.

143 *See* BOEM CHUKCHI SEA ENVIRONMENTAL ASSESSMENT, *supra* note 67, at A-2.

144 For analysis of the frequency of catastrophic oil spills, see, for example, Eckle et al., *supra* note 2, at 13,006 ("The resulting frequency of this analysis is 23 years with an uncertainty interval of 10–177 years," based on an analysis of accidental oil spills between 1974 and 2010).

145 *See* Regg et al., *supra* note 136, at 162.

146 Several factors fueled renewed interest in Arctic offshore drilling, including higher U.S. government estimates of the potential resources, improved technologies for extracting oil from remote locations, and expectations that the melting ice cap would lead to longer open water seasons and lower risk of ice collisions. *See* Margaret Kriz Hobson, *With Federal Green Light, Shell Hits the Gas on Arctic Plans*, E & E PUBLISHING, Dec. 19, 2011, http://www.eenews.net/stories/1059957834 (last visited July 26, 2014); CHARLES EBINGER ET AL., BROOKINGS INSTITUTION, OFFSHORE OIL AND GAS GOVERNANCE IN THE ARCTIC, x (2014), *available at* http://www.brookings.edu/~/media/Research/Files/Reports/2014/03/offshore%20oil%20gas%20governance%20arctic/Offshore%20Oil%20and%20Gas%20Governance%20web.pdf; *see also The Melting North*, ECONOMIST, June 16, 2012, http://www.economist.com/node/21556798 (last visited July 26, 2014) (noting that polar ice pack declined by 8% per decade between the 1970s and 1990s, and that in 2007 the Canadian Northwest Passage was "ice-free for the first time in memory").

147 *Beaufort Sea Oil Lease Sale Most Successful in 17 Years*, OFFSHORE, Mar. 31, 2005, http://www.offshore-mag.com/articles/2005/03/beaufort-sea-oil-lease-sale-most-successful-in-17-years.html (last visited July 26, 2014) [hereinafter *Beaufort Sea Oil Lease Sale*].

148 *See* DEP'T OF THE INTERIOR, REPORT ON SHELL'S 2012 EXPLORATION PROGRAM, *supra* note 23, at 9. By comparison, MMS received $46.73 million for the 2005 Beaufort Sea lease sale. *Beaufort Sea Oil Lease Sale*, *supra* note 147. Part of the reason the Chukchi Sea lease sale was more successful is that reevaluations of the Arctic's resource potential postdated the Beaufort Sea lease sale and predated the Chukchi Sea lease sale. *See* NAT'L COMM'N REPORT, *supra* note 135, at 301.

149 NAT'L COMM'N REPORT, *supra* note 1355, at 301.

150 Alan Bailey, *BOEM Affirms 2008 Chukchi Sea Lease Sale; Shell Plan Already In*, PETROLEUM NEWS, Oct. 9, 2011, http://www.petroleumnews.com/pntruncate/546729134.shtml (last visited July 26, 2014); Braden Reddall & Joseph Radford, *Repsol Suffers Spill at Alaska*

Though these latter companies took no immediate actions on their leases,[151] Shell moved aggressively toward exploration. Shell filed Exploration Plans for the Beaufort and Chukchi Seas in 2007 and 2009, respectively.[152] Both Exploration Plans received approval from MMS,[153] but oil exploration did not then proceed because of the *Deepwater Horizon* disaster, multiple NEPA suits,[154] and a Clean Air Act action challenging permits that were issued.[155] Following resolution of these suits, Shell submitted revised Exploration Plans in 2011.[156] Shortly thereafter, BOEM[157] approved the Exploration Plans[158] and issued Environmental Assessments in

Exploration Well – State, REUTERS, Apr. 9, 2013, http://www.reuters.com/article/2013/04/10/us-repsol-alaska-idUSBRE93900X20130410 (last visited July 26, 2014).

151 *See* Alan Bailey, *Explorers 2012: Statoil Takes Careful Approach*, PETROLEUM NEWS, Oct. 9, 2011, http://www.petroleumnews.com/pntruncate/257976350.shtml (last visited July 26, 2014) (discussing Statoil's plans to "watch[] progress of Shell's drilling project"); CONOCOPHILLIPS, FACT SHEET–ALASKA (2013), *available at*, http://www.conocophillips.com/investor-relations/fact-sheet-financial-data/Documents/PDF/SMID_392_FactSheet-Alaska.pdf (discussing "exploration prospects offshore in the Chukchi and Beaufort Seas"); Braden Reddall & Joseph Radford, *supra* note 150 ("Though Repsol holds leases in the Beaufort and Chukchi seas, offshore exploration plans have not yet been made . . . .").

152 Alaska Wilderness League v. Kempthorne, 548 F.3d 815, 818–19 (9th Cir. 2008) (discussing initial filing of the Beaufort Sea Exploration Plan in November 2006 and MMS's decision to deem it submitted in January 2007); DEP'T OF THE INTERIOR, REPORT ON SHELL'S 2012 EXPLORATION PROGRAM, *supra* note 23, at 10.

153 DEP'T OF THE INTERIOR, REPORT ON SHELL'S 2012 EXPLORATION PROGRAM, *supra* note 23, at 10.

154 Environmental and indigenous groups brought suit against Shell's drilling plans at several stages of NEPA review. *See* BURGER, *supra* note 19, at 11–23 (chronicling several of these challenges); Michael Burger, *Emerging Issues in the Arctic Part 7: Coda*, ENVTL. L. PROF BLOG (Sept. 26, 2012), http://lawprofessors.typepad.com/environmental_law/2012/09/emerging-issues-in-the-arctic-part-7-coda.html (last visited July 26, 2014) (characterizing the litigation as a form of "assault litigation"). In 2008, these groups successfully challenged approval of Shell's Exploration Plan for the Beaufort Sea in the Ninth Circuit. *See Alaska Wilderness League*, 548 F.3d at 817. However, the Ninth Circuit later withdrew its opinion and dismissed the appeal as moot when Shell temporarily withdrew its Exploration Plan. *See* Alaska Wilderness League v. Salazar, 571 F.3d 859, 860 (9th Cir. 2009). Shell then submitted revised Exploration Plans, which were again challenged in the Ninth Circuit, this time unsuccessfully. *See* Native Vill. of Point Hope v. Salazar, 378 F.App'x. 747, 748 (9th Cir. 2010). A later challenge to the EIS issued in conjunction with the Exploration Plan was successful, scuttling plans for Shell in 2014. *See infra* note 184 and accompanying text. In addition, environmental groups brought an action against the lease sale for the Chukchi Sea. The court initially ruled in favor of the environmental groups but later found that the lease sale was proper following additional NEPA review. *See* DEP'T OF THE INTERIOR, REPORT ON SHELL'S 2012 EXPLORATION PROGRAM, *supra* note 23, at 9–10.

155 *See* Resisting Envtl. Destruction on Indigenous Lands, Redoil v. EPA, 704 F.3d 743, 746–47 (9th Cir. 2012) (chronicling the initially successful Clean Air Act challenge); DEP'T OF THE INTERIOR, REPORT ON SHELL'S 2012 EXPLORATION PROGRAM, *supra* note 23, at 12–13; Charles W. Schmidt, *Offshore Exploration in the Arctic: Can Shell's Oil-Spill Response Plans Keep Up?*, 120 ENVTL. HEALTH PERSP. A194, A196 (2012) (discussing litigation); Selby, *supra* note 19, at 547–51.

156 *See* SHELL, BEAUFORT SEA EXPLORATION PLAN, *supra* note 50; SHELL, CHUKCHI SEA EXPLORATION PLAN, *supra* note 50.

157 As discussed above, BOEM had replaced MMS as the entity approving Exploration Plans after the *Deepwater Horizon* disaster. *See supra* note 7 and accompanying text.

158 Letter from Jeff Walker, Reg'l Supervisor, Field Operations, BOEM, to Susan Childs, Shell Offshore, Inc. (Aug. 4, 2011) [hereinafter BOEM, Beaufort Sea Exploration Plan Approval], *available at* http://www.boem.gov/uploadedFiles/BOEM/Oil_and_Gas_Energy_Program/Plans/

conjunction with the approvals. Simultaneously with the Exploration Plan process, Shell submitted regional OSRPs for the Beaufort and Chukchi Seas.[159] BSEE approved the plans in early 2012,[160] months before exploratory drilling began.[161]

Regulators approved Shell's 2012 exploratory drilling program subject to several conditions. For the Exploration Plans, Shell proposed, and BOEM agreed, that Shell would drill only when ice was expected to be absent.[162] BOEM added a further requirement that Shell end Chukchi Sea drilling thirty-eight days before ice was expected to encroach.[163] This condition was not imposed for the Beaufort Sea,[164] but BOEM required Shell to suspend Beaufort Sea drilling in mid-August so that Native Alaskans could hunt for nearby whales.[165] Shell committed, in the event of an oil spill, to contain the flow of oil using a specially designed piece of equipment called the "Arctic Containment System" (ACS).[166] Having secured the plan-level approvals,

Regional_Plans/Alaska_Exploration_Plans/2012_Shell_Beaufort_EP/2011_0804_soi.pdf; Letter from David W. Johnson, Reg'l Supervisor, Leasing and Plans, BOEM, to Susan Childs, Shell Gulf of Mexico, Inc. (Dec. 16, 2011) [hereinafter BOEM, Chukchi Sea Exploration Plan Approval], *available at* http://www.boem.gov/uploadedFiles/2011_12_16_10_58_33_BOEM%20Letter%20of%20Conditional%20Approval%20to%20Shell%20for%20Chukchi%20Sea%20Exploration%20Plan%281%29.pdf. Shell submitted the OSRP separately from the Exploration Plan; the latter excludes much of the information in the OSRP. *See* SHELL, BEAUFORT SEA EXPLORATION PLAN, *supra* note 50, at 8-1.

159 SHELL, BEAUFORT SEA REGIONAL EXPLORATION PROGRAM OIL SPILL RESPONSE PLAN (2011), *available at* http://www.bsee.gov/OSRP/Beaufort-Sea-OSRP/; SHELL, CHUKCHI SEA REGIONAL EXPLORATION PROGRAM OIL SPILL RESPONSE PLAN (2011), *available at* http://www.bsee.gov/uploadedFiles/BSEE/OSRP/Chukchi%20OSRP%20-%20February%202012.pdf.

160 Letter from David M. Moore, Chief, Oil Spill Response Div., BSEE, to Susan Childs, Shell Offshore, Inc. (Feb. 17, 2012), *available at* http://www.bsee.gov/OSRP/C - - - ; Letter from David M. Moore, Chief, Oil Spill Response Div., BSEE, to Susan Childs, Shell Offshore, Inc. (Mar. 28, 2012), *available at* http://www.bsee.gov/uploadedFiles/BSEE/BSEE_Newsroom/Press_Releases/2012/OSRP%20-%20Beaufort%20Sea%20-%20Shell%20Offshore%20Inc%20-%2028%20March%202012.pdf.

161 In addition, USFWS and NMFS issued Biological Opinions and an Incidental Take Statement to satisfy ESA requirements. DEP'T OF THE INTERIOR, REPORT ON SHELL'S 2012 EXPLORATION PROGRAM, *supra* note 23, at 15–16. Shell received separate authorizations for the incidental take of marine mammals under the MMPA and received an updated National Pollutant Discharge Elimination System permit to discharge pollutants under the CWA. *Id.* at 13–14.

162 BOEM, BEAUFORT SEA ENVIRONMENTAL ASSESSMENT, *supra* note 67, at 39; BOEM, CHUKCHI SEA ENVIRONMENTAL ASSESSMENT, *supra* note 67, at 25.

163 BOEM, Chukchi Sea Exploration Plan Approval, *supra* note 1588, at 2. The average earliest ice encroachment date was November 1. BOEM required that Shell complete operations 38 days before this date. *Id.* The reason for the 38-day buffer is that BOEM estimated that Shell would need 34–38 days to drill a relief well if one were required. BOEM, CHUKCHI SEA ENVIRONMENTAL ASSESSMENT, *supra* note 67, at 7.

164 For the Beaufort Sea, BOEM allowed Shell to drill through October 31. *See* BOEM, Beaufort Sea Exploration Plan Approval, *supra* note 1588, at 2. That BOEM set different end dates for the Beaufort and Chukchi Seas "suggests that BOEM [did] not have a clear policy with respect to the end of the drilling season." Robertson, *supra* note 19, at 122.

165 BOEM, Beaufort Sea Exploration Plan Approval, *supra* note 158, at 2.

166 DEP'T OF THE INTERIOR, REPORT ON SHELL'S 2012 EXPLORATION PROGRAM, *supra* note 23, at 17. The ACS was designed to be "a last line of defense" in the event of a serious blowout. *Id.* Initial measures of defense included mud injection in the well, a blowout preventer to seal the

Shell moved on to the site-specific permits, and to exploratory drilling itself, in mid-2012.

C. Shell's 2012 Exploratory Drilling

Shell's 2012 drilling season was, in several respects, a near disaster, though no major oil spills or loss of life occurred. First, the ACS never deployed. Shell submerged its collection dome during a BSEE-observed performance test and underwater pressure "crushed [the dome] like a beer can," rendering it inoperable.[167] Because Shell could not contain spilled oil, BSEE granted permission to drill only in the shallow part of wells, above where oil and gas resources are found.[168] In a review of Shell's exploratory season, the Department of the Interior attributed the ACS failure to "Shell's lack of rigorous and direct contractor oversight for a complex first-of-its-kind project."[169]

Second, all three of Shell's ships designated for Arctic operations—the ACS support vessel, named the *Arctic Challenger*, and two drillships, named the *Kulluk* and the *Noble Discoverer*—experienced problems.[170] In December 2012, the *Kulluk*—traveling from the Arctic to Seattle—ran aground during

well, and a capping stack, also to seal the well. *Id.*; *see also* Press Release, BSEE, BSEE Issues Approval for Shell Beaufort Sea Oil Spill Response Plan (Mar. 28, 2012), http://www.bsee.gov/BSEE-Newsroom/Press-Releases/2012/BSEE-Issues-Approval-for-Shell-Beaufort-Sea-Oil-Spill-Response-Plan/ (last visited July 26, 2014) (discussing BOEM conditions on Shell's Beaufort Sea project); BSEE, *Fact Sheet: Shell Chukchi Sea Oil Spill Response Plan*, http://www.bsee.gov/BSEE-Newsroom/BSEE-Fact-Sheet/FACT-SHEET--Shell-Chukchi-Oil-Spill-Response-Plan-%28OSRP%29/ (last visited July 26, 2014). The ACS connected to the capping stack as part of a larger "capping and containment system." DEP'T OF THE INTERIOR, REPORT ON SHELL'S 2012 EXPLORATION PROGRAM, *supra* note 23, at 11–12 (identifying, as a condition to Shell drilling in the Beaufort Sea, a "field exercise demonstrating the company's ability to deploy its capping and containment system").

167 John Ryan, *Sea Trial Leaves Shell's Arctic Oil-Spill Gear "Crushed Like a Beer Can,"* KUOW, Nov. 30, 2012, http://www.kuow.org/post/sea-trial-leaves-shells-arctic-oil-spill-gear-crushed-beer-can (last visited July 26, 2014) (quoting from BSEE internal emails stating that the top half of the dome "breached like a whale," sank, then became "crushed like a beer can"). The ACS's containment dome failed after rising to the surface and sinking, creating pressure equalization problems that crushed the dome's upper chambers. DEP'T OF THE INTERIOR, REPORT ON SHELL'S 2012 EXPLORATION PROGRAM, *supra* note 23, at 19.

168 DEP'T OF THE INTERIOR, REPORT ON SHELL'S 2012 EXPLORATION PROGRAM, *supra* note 23, at 16, 19. A new dome reportedly passed a BSEE trial test in March 2013. John Ryan, *Shell's Arctic "Beer Can" Passes Federal Test in Puget Sound*, KUOW, Apr. 23, 2013, http://www.kuow.org/post/shells-arctic-beer-can-passes-federal-test-puget-sound (last visited July 26, 2014).

169 DEP'T OF THE INTERIOR, REPORT ON SHELL'S 2012 EXPLORATION PROGRAM, *supra* note 23, at 31.

170 *See* DEP'T OF THE INTERIOR, REPORT ON SHELL'S 2012 EXPLORATION PROGRAM, *supra* note 23, at 18-23. Shell designated the *Kulluk* for drilling in the Beaufort Sea and the *Noble Discoverer* for drilling in the Chukchi Sea. *See* BOEM, BEAUFORT SEA ENVIRONMENTAL ASSESSMENT, *supra* note 67, at 12; BOEM, CHUKCHI SEA ENVIRONMENTAL ASSESSMENT, *supra* note 677, at 9.

Gulf of Alaska storms.[171] While little oil spilled and no one was injured, the U.S. Coast Guard had to carry out a dangerous helicopter rescue of the *Kulluk*'s crew.[172] In November 2012, the *Noble Discoverer* suffered an engine fire and was towed to shore for repairs, also en route from the Arctic to Seattle.[173] Even before these accidents, the *Kulluk* and *Noble Discoverer* repeatedly violated Clean Air Act permits for nitrogen oxide emissions.[174] As for the *Arctic Challenger*, Shell did not receive Coast Guard certification to use it until October 2012—after the containment dome had already failed—because it had been inactive for ten years and took longer than expected to refurbish.[175] The Department of the Interior's review found that these problems resulted from "Shell not employing its internal marine expertise" and from insufficiently auditing the *Noble Discoverer* in advance of operations.[176]

Third, unexpected ice floes shortened the already brief exploratory drilling season. In early September 2012—nearly two months before the average first date of ice encroachment—a large floe neared one of Shell's drill sites in the Chukchi Sea.[177] Shell moved its ships out of danger before the ice floe arrived and later, after the floe passed, returned to the site.[178] The incident shortened Shell's drilling season and underscored the unpredictability of drilling in Arctic environments.[179]

The many complications during Shell's 2012 exploratory season nearly precluded Shell from searching for oil at all. Shell's goal was to drill up to ten wells in 2012,[180] but only two were drilled, and to much shallower than planned depths.[181] The two wells did not reach oil and gas resources

171 Kalee Thompson, *The Harrowing Helicopter Rescue of the Kulluk Rig*, POPULAR MECHANICS, Jan. 4, 2013, http://www.popularmechanics.com/outdoors/survival/stories/the-harrowing-helicopter-rescue-of-the-kulluk-rig-14940780 (last visited July 26, 2014).

172 *Id.*

173 DEP'T OF THE INTERIOR, REPORT ON SHELL'S 2012 EXPLORATION PROGRAM, *supra* note 23, at 28.

174 *Id.* at 25–26 ("Only once in more than 60 tests had the equipment met the NOx limit . . . ."); Ben Lefevbre & Alison Sider, *EPA Citation Further Muddles Shell's Arctic Plans*, WALL ST. J., Jan. 12, 2013, at A3 ("[T]he company's drilling rigs violated conditions of air-quality permits 32 times."). Floating drillships raise particular air pollution concerns because the drillships continuously emit pollutants for the duration of the exploratory season. *See* Alan Bailey, *More OCS permits: EPA Issues Draft Arctic Air Quality Permits for Shell & ConocoPhillips*, PETROLEUM NEWS, Week of July 31, 2011, http://www.petroleumnews.com/pntruncate/383975618.shtml (last visited July 26, 2014) ("A major point of contention in the appeals over Shell's air quality permits has been the question of defining the periods within which a drillship becomes a stationary emissions source, requiring an air permit, rather than a regular vessel plying the ocean—the quantity of total emissions regulated as part of a drilling operation becomes larger as the stationary source time period lengthens.").

175 DEP'T OF THE INTERIOR, REPORT ON SHELL'S 2012 EXPLORATION PROGRAM, *supra* note 23, at 18–19.

176 *Id.* at 31–32.

177 *Id.* at 22.

178 *Id.* at 22–23.

179 *Id.*

180 *Id.* at 11–12 (four in the Beaufort Sea and six in the Chukchi Sea).

181 Broder, *supra* note 15. These partially drilled wells are known as "top holes." *See* Alan Bailey, *Shell Arctic Season Ends; Top Holes Drilled at Burger, Sivulliq*, PETROLEUM NEWS, Week

underground because of restrictions imposed by BSEE following the ACS failure.[182]

D. Looking Ahead

In the wake of Shell's 2012 drilling season, all exploratory drilling, whether by Shell or anyone else, has been on hold. After the Department of the Interior completed its review of Shell's operations, then-Secretary Ken Salazar stated that Shell would not resume drilling until it could demonstrate its operations would be conducted safely.[183] Shell proposed drilling plans for the 2014 season but then abandoned those plans in January 2014 following an adverse Ninth Circuit decision.[184] Other major companies with interests in U.S. Arctic waters also suspended plans for oil exploration.[185]

This pause is likely temporary. The U.S. government has reiterated its long-term commitment to Arctic offshore drilling.[186] Industry observers expect that oil companies eventually will resume drilling because of the region's resource potential.[187] The suspension thus provides a moment to

of Nov. 4, 2012, http://www.petroleumnews.com/pntruncate/26914361.shtml (last visited July 26, 2014).

182 Clifford Krauss, *Shell Ends Alaska Offshore Drilling for the Year*, N.Y. TIMES, Oct. 31, 2012, http://green.blogs.nytimes.com/2012/10/31/shell-ends-alaska-offshore-drilling-for-the-year/?_php=true&_type=blogs&_r=0 (last visited July 26, 2014); DEPARTMENT OF THE INTERIOR, REPORT ON SHELL'S 2012 EXPLORATION PROGRAM, *supra* note 23, at 16.

183 John M. Broder, *Interior Dept. Warns Shell on Arctic Drilling*, N.Y. TIMES, Mar. 14, 2013, http://www.nytimes.com/2013/03/15/business/global/interior-dept-warns-shell-on-arctic-drilling.html (last visited July 26, 2014) (quoting then-Department of the Interior Secretary Ken Salazar as saying that "Shell screwed up in 2012," that future operations were paused, "and we're not going to let them screw up whenever their pause is removed unless they have these [safety] systems in place"). Shell had previously announced that it would not pursue exploratory activities in 2013.

184 *See* Sean Cockerham, *Shell Won't Drill Offshore in Alaska Arctic This Year*, ANCHORAGE DAILY NEWS, Jan. 30, 2014, http://www.adn.com/2014/01/30/3298785/shell-abandons-plans-for-alaska.html (last visited July 26, 2014). The Ninth Circuit held in January 2014 that BOEM's reliance on the EIS for the Chukchi Sea was in part arbitrary and capricious. *See* Native Vill. of Point Hope v. Jewell, 740 F.3d 489, 502–05 (9th Cir. 2014).

185 *See* Lisa Demer, *Oil Company Delays Exploration in Arctic Waters Off Alaska*, ANCHORAGE DAILY NEWS, Sept. 6, 2012, http://www.adn.com/2012/09/06/2614308/oil-company-delays-arctic-exploration.html (last visited July 26, 2014) (discussing Statoil's decision to delay further steps until at least 2015); Jennifer A. Dlouhy, *ConocoPhillips Puts Arctic Drilling Plans on Ice*, FUEL FIX, Apr. 10, 2013, http://fuelfix.com/blog/2013/04/10/conocophillips-puts-arctic-drilling-plans-on-ice/ (last visited July 26, 2014) (discussing ConocoPhillips' delay); Radford, *supra* note 150 (discussing Repsol's plans).

186 Broder, *supra* note 1833; Yereth Rosen, *Oil Work to Go on in Alaska's Arctic Waters, Without Drilling*, REUTERS, June 28, 2013, http://www.reuters.com/article/2013/06/28/alaska-oil-offshore-idUSL2N0F419620130628 (last visited July 26, 2014) (stating that BOEM director Tommy Beaudreau is "still bullish on energy exploration in the waters off northern Alaska, and the relative lull in activity this year should not be seen as a harbinger of future events, given ongoing interest from the industry").

187 *See* Schmidt, *supra* note 154, at A194 (citing industry observers' belief in 2012 that oil companies eventually will move to development); Jessica Tippee, *E&P Activity Rises in Arctic, Sub-Arctic Regions*, OFFSHORE, May 2013, at 70, 70–72 (discussing expected growth in Arctic oil exploration and development, including in the United States, through 2018).

consider the future of Arctic offshore drilling, both at the exploration and development stages.[188] Part IV next reviews the legal literature on offshore drilling to see what lessons it might hold for the Arctic.

IV. PREVIOUS SCHOLARSHIP ON OFFSHORE DRILLING

Offshore drilling has provided rich fodder for legal scholarship, particularly since the *Deepwater Horizon* disaster. This Part reviews the literature to tease out remaining theoretical questions; subsequent Parts consider whether the Arctic offers answers.

Commentary has identified several characteristics of the offshore drilling industry. First, offshore drilling has the potential to cause disastrous harm, a potential that manifested itself during the *Deepwater Horizon* disaster.[189] Second, drilling activities are complex—both in terms of the technologies employed and their ecosystem effects—creating handicaps for regulators attempting to stay up to speed.[190] Third, the oil industry has historically had a cozy relationship with offshore drilling regulators, raising the specter of industry influence or outright corruption—both variants of "agency capture."[191] These features are not unique to offshore drilling—other

188 Commercial development, though at least 10–15 years away, would be year round and dwarf exploratory activities in size and scale. *See* Schmidt, *supra* note 154, at A194 ("Exploration merely sets the stage for the much greater threat that comes later, at the point of development."); Kristin Nelson, *Chukchi Would Be Huge: ConocoPhillips Says Offshore Development Would Take Years, Cost Multibillions*, PETROLEUM NEWS, Nov. 21, 2010, http://www.petroleumnews.com/pntruncate/367556618.shtml (last visited July 26, 2014) (discussing 10- to 15-year timeline and referring to commercial oil development in the region as a "multibillion-dollar project"). To produce oil commercially, oil companies would construct new production facilities and underwater buried pipelines for transporting the oil to Alaska's North Shore. *Id.* (stating that, according to ConocoPhillips vice president Geoff Haddad, transporting oil from the Chukchi Sea to Alaska's North Slope "would be a multibillion-dollar project involving an offshore hub, a buried pipeline running seventy or eighty miles to shore, and a 200-mile line across the National Petroleum Reserve-Alaska"); *see also* GOODYEAR ET AL., *supra* note 19, at 3 (citing MMS reports that development in the Chukchi Sea may lead to the construction of up to 200 miles of offshore pipeline); Jennifer A. Dlouhy, *Arctic Project Carries Alaska-Size Challenges*, FUEL FIX, Nov. 12, 2012 (summarizing challenges in constructing offshore pipeline).

189 *See* LYNN SCARLETT ET AL., RESOURCES FOR THE FUTURE, RISK MANAGEMENT PRACTICES: CROSS-AGENCY COMPARISON WITH MINERALS MANAGEMENT SERVICE 21 (2011) ("[S]pills greater than 1,000 barrels account for just 0.05 percent of spills but for 79 percent of the total volume spilled."); Viscusi & Zeckhauser, *supra* note 99, at 1720–21 (characterizing offshore drilling activities as having a "fat-tail" distribution where there is a small, but important, risk of catastrophic effects).

190 *See, e.g.*, Michael Livermore, *Patience Is an Economic Virtue: Real Options, Natural Resources, and Offshore Oil*, 84 COLO. L. REV. 581, 605–10 (2013) (discussing ecosystem and technological uncertainties); Viscusi & Zeckhauser, *supra* note 99, at 1720–21 (remarking that decision making in the offshore drilling industry is constantly evolving because of new technologies).

191 *See, e.g.*, Alyson Flournoy, *Three Meta-Lessons Government and Industry Should Learn from the BP Deepwater Horizon Disaster and Why They Will Not*, 38 B.C. ENV. AFF. L. REV. 281 (2011) (discussing inadequacy of industry self-regulation); Oliver A. Houck, *Worst Case and the Deepwater Horizon Blowout: There Ought To Be a Law*, 24 TUL. ENVTL. L.J. 1, 12–18 (2010)

high-risk industries, such as nuclear power or prescription drugs, share some similarities[192]—but a cottage industry of post-*Deepwater Horizon* scholarship has explored their particular interaction here.[193]

To organize the discussion, this piece divides the scholarship into three groups, each of which reflects a persistent and interrelated problem in regulatory theory[194] and principal–agent analysis.[195] The first group centers on the problem of differing or asymmetric preferences between government and firms,[196] which are common everywhere but particularly salient in the

(suggesting "willful blindness" among regulators); Osofsky, *supra* note 1233, at 1096–99 (discussing "public-private dynamics"); Zygmunt J.B. Plater, *Learning from Disasters: Twenty-One Years After the Exxon Valdez Oil Spill, Will Reactions to the Deepwater Horizon Blowout Finally Address the Systemic Flaws Revealed in Alaska?*, 40 ENVTL. L. REP. 11041, 11042 (2010) ("The 'revolving door' between industry and regulators produced what political scientists often describe as 'agency capture.'"); Zygmunt J.B. Plater, *The* Exxon Valdez *Resurfaces in the Gulf of Mexico . . . and the Hazards of "Megasystem Centripetal Di-Polarity,"* 38 B.C. ENVTL. AFF. L. REV. 389, 392–93 (2011) (arguing that industry and government become enmeshed in a "di-polar" system characterized by complacency and neglect). For broader discussion of agency capture in the context of regulated industries, see Mark Seidenfeld, *The Irrelevance of Politics for Arbitrary and Capricious Review*, 90 WASH. U. L. REV. 141, 154–55 (2012) (discussing interest group model for regulated industries and the effect of day-to-day interactions with industry on agency decisions).

192 *See infra* Part VII.A (comparing offshore drilling to other high-risk industries).

193 Offshore drilling is a topic crossing many scholarly fields. *See* NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, DEEPWATER HORIZON: A PRELIMINARY BIBLIOGRAPHY OF PUBLISHED RESEARCH AND EXPERT COMMENTARY, (2014), *available at* http://www.lib.noaa.gov/research tools/subjectguides/dwh_bibliography.pdf (cataloguing the many relevant works). Therefore, while this review focuses on legal scholarship addressing offshore drilling, it references and informs other contexts as well.

194 For a sampling of this literature, see STEVEN SHAVELL, FOUNDATIONS OF ECONOMIC ANALYSIS OF LAW 572–73 (2004) (providing overview of government oversight that draws in significant part on the law and economics school); Matthew D. McCubbins & Thomas Schwartz, *Congressional Oversight Overlooked: Police Patrols versus Fire Alarms*, 28 AMER. J. POL. SCI. 165, 166 (1984) (developing a political science-based analytical framework for congressional oversight of government agencies); Andrei Shleifer, *Efficient Regulation*, (Nat'l Bureau of Econ. Research, Working Paper 15651, 2010), *available at* http://www.nber.org/papers/w15651.pdf?new_window=1 (explaining the existence of regulation, as opposed to other legal instruments, by reference to economic theory).

195 The principal–agent lens is one of the more common approaches for understanding the relationship between government and firms. *See, e.g.*, Jean-Jacques Laffont, *Regulation, Moral Hazard and Insurance of Environmental Risks*, 58 J. PUB. ECON. 319, 320 (1995) (tying principal–agent model to regulatory theory); Jeffrey T. Macher et al., *Regulator Heterogeneity and Endogenous Efforts to Close the Information Asymmetry Gap*, 54 J.L. & ECON. 25, 26–27 (2011) (discussing standard assumptions of principal–agent model when applied to regulators and firms); Gary J. Miller, *The Political Evolution of Principal-Agent Models*, 8 ANN. REV. POL. SCI. 203, 216–23 (2005) (analyzing limitations of the principal-agent model and its continuing application).

196 *See, e.g.*, Miller, *supra* note 195, at 205–06 (listing "[a]symmetry in preferences" between the principal and agent as a canonical assumption of the principal–agent model). The interests of government do not necessarily reflect those of society generally. For instance, in the immediate aftermath of the *Deepwater Horizon* spill, the Coast Guard was focused on "tripling" its manpower in response to public outcry, even though it arguably came at the expense of a more careful organizational response. *Nat'l Comm'n Report on Unified Command*, *supra* note 84, at 7; *Obama Pledges to Triple Oil Response Manpower in Gulf*, BBC, May 28, 2010, http://www.bbc.co.uk/news/10179369 (last visited July 26, 2014).

offshore oil industry. Scholarship on this topic, typically in tort and insurance law, advances liability and tax-based solutions for aligning interests, including major reforms of OPA. The second group considers another paradigmatic issue in government–firm relations: the pervasive information asymmetries favoring firms, which are pronounced in the offshore drilling context because of the sophisticated and rapidly changing technologies involved.[197] Much of this commentary advocates information-forcing tools to reduce the informational imbalances. The third, and perhaps most divided, category of scholarship steps away from the government–firm dynamic to look at the deficiencies in regulators themselves due to agency capture by the oil industry or inherent limitations in the regulator's institutional capacity to provide effective oversight. Commentary in this vein calls for NEPA sunlighting of agency decision making, institutional reforms to reduce the risk of regulatory capture, and searching judicial review. Each of these groups of scholarship is discussed in greater detail below.[198]

A. Scholarship on Differing Goals Between Government and Firms

Various works have examined the diverging goals of oil companies and society. The most commonly cited reason for this divergence is that firms, as a whole, prioritize profit maximization,[199] whereas society places higher value on environmental and social concerns.[200] Because social and business goals differ, government, acting as society's rough proxy,[201] employs policy tools to induce a firm to do the government's bidding.[202] Among the more

197 *See* Miller, *supra* note 195, at 205 (discussing asymmetry in information as another core assumption of the principal–agent model).

198 Some research on the *Deepwater Horizon* disaster does not cleanly fit within any of these categories. *See, e.g.*, Macey, *supra* note 85 (exploring crisis management in the aftermath of the disaster).

199 *See, e.g.*, Viscusi & Zeckhauser, *supra* note 99, at 1727. This characterization of oil company goals is a simplification. An oil company consists of many individuals, each of whom has goals that may or may not align with the firm-wide objective. *See* I. B. Dahle et al., *Major Accidents and Their Consequences for Risk Regulation*, *in* ADVANCES IN SAFETY, RELIABILITY AND RISK MANAGEMENT 33, 36 (Christophe Bérenguer et al. eds., 2012) (describing how the safety culture of a company depends on "management commitment to safety . . . and colleague involvement"). Goals other than profit may also matter, such as reputation, though research suggests that reputation effects on oil company behavior are modest. *See* Cohen et al., *supra* note 98, at 1878 (noting that most empirical work has not shown that environmental violations impose a reputational penalty on firms).

200 *See* Viscusi & Zeckhauser, *supra* note 99, at 1727.

201 In a subsequent subpart, I review scholarship that questions whether government acts in society's interests. *See infra* Part IV.C; *see also supra* note 189 and accompanying text.

202 A firm is comprised of multiple individuals in chains of principal–agent relationships. Managers who make decisions on behalf of a firm may not fully internalize the risks faced by the firm's shareholders. *See, e.g.*, Cohen et al., *supra* note 98, at 1904–06 (discussing disconnect between managers and shareholders). Some scholarship has explored the benefits of corporate governance reforms to U.S. oil companies so that preferences between shareholders and managers are better aligned. *See id.* It is worth noting, in this context, that corporate governance regulations may not apply to private-held or foreign-state-owned oil companies, and such companies are important players in offshore drilling. *Id.* at 1905–06.

conventional tools is to make a firm liable[203] for the environmental and social harms it causes.[204] Liability offers important advantages relative to regulation because it does not require the government to have extensive knowledge of a firm's activities to function effectively.[205] Rather, liability causes the firm to at least partially internalize incentives for proper care.[206] This aspect of liability is particularly relevant for complex industries like offshore drilling, where it is difficult for government to obtain the requisite knowledge.[207] Another instrument is tax, which may have similar effects to liability to the extent the tax is calibrated to the relevant risks.[208]

Much of the commentary views the current offshore oil spill liability regime as flawed.[209] Commentary focuses on four problems in particular: OPA's outdated and patently insufficient $75 million liability cap;[210]

203 Oil spills affect unwitting victims, creating a justification for tort remedies.

204 *See* Cohen et al., *supra* note 98, at 1887–93 (discussing the effects of liability on deterring a firm from committing an oil spill). An ex post liability system may also provide compensation for those harmed by an oil spill, though other mechanisms, such as insurance, may be more effective vehicles.

205 Oil drilling involves a wide range of companies, several of which may be responsible for an oil spill. OPA's channeling mechanism helps ensure that the responsible party absorbs liability and, at least in concept, ensures that any subcontracting parties exercise proper care. *See supra* note 98 and accompanying text.

206 *See generally* LOUIS KAPLOW & STEVEN SHAVELL, *ECONOMIC ANALYSIS OF LAW*, *in* 3 HANDBOOK OF PUBLIC ECONOMICS 1661, 1694–95 (Alan J. Auerbach & Martin Feldstein eds. 2002).

207 *See* Viscusi & Zeckhauser, *supra* note 99, at 1720–21 (commenting on the complexity of offshore drilling and arguing that "regulation alone will not be sufficient because the government will likely direct it at yesterday's problems").

208 Tax differs from liability in many ways including the ex ante versus ex post nature of their effects. Taxes may be less effective than liability in incentivizing proper care because taxes spread risks across the entire industry. *See* KIM, *supra* note 83, at 170–71 (discussing interplay between taxes and liability). Taxes also may require more information to effectively implement because they depend on advance predictions about potential harm rather than after-the-fact calculations of harm. Viscusi & Zeckhauser, *supra* note 99, at 1751–52. However, taxes mitigate the judgment proof problem and the administrative cost of courts, and therefore may be a preferable policy instrument in some settings. *See id.* at 1723; KIM, *supra* note 83, at 170 (discussing the trade-offs between liability and tax as instrument choices).

209 *See, e.g.*, Craig H. Allen, *Proving Natural Resource Damage Under OPA 90: Out with the Rebuttable Presumption, in with APA-Style Judicial Review?*, 85 TUL. L. REV. 1039 (2011); Cohen et al., *supra* note 98, at 1887–93; Gaia J. Larsen, *Skewed Incentives: How Offshore Drilling Policies Fail to Induce Innovation to Reduce Social and Environmental Costs*, 31 STAN. J. ENVTL. L. 139 (2012); Kenneth M. Murchison, *Liability Under the Oil Pollution Act: Current Law and Needed Revisions*, 71 LA. L. REV. 917 (2011); Ronen Perry, *The Deepwater Horizon Oil Spill and the Limits of Civil Liability*, 86 WASH. L. REV. 1 (2011) (critically evaluating civil liability for oil pollution before and after enactment of OPA); Viscusi & Zeckhauser, *supra* note 99, at 1724.

210 *See, e.g.*, Cohen et al., *supra* note 98, at 1909–12 (calling OPA's liability cap "woefully out of proportion" to damages from the *Deepwater Horizon* disaster); Viscusi & Zeckhauser, *supra* note 99, at 1724 (referring to the cap as "paltry"). Cohen et al. acknowledge that OPA liability cap weakens safety incentives "to some degree" but argue that other factors mitigate the extent of the problem. Cohen et al., *supra* note 98, at 1890–93 (noting that the cap does not apply to acts of gross negligence, and further arguing that most companies responsible for oil spills will have violated an applicable federal regulation—and therefore face unlimited liability under OPA—or be subject to state law causes of action that are not preempted by OPA).

weaknesses in OPA's financial responsibility requirements;[211] limitations in liability exposure under other federal and state laws apart from OPA;[212] and the high legal costs of obtaining recovery under the various liability regimes.[213]

These critiques have prompted a series of policy recommendations. The most widely embraced is removing OPA's liability cap[214] and raising the financial responsibility requirements to cover the social costs of worst-case oil spills.[215] A supplemental step is to mandate insurance requirements equivalent to, if not in excess of, the financial responsibility threshold.[216] Another recommendation, recognizing that a truly devastating spill would bankrupt many firms, is to levy offshore drilling taxes to account for the unrecoverable social costs of an oil spill.[217] Other scholarship has explored criminal liability for major oil spills[218] or lax oversight of oil operation safety

211 Because OPA's financial responsibility requirements are consistent with the $75 million liability cap, some firms unable to pay the true costs of an oil spill are able to drill. *See, e.g.*, Cohen et al., *supra* note 98, at 1893–95. Limitations in OPA's financial responsibility requirements reflect a type of information asymmetry between principal and agent—asymmetry in knowledge about the agent's financial resources and its ability to evade liability. This asymmetry is an example of the "adverse selection" problem.

212 *See, e.g.*, Cohen et al., *supra* note 98, at 1889–91 (noting state common law negligence claims, while not preempted by OPA, do not benefit from the channeling and strict liability benefits that OPA provides); Krupnick et al., *supra* note 102, at 44 (discussing other laws, such as the Clean Water Act, that could further internalize harm but acknowledging uncertainty).

213 *E.g.*, Cohen et al., *supra* note 98, at 1889–90 (arguing that legal costs are high because major oil spills harm many victims and therefore require costly class-action procedures).

214 *E.g.*, *id.* at 1909. A second best recommendation, if removing the liability cap is politically infeasible—as has thus far proven to be the case—is to implement a damages cap regime tied to worst-case discharges. *See id.*

215 *E.g.*, *id.* at 1912–13; Viscusi & Zeckhauser, *supra* note 99, at 1723–24; Robertson, *supra* note 19, at 120. Determining the magnitude of social costs is not an easy task. Cohen et al., *supra* note 98, at 1913.

216 *See* Cohen et al., *supra* note 98, at 1913. Justifications for insurance mandates include using the insurance system to pool risks so as to cover costs that individual firms could not; and outsourcing regulatory responsibilities to the insurance company, which has an incentive to monitor offshore drilling in order to reduce the chance of an insurance payout. *See id.*; *see also* KIM, *supra* note 83, at 168–69 (analyzing whether insurers would be more efficient than government at regulation). It is doubtful the insurance market would provide coverage in the event of unlimited liability and coverage given the potential damages of a worst-case oil spill. *See* KIM, *supra* note 83, at 260–61 (reviewing insurance market capacity for worst-case risks); Cohen et al., *supra* note 988, at 1900–01 (discussing testimony after the *Deepwater Horizon* disaster on the difficulty of underwriting for severe but difficult to predict events).

217 *See* Viscusi & Zeckhauser, *supra* note 99, at 1723. *Cf.* Cohen et al., *supra* note 98, at 1913 (recommending tax-like fees calibrated to the risks of drilling). In addition to the OPA-focused research above, some scholars have argued that product liability law provides another way for oil companies to pay the true costs of an oil spill. *See, e.g.*, Thomas H. Koenig & Michael L. Rustad, *Reconceptualizing the BP Oil Spill as* Parens Patriae *Products Liability*, 49 HOUS. L. REV. 291 (2012).

218 *See, e.g.*, David M. Uhlmann, *After the Spill is Gone: The Gulf of Mexico, Environmental Crime, and the Criminal Law*, 109 MICH. L. REV. 1413 (2011). For a critical view, see Joshua Fershee, *Choosing a Better Path: The Misguided Appeal of Increased Criminal Liability After Deepwater Horizon*, 36 WM. & MARY ENVTL. L. & POL'Y REV. 1 (2011). Relative to civil liability, work on criminal liability is more divided. On one hand, the threat of criminal punishment would incentivize oil company managers to increase their care in ways that mitigate the

systems.[219] None of these recommendations have not translated into policy changes to date.[220]

B. Scholarship on Asymmetrically Held Information in Offshore Drilling

Research on offshore drilling regulation has focused in significant part on the quality of relevant information that regulators possess. Asymmetrically held information is a regular challenge of regulation, occurring both when firms withhold key information from regulators and when firms give regulators *too much* information.[221] This challenge is particularly great in the offshore drilling context because of the detailed geological and geophysical data, ever-changing slate of technologies, and the web of oil company–contractor relationships involved.[222] Indeed, the

judgment proof problem and the diminishing returns of civil liability. On the other hand, criminal punishment is typically reserved for intentional or reckless acts (such as the purposeful dumping of hazardous waste), raising questions about the appropriate role of criminal law in this context. *See* Uhlmann, *supra* at 1419–20.

219 This work draws from the Sarbanes-Oxley Act of 2002, Pub. L. 107–204, 116 Stat. 745 (July 30, 2002), which requires senior management to certify the company's accuracy of its financial information. For applications to the offshore drilling context, see HARVARD ENVIRONMENTAL LAW CLINIC, RECOMMENDATIONS FOR OFFSHORE DRILLING, *supra* note 18, at 45–47.

220 Liability-based changes require legislation from a Congress that has been loath to act. *See* 2013 OIL SPILL COMM'N REPORT, *supra* note 3, at 11 (noting, as of April 2013, that increasing the liability cap and financial responsibility requirements were among the Commission's most important recommendations but that "Congress has taken no action"). Indeed, the only action has been the June 2012 RESTORE Act, which allocates certain monies to ecosystem restoration and economic development in the Gulf of Mexico region. *See id.* at 3–4, 8 (explaining the RESTORE Act, assigning Congress a grade of "D+" for its response to the *Deepwater Horizon* disaster, and noting that, "three years after the worst oil spill in U.S. history, Congress has yet to take action to bolster the government's program for managing offshore activities"); NICHOLAS CUNNINGHAM, THE ARCTIC INST., OFFSHORE DRILLING IN THE ARCTIC 7 (Aug. 2012), *available at* http://americansecurityproject.org/ASP%20Reports/Ref%200076%20-%20Offshore%20Oil%20Drilling%20in%20the%20Arctic.pdf (noting that a significant minority in Congress supported a bill that would *accelerate* the offshore drilling permitting process in March 2011, less than a year after the *Deepwater Horizon* disaster occurred). The lack of legislative response is in some sense surprising, considering that previous large-scale offshore oil spills prompted landmark environmental legislation. The public response to the 1969 Santa Barbara oil spill helped motivate Congress and state legislatures to pass major environmental laws, including NEPA, California Environmental Quality Act, and the establishment of marine sanctuary designations off the California Coast. *See* NAT'L COMM'N REPORT, *supra* note 1, at 28–29; Bradley C. Karkkainen, *Getting to "Let's Talk": Legal and Natural Destabilizations and the Future of Regional Collaboration*, 8 NEV. L.J. 811, 819 (2008); Richard J. Lazarus, *The Greening of America and the Graying of United States Environmental Law: Reflections on Environmental Law's First Three Decades in the United States*, 20 VA. ENVTL. L.J. 75, 79 (2001) (citing the Santa Barbara oil spill, the 1969 burning of the Cuyahoga River in Ohio, and the 1962 publication of Rachel Carson's book *Silent Spring* as important public viewpoint-forming events). A subject for future research is why the legislative response to the *Deepwater Horizon* oil spill has been conspicuously absent.

221 *See generally* Wendy E. Wagner, *Administrative Law, Filter Failure, and Information Capture*, 59 DUKE L.J. 1321 (2010).

222 *See* Hope M. Babcock, *A Risky Business: Generation of Nuclear Power and Deepwater Drilling for Offshore Oil and Gas*, 37 COLUM. J. ENVTL. L. 63, 95–96 (2012) (detailing information

information failures and agency capture in offshore drilling may account for the regulatory lacuna before the *Deepwater Horizon* disaster.[223]

Unlike research on civil liability, about which there is broad agreement, scholarship on information failures follow different tracks. One line of scholarship views the information failures in offshore drilling as intractable and advocates a modest regulatory role.[224] Other work suggests that certain policies, loosely grouped together as "information-forcing tools,"[225] induce firms to divulge information that improves the quality of regulatory design.[226] Two such tools have received attention in the offshore drilling context: risk-based regulations and whistleblower protections. Another information-forcing tool, NEPA, is also discussed in the next subsection on regulatory accountability.[227]

Risk-based regulations, which prioritize regulatory interventions based on risk significance and other system level indicators,[228] are employed for such complex industries as nuclear power[229] and food safety.[230] A distinctive

failures between BP and Transocean in the immediate run-up to the *Deepwater Horizon* disaster); Viscusi & Zeckhauser, *supra* note 99, at 1749 (discussing the informational advantages possessed by oil companies).

223 *See, e.g.*, Osofsky, *supra* note 1233 at 1098–99; NAT'L COMM'N REPORT, *supra* note 1, at 225, 228 (stating that, before the *Deepwater Horizon* disaster, government lacked meaningful regulations on some of the key issues causing that disaster, such as requirements for cementing a well, testing the cement used, and negative-pressure testing of the well's integrity, and further noting the American Petroleum Institute's role in this result).

224 *See, e.g.*, Viscusi & Zeckhauser, *supra* note 99, at 1752–53 (arguing that offshore drilling regulation should set broad safety standards but not assess specific safety practices and technologies because of the information problems in regulation).

225 *See, e.g.*, Bradley C. Karkkainen, *Information-Forcing Environmental Regulation*, 33 FLA. ST. L. REV. 861 (2006); *see also* Macher et al., *supra* note 195.

226 The purpose of information-forcing tools is to use the information gleaned to develop better regulations. *See, e.g.*, Dahle et al., *supra* note 199, at 35. These regulations may take several forms, including prescriptive regulations (specifying exact measures for compliance) or performance-based (setting a desired level of performance and allowing regulated entities to meet that target). *Id.* at 34. Under either regulatory model, current information is needed to make the regulations effective. *See* HARVARD ENVIRONMENTAL LAW CLINIC, RECOMMENDATIONS FOR OFFSHORE DRILLING, *supra* note 19, at 42–43 (reviewing past problems with prescriptive regulations).

227 For commentary on NEPA as an information-forcing tool, see Aagaard, *supra* note 20, at 88; Bradley C. Karkkainen, *Information as Environmental Regulation: TRI and Performance Benchmarking, Precursor to a New Paradigm?*, 89 GEO. L.J. 257, 296 (2001); Carol M. Rose, *Scientific Innovation and Environmental Protection: Some Ethical Considerations*, 32 ENVTL. L. 755, 768 (2002). Karkkainen discusses a particular type of information-forcing tool: regulatory penalty default rules that impose the default of an onerous EIS unless a developer changes the project so that only an EA is required. Karkkainen, *supra*, at 296. This concept has little traction for offshore drilling, as oil companies probably cannot reduce the environmental threat of offshore drilling to EA thresholds.

228 *See, e.g.*, Peter J. May, *Regulatory Regimes and Accountability*, 1 REG. & GOVERNANCE 8, 18–20 (2007); Julia Black & Robert Baldwin, *When Risk-Based Regulation Aims Low: Approaches and Challenges*, 6 REG. & GOVERNANCE 2, 2 (2012).

229 *See, e.g.*, Thomas C. Galligan, Jr., *A Sad Tale of the Deepwater Horizon Disaster, Normal Accidents, and Our Appetite for Risk*, 17 ROGER WILLIAMS U. L. REV. 264, 267–70 (2012). In this context, "complex" systems are those where failures "are not easily or readily identified or

feature of risk-based regulation is the information used to govern conduct.[231] Industry typically provides detailed information on accidents and near-accidents to regulators,[232] who capitalize on this information to adopt a more tailored regulatory approach relative to traditional, prescriptive regulation.[233] Several scholars argue that risk-based regulations have had a positive effect in the nuclear power industry[234] and in offshore drilling in Norway and the United Kingdom,[235] though other commentary is less sanguine.[236]

understood." *Id.* at 269. A related concept is "tightly coupled" systems, which are systems where it is difficult to segregate those parts of the system that fail from others that do not. *Id.*

230 *See, e.g.*, Peter J. May, *Regulatory Regimes and Accountability*, 1 REG. & GOVERNANCE 8, 14–17 (2007).

231 While there is no necessary relationship between the form of information acquisition and the type of regulatory intervention, the information acquisition and regulatory intervention components of risk-based regulation tend to operate together. *See generally* BRIDGET M. HUTTER, ESRC CENTRE FOR ANALYSIS OF RISK AND REGULATION, THE ATTRACTIONS OF RISK-BASED REGULATION: ACCOUNTING FOR THE EMERGENCE OF RISK IDEAS IN REGULATION, DISCUSSION PAPER NO. 33, (Mar. 2005), *available at* http://grammatikhilfe.com/researchAndExpertise/units/CARR/pdf/DPs/Disspaper33.pdf.

232 *See* NAT'L COMM'N REPORT, *supra* note 1, at 251. The rationale is that risk-based regulations use this information to develop a risk-informed model and then assess company performance against this model by monitoring the company's internal controls. *See* May, *supra* note 230, at 19.

233 *See* Dahle et al, *supra* note 199, at 35–36; ROGER M. COOKE ET AL., PRECURSOR ANALYSIS FOR OFFSHORE OIL AND GAS DRILLING, RESOURCES FOR THE FUTURE DISCUSSION PIECE 10-61, at 3–4 (2011); NAT'L COMM'N REPORT, *supra* note 1, at 251–54; Anne L. Hanson, *Offshore Drilling in the United States and Norway: A Comparison of Prescriptive and Performance Approaches to Safety and Environmental Regulation*, 23 GEO. INT'L ENVTL. L. REV. 555 (2011) (comparing Norway's "performance-based" regulation of offshore oil drilling to the prescriptive model employed in the United States). One approach is Probabilistic Risk Analysis (PRAs), in which regulators model the probability that an individual system, like an offshore drilling operation, will fail by creating "event trees" and "fault trees" of incidents that lead to safety risks. *See* Cooke et al., *supra* at 5. Another approach, known as Accident Sequence Precursor (ASP), models risk for multiple facilities—rather than for a single facility as in the case of PRAs—by a developing a "generic" event tree for facilities generally. *Id.*

234 *See* Cooke et al., *supra* note 233, at 3–4 (discussing the U.S. Nuclear Regulatory Commission's use of the PRA and the ASP programs).

235 *See* NAT'L COMM'N REPORT, *supra* note 1, at 252 (recommending risk-based regulations based on the "safety case" approach); Rena Steinzor, *Lessons from the North Sea: Should "Safety Cases" Come to America?*, 38 B.C. ENVTL. AFF. L. REV. 417 (2011). Norway implemented a form of risk-based regulations, known as the "safety case" approach, following the 1980 *Alexander Kielland* disaster in the North Sea that killed 123 people. *See* NAT'L COMM'N REPORT, *supra* note 1, at 68–69. The United Kingdom adopted a similar approach after 167 people died in the 1988 *Piper Sea* disaster, also in the North Sea. *Id.*

236 Outside the offshore drilling context, some scholars argue that reporting requirements create a false assurance that salient risks are identified and under control, when disasters often result from unpredictable confluences of events. *See* James Fanto, *Anticipating the Unthinkable: The Adequacy of Risk Management in Finance and Environmental Studies*, 44 WAKE FOREST L. REV. 731, 752–53 (2009). Other scholars focus on the role of politics, arguing that a regulator in charge of risk-based regulation may focus on the risks most pertinent to the regulator's political survival rather than those of society generally. *See* H. Rothstein et al., *The Risks of Risk-Based Regulation: Insights from the Environmental Policy Domain*, 32 ENV'T INT'L 1056, 1062 (2006).

The United States did not have comprehensive risk-based regulations in place for offshore drilling before the *Deepwater Horizon* disaster.[237] The Department of the Interior subsequently implemented[238] a Safety and Environmental Management System (SEMS)[239] that incorporates some of the information-forcing concepts discussed above, and creates a process for system-level monitoring of a firm's internal controls.[240]

Other scholarship suggests greater whistleblower programs to overcome information asymmetries in offshore drilling.[241] Whistleblower programs build off the insight that a firm is, in reality, a collection of self-interested individuals who may be motivated to turn over information if they receive employment protections and, perhaps, bounty hunting rewards.[242] After the *Deepwater Horizon* disaster, several policy groups recommended that the government institute a whistleblower protection for reporting safety lapses in the offshore drilling industry.[243] In 2013, a modest version of these

237 MMS considered adopting a safety-case approach during the 1990s but did not do so because of industry resistance. *See* NAT'L COMM'N REPORT, *supra* note 1, at 68–76.

238 *See, e.g.*, U.S. DEPT. OF THE INTERIOR, INCREASED SAFETY MEASURES FOR ENERGY DEVELOPMENT ON THE OUTER CONTINENTAL SHELF 27–28 (2010), *available at* http://www.doi.gov/deepwaterhorizon/loader.cfm?csModule=security/getfile&PageID=33598.

239 The Department of the Interior announced the establishment of SEMS in 2010 and revised it in 2013. Oil and Gas and Sulphur Operations in the Outer Continental Shelf—Revisions to Safety and Environmental Management Systems, 78 Fed. Reg. 20,423 (Apr. 5, 2013) (codified at 30 C.F.R. pt. 250). For general discussion, see BUREAU OF SAFETY AND ENVTL. ENFORCEMENT, SAFETY AND ENVIRONMENTAL MANAGEMENT SYSTEMS (SEMS) FACT SHEET [SEMS FACT SHEET], *available at* www.bsee.gov/BSEE-Newsroom/BSEE-Fact-Sheet/SEMS-II-Fact-Sheet.aspx. One major revision to the SEMS rule is to require independent third-party experts, rather than the company itself, to conduct audits of operations. *See* 2013 OIL SPILL COMM'N REPORT, *supra* note 3, at 7.

240 SEMS requires the establishment of a ground-level company authority who will stop work in the event of an imminent risk; establishment of an authority that has ultimate responsibility for operational safety at any given time; a system for reporting unsafe working conditions—such as accidents and near-accidents—to BSEE from different levels within the company; and external audit requirements. *See* SEMS FACT SHEET, *supra* note 239. A related justification for the safety-case approach is to instill a "culture of safety" in offshore drilling by requiring oil companies to establish a process in which mistakes are reported and corrected at the company level. *See* TRANSPORTATION RESEARCH BOARD OF THE NATIONAL ACADEMIES, EVALUATING THE EFFECTIVENESS OF OFFSHORE SAFETY AND ENVIRONMENTAL MANAGEMENT SYSTEMS, SPECIAL REPORT NO. 309, at 18 (2012).

241 *See* NAT'L COMM'N REPORT, *supra* note 1, at 254; Babcock, *supra* note 222, at 126 (discussing National Commission recommendation). Whistleblower programs that are not unique to offshore drilling also have application. *See, e.g.*, Jad Mouawad, *Fast-Growing BP Also Has a Mounting List of Spills and Safety Lapses*, N.Y. TIMES, May 9, 2010, at A22 (describing whistleblower allegations of safety violations at an offshore BP facility in the Gulf of Mexico).

242 The topic of whistleblower programs has received considerable scholarly attention outside of the offshore drilling context. *See, e.g.*, False Claims Act, 31 U.S.C. §§ 3729–3733 (2006) (False Claims Act qui tam provision providing that whistleblowers may file against entities that defraud governmental programs and potentially recover a bounty of any recovered damages); Alexander Dyck et al., *Who Blows the Whistle on Corporate Fraud?*, 65 J. FINANCE 2213 (2010) (finding employee whistleblowing is an important mechanism for detecting corporate fraud and is induced by financial incentives).

243 *See* NAT'L COMM'N REPORT, *supra* note 1, at 254 (recommending whistleblower-based amendment to OCSLA); TRANSPORTATION RESEARCH BOARD OF THE NATIONAL ACADEMIES, *supra*

recommendations became reality. BSEE's revised SEMS program mandates that oil companies create guidelines for employee reporting of unsafe working conditions directly to BSEE.[244]

Research to date on information-forcing tools raises several issues. First, these studies have focused on a fairly narrow subset of possible tools that, while promising, do not capture the range of regulatory approaches available. Part VI of this piece considers other possibilities. Second, the two policy tools that have received most attention[245]—whistleblower protections and risk-based regulations—are recent developments for offshore drilling, so evaluations of their effectiveness are scant.[246] It is thus unclear whether they will work in the Arctic—an issue addressed in Part V—and whether the regulators entrusted with their implementation will adequately carry out their roles. I turn to the latter issue next.

C. Scholarship on Regulatory Imperfections

In contrast with scholarship on types of *regulation*, the last line of scholarship I discuss concerns the *regulators* of offshore drilling. This scholarship flows from the recognition that the government is, by its nature, an imperfect regulator. In the offshore drilling context, this imperfection may arise from various factors, including regulators' natural tendency to discount uncommon yet disastrous events like a major oil spill,[247] regulatory limitations in overseeing a technologically advanced industry like offshore drilling,[248] and—as the *Deepwater Horizon* disaster revealed—powerful

note 240, at 104–05 (recommending a whistleblower program for anonymous reporting of possible safety violations).

244 SEMS FACT SHEET, *supra* note 239.

245 *See, e.g.*, Murchison, *supra* note 75, at 300–01 (discussing technology-based standards).

246 *See* TRANSPORTATION RESEARCH BOARD OF THE NATIONAL ACADEMIES, *supra* note 241, at 89–105 (analyzing the initial SEMS rule and making various recommendations, many of which were incorporated in the 2013 SEMS revision). One of the main questions with respect to SEMS is whether it will improve the quality of information received or become a pro forma exercise. *See* Cooke et al., *supra* note 233, at 2 (criticizing the initial SEMS rule for "rel[ying] on a narrative description of hazards and their mitigation, not on rigorous data analysis and risk estimation"); DEP'T OF THE INTERIOR, REPORT ON SHELL'S 2012 EXPLORATION PROGRAM, *supra* note 23, at 30–31 (criticizing Shell's use of SEMS in the Arctic and arguing "the existence of programmatic design elements does not guarantee a functional and effective risk management program"). An underlying debate is whether risk-based regulations need to be more analytically rigorous, or if highly quantitative regulations will only obscure the value and political judgments at stake. *See, e.g.*, STEPHEN BREYER, BREAKING THE VICIOUS CYCLE: TOWARDS EFFECTIVE RISK REGULATION 55–81 (1995) (advocating a depoliticized risk-management approach).

247 The tendency to discount such risks—typically because regulators have not previously experienced them—is known as the "availability heuristic" in behavioral economics. For application to catastrophic events, see, for example, Viscusi & Zeckhauser, *supra* note 99, at 1731.

248 *See generally* Richard T. Sylves & Louise K. Comfort, *The Exxon Valdez and BP Deepwater Horizon Oil Spills: Reducing Risk in Socio-Technical Systems*, 56 AMER. BEHAVIORAL SCIENTIST 76, 99 (2012) (discussing slow adaptation of government oversight over offshore oil industry as relating to "large-scale, complex, socio-technical systems").

industry influence.[249] The assumption of government imperfection underpins many of the accountability checks—including judicial review and public "sunlighting" of agency decisions[250]—which the modern administrative state provides.[251]

In the environmental arena, one accountability check has received attention above all others: NEPA, a law that partly came into being because of another offshore oil spill more than forty years ago.[252] Two perspectives on NEPA warrant attention here.[253] One view, steeped in the hallmark administrative law values of transparency and accountability, argues that NEPA's exhaustive environmental review[254] and public participation requirements,[255] combined with the possibility of court challenge, improve

249 A takeaway from the *Deepwater Horizon* disaster is that MMS's combination of responsibilities sowed internal conflicts of interest and made it vulnerable to industry capture. For general discussion of the MMS's competing priorities, see NAT'L COMM'N REPORT, *supra* note 1, at 55–58; Barsa & Dana, *supra* note 24, at 52–53 (discussing the receipt of inappropriate gifts from oil and gas companies at the MMS's Lake Charles, Louisiana office that regulated offshore drilling in the Gulf of Mexico); Murchison, *supra* note 75, at 302–03 ("Almost everyone recognizes that a seriously flawed administrative structure contributed to the BP Deepwater Horizon disaster."). *But see* CHRISTOPHER CARRIGAN, *Captured by Disaster? Reinterpreting Regulatory Behavior in the Shadow of the Gulf Oil Spill, in* PREVENTING REGULATORY CAPTURE: SPECIAL INTEREST INFLUENCE AND HOW TO LIMIT IT (Daniel Carpenter & David Moss, eds. 2013) (questioning the extent of agency capture). These criticisms prompted the Department of the Interior to eliminate MMS and create BOEM, BSEE, and the Office of Natural Resources Revenue in its place. Although this reorganization quieted criticisms of the institutional framework for offshore drilling regulation, the long-term ability of this institutional framework to fend off industry capture is questionable. For an analysis of regulatory capture and institutional reforms, including in the context of the *Deepwater Horizon* oil spill, see Rachel E. Barkow, *Insulating Agencies: Avoiding Capture Through Institutional Design*, 89 TEX. L. REV. 15 (2010).

250 The concept of sunlighting agency decision making gained currency through Justice Brandeis's phrase, "sunlight is said to be the best of disinfectants." *See* LOUIS D. BRANDEIS, WHAT PUBLICITY CAN DO (1913), *reprinted in* OTHER PEOPLE'S MONEY AND HOW THE BANKERS USE IT 92 (1914).

251 It is not clear that public input leads to "better" policy decision making. Work outside the offshore drilling context has explored the effect of behavioral biases on public perceptions of risks and proposed reforms to *insulate* the regulators from ill-formed public demands. *See, e.g.*, Timur Kuran & Cass R. Sunstein, *Availability Cascades and Risk Regulation*, 51 STAN. L. REV. 683, 746–48 (1999).

252 Karkkainen, *supra* note 220, at 819 (noting that the Santa Barbara oil spill was "on the minds of the legislators who voted to enact NEPA in 1969").

253 For a general review, see Bradley C. Karkkainen, *Whither NEPA?*, 12 N.Y.U. ENVTL. L.J. 333, 338–43 (2004) (describing four divergent views of NEPA: that of the "optimist," the "monkey wrencher," the "skeptic," and the "legalist critic").

254 The theory behind NEPA review is that requiring an agency to take account of environmental factors—even if the agency need not follow the most environmentally beneficial path—will lead to more enlightened decision making. Aagaard, *supra* note 20, at 88 (stating that one of NEPA's objectives is "to induce agencies to consider environmental impacts in their decision making"); *see also* Sandra Zellmer et al., *Throwing Precaution to the Wind: NEPA and the Deepwater Horizon Blowout*, J. ENERGY & ENVTL. L., Summer 2011, at 62, 65. This is the arguably naive theory that courts commonly invoke. *See, e.g.*, Balt. Gas & Elec. Co. v. Natural Res. Def. Council, Inc., 462 U.S. 87, 97–98 (1983).

255 Public participation and outside review are designed to act as checks against regulatory laziness, groupthink, or industry collusion. Aagaard, *supra* note 20, at 93; Doremus, *supra* note

the quality of agency decision making.[256] Another view champions similar values but reaches a more pessimistic conclusion.[257] By this critique, the sheer weight of NEPA's documentation requirements[258] decreases transparency through obfuscation,[259] and it weakens accountability by giving judges a substantively shallow way to review agency decision making.[260] This debate over NEPA's effectiveness does not always pit legal scholars against one another; many are both supportive yet critical of NEPA's record.[261]

32, at 252; Uma Outka, *NEPA and Environmental Justice: Integration, Implementation, and Judicial Review*, 33 B.C. ENVTL. AFF. L. REV. 601, 608–10 (2006) (critically discussing NEPA's public participation requirements in the context of environmental justice).

256 Although NEPA lacks the citizen suit provisions found in the Endangered Species Act and Clean Water Act, citizens can, and often do, challenge NEPA review on the basis of such reviews being "arbitrary and capricious" under the Administrative Procedure Act. 5 U.S.C. §§ 702, 704, 706 (2006); Outka, *supra* note 255, at 618–19.

257 This critique focuses on NEPA's arguable inefficiency and lack of monitoring. Bradley C. Karkkainen, *Toward a Smarter NEPA: Monitoring and Managing Government's Environmental Performance*, 102 COLUM. L. REV. 903, 906–07 (2002). Indeed, some environmental advocates may favor NEPA *because of* its onerousness. By this perspective, NEPA's main purpose is not so much to improve the quality of decision making but to add enough cost and time to delay some projects from moving forward and to stop other projects altogether. *See* Karkkainen, *supra* note 253, at 339–40 (2004) (NEPA review gives project opponents an opportunity "to raise the financial and political costs of projects they oppose and stretch out decisions over an extended time frame, giving time to rally political opposition" and possibly to impose enough costs "to derail the project entirely").

258 Bradley C. Karkkainen, *Bottlenecks and Baselines: Tackling Information Deficits in Environmental Regulation*, 86 TEX. L. REV. 1409 (2007) (remarking that an EIS "typically is hundreds or even thousands of pages in length, and takes millions of dollars and months, if not years, to complete").

259 *See* Doremus, *supra* note 32, at 254 ("In theory, public oversight could provide the needed check [for NEPA review], but costs and lack of expertise are substantial barriers to effective public review."). *Cf.* Outka, *supra* note 255, at 608 (noting that when an EA is prepared as opposed to an EIS, public participation is typically limited to ex post commenting, preventing effective public oversight of nonmajor federal actions).

260 *See, e.g.*, Alyson Flournoy et al., *Harnessing the Power of Information to Protect Our Public Natural Resource Legacy*, 86 TEX. L. REV. 1575, 1582–83 (2007) (noting that successful challenges to NEPA compliance turn on gaps in documentation rather than the reasonableness of the environmental analysis). Court deference as to the substantive conclusions in NEPA documents is commonplace. *See, e.g.*, Marsh v. Or. Natural Res. Council, 490 U.S. 360, 376–77 (1989) (deferring to agency expertise in NEPA because the analysis required "a high level of technical expertise"); Lands Council v. McNair, 537 F.3d 981, 993 (9th Cir. 2008) (holding that deference to the Forest Service was appropriate because the issues of restoring forest health and wildlife habitat required a high level of technical expertise). *See generally* Aaron Gershonowitz, *The Role of Science in Environmental Litigation: Courts Give Deference to Agency Experts Except When They Don't*, 39 SW. L. REV. 233 (2009) (explaining judicial deference standards in reviewing agency decisions).

261 Karkkainen, *supra* note 257, at 906 (arguing that "NEPA's supporters and its critics both have it right, up to a point"); COUNCIL ON ENVTL. QUALITY, THE NATIONAL ENVIRONMENTAL POLICY ACT: A STUDY OF ITS EFFECTIVENESS AFTER TWENTY-FIVE YEARS 111 (1997), *available at* http://www.blm.gov/or/regulations/files/nepa25fn.pdf (characterizing NEPA as successful but suggesting that some agencies have seen NEPA documentation as the goal of the process rather than improving agency decision making). *See generally* Daniel R. Mandelker, *The National Environmental Policy Act: A Review of Its Experiences and Problems*, 32 WASH. U. J.L. & POL'Y 293, 294 (2010) (stating that most studies of NEPA's effectiveness conclude that it "has had a moderately positive effect").

The broader NEPA debate plays out in a particular context of offshore drilling: analysis of worst-case scenarios of a catastrophic oil spill.[262] One of the most frequent post-*Deepwater Horizon* critiques was that MMS, in conducting its NEPA environmental reviews,[263] failed to anticipate an oil spill anywhere close to the magnitude of the *Deepwater Horizon* disaster.[264] Much of the blame falls on the regulations implementing NEPA, which once required agencies to include a "worst-case analysis" for uncertain adverse effects,[265] but since 1986 have employed a "reasonably foreseeable significant adverse effects" test instead.[266] According to this perspective, a requirement to consider worst-case effects—as would have been the case under NEPA's old regulations—reduces agencies' natural tendency to downplay such risks[267] and better prepare for a *Deepwater Horizon*-scale oil spill.[268] This argument, rooted in the NEPA-centric idea of requiring agencies to produce more information and plan for more scenarios, has run into criticism of its own, mostly by scholars who question the meaning and value of a worst-case analysis.[269]

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262 Victor B. Flatt, *The "Worst Case" May Be the Best: Rethinking NEPA Law To Avoid Future Environmental Disasters*, ENVTL. & ENERGY L. & POL'Y J., Fall 2011, at 25, 26 (discussing a proposed Senate legislative response to the *Deepwater Horizon* spill as including "worst case analysis" for offshore drilling); Zellmer et al., *supra* note 254, at 63–66 (discussing the failure to consider the risk of a catastrophic spill before the *Deepwater Horizon* disaster); Barsa & Dana, *supra* note 190, at 221–23.

263 As discussed *infra*, notes 270–276 and accompanying text, MMS did not carry out an environmental review of BP's Exploration Plan for the Macondo well because MMS categorically excluded that plan from NEPA analysis. *See also* NAT'L COMM'N REPORT, *supra* note 1, at 82–83 (giving a background discussion on the review and permitting of the Macondo well).

264 NAT'L COMM'N REPORT, *supra* note 1, at 82–83 ("MMS performed no meaningful NEPA review of the potentially significant adverse environmental consequences associated with its permitting for drilling of BP's exploratory Macondo well."); Laruen Hunt Brogdon, Note, *A New Horizon?: The Need for Improved Regulation of Deepwater Drilling*, 37 COLUM. J. ENVTL. L. 291, 313–14 (2012); Constance L. Rogers, *Under Extraordinary Circumstance: NEPA Practice Post-Deepwater Horizon*, NAT. RESOURCES & ENV'T, Fall 2011, at 15–17; Zellmer et al., *supra* note 254, at 64 ("MMS's implementation of NEPA fell far short of the statutory goals and requirements by failing to consider and plan for the worst-case scenario."); Holly Doremus, *A Great Case for Worst Case Analysis*, LEGAL PLANET, May 1, 2010, http://legalplanet.wordpress.com/2010/05/01/a-great-case-for-worst-case-analysis/ (last visited July 26, 2014).

265 40 C.F.R. § 1502.22 (1979).

266 40 C.F.R. § 1502.22 (1986). The Supreme Court upheld the revised test in *Robertson v. Methow Valley Citizens Council*, 490 U.S. 332, 356, 359 (1989).

267 *See* Viscusi & Zeckhauser, *supra* note 99, at 1731 (discussing the availability heuristic in agency decision making).

268 *See, e.g.*, Doremus, *supra* note 264 ("Faced with a worst-case scenario . . . surely BP and Interior would have done more both to ensure that the blowout prevention systems were reliable, and to prepare a rapid response to a catastrophic leak."); *see also* Flatt, *supra* note 262, at 40 (arguing that MMS should have considered environmental effects of drilling in the Macondo well more seriously even under the "reasonably foreseeable" test).

269 *See* Aagaard, *supra* note 20, at 90–91 (arguing that even a worst-case analysis must exclude some highly unlikely scenarios and increase the existing tendency for NEPA to generate "too much rote discussion and not enough penetrating analysis"); Farber, *supra* note 20, at 916 (arguing that "the worst case scenario is a relevant consideration—although not usually decisive—in certain models of decision making under uncertainty"). The tensions in this

Two other lines of NEPA research are particularly relevant. One line considers MMS's practice of categorically excluding OCSLA exploration plans from NEPA review altogether.[270] Since the *Deepwater Horizon* disaster, BOEM has restricted its use of categorical exclusions for Exploration Plans,[271] including in the Arctic,[272] but BOEM's policy is only guidance and invites doubts about the long-term regulatory approach.[273] A related critique is that MMS improperly shortcuts NEPA analysis by tiering project level environmental reviews—for Exploration Plans or DPPs—to those at the broader, programmatic level—i.e., at the lease sale stage of the OCSLA process.[274] Unlike categorical reviews, tiering continues much as it did before

debate continue to play out. Oil companies must conduct a 30-day worst-case analysis for purposes of an OSRP but not for a NEPA Exploration Plan or DPP. U.S. DEP'T OF INTERIOR, BOEM, NTL NO. 2010-N06 INFORMATION REQUIREMENTS FOR EXPLORATION PLANS, DEVELOPMENT AND PRODUCTION PLANS, AND DEVELOPMENT OPERATIONS COORDINATION DOCUMENTS ON THE OUTER CONTINENTAL SHELF 2–3 (2010); U.S. DEP'T OF INTERIOR, NTL NO. 2012-N06, GUIDANCE TO OWNERS AND OPERATORS OF OFFSHORE FACILITIES SEAWARD OF THE COAST LINE CONCERNING REGIONAL OIL SPILL RESPONSE PLANS 28–32 (2012). NTL No. 2012-N06 acknowledges the 30-day limit but "[e]ncourages" operators and lessees "to identify sources for supplies and materials that can support a response to an uncontrolled spill lasting longer than 30 days." *Id.* at 4.

270 *See* Flatt, *supra* note 262, at 41 (arguing that the use of categorical exclusions has become "problematic" and suggesting the public challenge those exclusions by petitioning for new rulemakings); Hartsig, *supra* note 19, at 310–11 (arguing that BOEM should eliminate categorical exclusions altogether for drilling activities in the Outer Continental Shelf); *see also* NAT'L COMM'N REPORT, *supra* note 1, at 260–61 (stating the "disparity in the [MMS's] use of categorical exclusions" across different regions was "questionable").

271 Press Release, U.S. Dep't of the Interior, *Categorical Exclusions for Gulf Offshore Activity to be Limited While Interior Reviews NEPA Process and Develops Revised Policy* (Aug. 16, 2010), http://www.doi.gov/news/pressreleases/Categorical-Exclusions-for-Gulf-Offshore-Activity-to-be-Limited-While-Interior-Reviews-NEPA-Process-and-Develops-Revised-Policy.cfm (last visited July 26, 2014) [hereinafter Dep't of the Interior, Categorical Exclusion Press Release] (Director of BOEM instructing his staff not to use categorical exclusions for "deepwater drilling activities similar to the Deepwater Horizon operation.")

272 *See, e.g.*, BOEM, BEAUFORT SEA ENVIRONMENTAL ASSESSMENT, *supra* note 67, at 3–4 (conducting an EA for, rather than categorically excluding, Shell's Exploration Plan); BOEM, CHUKCHI SEA ENVIRONMENTAL ASSESSMENT, *supra* note 67, at 3.

273 *See* Dep't of the Interior, Categorical Exclusion Press Release, *supra* note 271 (explaining that the Department of the Interior has limited use of categorical exclusions "while it undertakes a comprehensive review of its NEPA process and the use of categorical exclusions for exploration and drilling on the Outer Continental Shelf"); Notice of Intent to Conduct a Review of Categorical Exclusions for Outer Continental Shelf Decisions, 75 Fed. Reg. 62,418 (Oct. 8, 2010).

274 *See, e.g.*, NAT'L COMM'N REPORT, *supra* note 1, at 254 ("As applied by MMS . . . tiering was not always consistent with its original purpose: instead, it created a system where deeper environmental analysis at more geographically targeted and advanced planning stages did not always take place."); Hartsig, *supra* note 19, at 308–10; Zellmer et al., *supra* note 254, at 67 (arguing that the tiering resulted in an environmental analysis that was a "poorly performed cut-and-paste job").

the *Deepwater Horizon* disaster,[275] though BOEM has stated that tiering would not come at the expense of site-specific analysis.[276]

Notably, most scholarship on transparency and accountability has addressed the four stages of OCSLA review, not OPA's OSRP requirement. This tendency may reflect the fact that MMS conducted at least some NEPA review of at least some OCSLA stages. OSRPs, by contrast, have never been subject to NEPA review.[277] The Arctic provides a fresh setting in which to consider the values of transparency and accountability anew.

V. CHALLENGES OF REGULATING INFREQUENT, CATASTROPHIC RISKS AT THE FRONTIER

This literature review points to various weaknesses in government oversight of offshore drilling. These include a lack of transparency in oil spill response planning, underdeveloped tools for gathering information on oil company activities, and insufficient liability exposure in the event of a major spill. This Part builds on the literature to develop a basic framework for analyzing government oversight of industries capable of causing catastrophic harm.[278] I show how the Arctic presents an important case study because it sits at the technological frontier. I then explore how the problems of regulating at the frontier interact with catastrophic risks to undermine the efficacy of conventional regulatory models.

275 *See, e.g.*, BOEM, CHUKCHI SEA ENVIRONMENTAL ASSESSMENT, *supra* note 67, at 17–18 (tiering to lease-sale stage EIS and SEIS for analysis of oil spill size); *id.* at 89 (tiering to lease-sale stage EIS and SEIS to determine effects of offshore drilling on marine mammals).

276 In its most recent programmatic EIS for the OCS, BOEM listed several steps to improve the tiering process, including an annual progress report on programmatic implementation and enhanced "systematic planning" with other agencies. BOEM, U.S. DEP'T OF INTERIOR, OUTER CONTINENTAL SHELF OIL AND GAS LEASING PROGRAM: 2012-2017, FINAL PROGRAMMATIC ENVIRONMENTAL IMPACT STATEMENT, xi, 2-16, 4-76, 4-77 (July 2012); *see also* COUNCIL ON ENVTL QUALITY, EXECUTIVE OFFICE OF THE PRESIDENT, REPORT REGARDING THE MINERALS MANAGEMENT SERVICE'S NATIONAL ENVIRONMENTAL POLICY ACT POLICIES, PRACTICES, AND PROCEDURES AS THEY RELATE TO OUTER CONTINENTAL SHELF OIL AND GAS EXPLORATION AND DEVELOPMENT, 22–26 (Aug. 16, 2010) (discussing BOEM's commitments to improving the tiering process). The meaningfulness of these steps is open to question.

277 *See* District of Alaska, August 2013 Decision, *supra* note 93, at 29.

278 In characterizing oil spills as industry "caused," it is important to recognize that disasters may have several causal agents. *See* W. Kip Viscusi & Richard J. Zeckhauser, *Addressing Catastrophic Risks: Disparate Anatomies Require Tailored Therapies* 3–4 (Harvard Kennedy School, Working Paper, RWP11-045, Nov. 2011) (developing a typology of catastrophic risks and categorizing such risks by the number of causal actors). For an overview of other industries capable of causing catastrophic harm, see Marcus Radetzki & Marian Radetzki, *Liability of Nuclear and Other Industrial Corporations for Large Scale Accident Damage*, 15 J. ENERGY & NAT. RESOURCES L. 366, 366 (1997) (exploring such industries as nuclear power, hydroelectric power, and passenger airlines).

A. Framework for Evaluating Government Action to Reduce Catastrophic Events

The offshore drilling literature provides a way of thinking generally about government prevention of infrequent, catastrophic risks[279] using the concepts above: asymmetric preferences between firms and government, asymmetric information between firms and government, and weaknesses in the government's capacity to act as society's agent.[280] With respect to asymmetric preferences, the offshore drilling literature underscores the difficulty of aligning social and firm preferences when firm activities may cause, or interact with natural forces to cause, catastrophic harm.[281] Analysis of accidents in the chemical and nuclear power industries[282] reaches similar

279 There are other ways of conceptualizing infrequent, catastrophic risks. One set of theories draws on industrial engineering concepts to model the ways accidents occur and tools for reducing the risk of accident. *See* CHARLES PERROW, NORMAL ACCIDENTS 5 (1984) (setting forth a "normal accident" theory to explain inevitability of accidents in complex, tightly coupled systems); *see also* C.F. LARRY HEIMANN, ACCEPTABLE RISKS: POLITICS, POLICY, AND RISKY TECHNOLOGIES 8–12 (1997) (discussing the "high reliability" approach that articulates the features employed by companies to minimize the possibility of accidents); Samir Shrivastava et al., *Normal Accident Theory Versus High Reliability Theory: A Resolution and Call for an Open Systems View of Accidents*, 62 HUM. REL. 1357, 1357–59 (2009). Other work looks to organizational theory to examine how different institutions, both private and public, respond in ad hoc ways during a crisis. *See generally* Macey, *supra* note 85. This piece relies on the lens of principal–agent analysis rather than on the theories above because my focus is on government prevention, not on company responses to catastrophes or crisis management of catastrophes. *See supra* note 195.

280 We might conceive of this framework as a four-link chain of principal–agent relationships. At one end of the chain is society, which acts as principal. At the other end of the chain are firms, which serve as imperfect agents of society by carrying out social mandates—e.g., not to pollute—that are mediated through the law—e.g., laws penalizing pollution. In the middle of the chain are politicians and regulators. Politicians act as agents for society and as principals that direct regulatory agents; regulators act as agents of politicians and as principals exerting legal authority over the firms. Each link in this chain includes its own set of principal–agent relationships, and agents interact with one another in complex ways. *See* Katharine A. Neill & John C. Morris, *A Tangled Web of Principals and Agents: Examining the* Deepwater Horizon *Spill Through a Principal-Agent Lens*, 40 POL. & POL'Y 629, 631 (2012) (applying principal–agent relationships to the context of offshore drilling).

281 Many disasters result from a complex interaction of manmade causal agents and natural factors. *See* Howard Kunreuther & Geoffrey Heal, *Managing Catastrophic Risk*, ENCYCLOPEDIA OF ENERGY, NATURAL RESOURCES AND ENVIRONMENTAL ECONOMICS (forthcoming) (manuscript at 3), *available at* http://ssrn.com/abstract=2049456 (discussing the interaction of natural and technological conditions in the case of the March 2011 earthquake, tsunami, and nuclear meltdown in Japan). It may be that a natural event, such as a hurricane, will play a major role in "causing" the next major oil spill. *See generally id.* However, a firm may also cause an oil spill, even if the spill happens during a hurricane, if it should have anticipated the possibility that a hurricane would strike. The interaction between natural and industry-caused actions complicates efforts to align preferences.

282 *See generally id.* at 12–13 (exploring the difficulties in aligning preferences across several industries capable of causing catastrophic harm). Mechanisms other than the law, such as industry self-policing, may help correct asymmetric preferences in certain contexts. In Part VII, I discuss the conditions in which industry self-policing might arise.

conclusions.[283] A reason for misalignment is that catastrophes are hugely expensive, complex, and unpredictable. As a result, liability-based solutions face judgment proof problems[284] and indeterminate causality;[285] insurance markets may be unable to pool risks;[286] and taxes fail to cause industry to fully internalize social harms.[287] The inability to align preferences has myriad effects on industry behavior,[288] including reducing incentives to plan for catastrophic events in advance.[289] It also suggests a role for regulation, since regulators may mandate compliance when firm and government interests are not in sync.[290]

283 Another example is the financial industry, where major stock market losses periodically occur. For a comparison of catastrophic loss in the financial and environmental sectors, see Fanto, *supra* note 236.

284 *See supra* note 103 (discussing how a major oil spill would bankrupt nearly any firm); *see also* Jim Chen, *Modern Disaster Theory: Evaluating Disaster Law as a Portfolio of Legal Rules*, 25 EMORY INT'L L. REV. 1121, 1134 (2011) (noting that, in the case of major disasters, "the sheer magnitude of the losses at stake will exceed the capacity of any single financial actor").

285 Causality problems are more likely to occur when a catastrophe has multiple causal agents that are not in a hierarchical relationship—e.g., multiple homeowners living in an earthquake zone. Oil companies typically have contractual relationships with one another, making causality determinations arguably simpler for oil spills. *See supra* note 222.

286 The theory is that insurance companies and oil companies would be incentivized to regulate the sector themselves in order to mitigate the possible exposure. *See, e.g.*, Cohen et al., *supra* note 98, at 1899. This topic has been fertile for academic discussion. *See* Chen, *supra* note 284, at 1134 (noting that "many disasters pose special trouble, even for the largest, most financially secure insurers. Like their customers, insurance carriers have trouble evaluating the true likelihood of actuarially remote events."); Farber, *supra* note 20, at 926 n.109; Roger M. Cooke & Carolyn Kousky, *Are Catastrophes Insurable?*, RESOURCES, at 18, 20 (Summer 2009). Although some work has lauded the potential for catastrophe bonds or other financial instruments to address for catastrophic risks, these instruments have made limited headway, perhaps because of the difficulties in modeling major risks. For discussion, see M. M. Boyer & C. M. Myce, *Insuring Catastrophes and the Role of Governments*, 13 NAT. HAZARDS EARTH SYST. SCI. 2053 (2013).

287 A principal reason taxes fail to fully align incentives is that they spread the costs of a major oil spill across the entire oil industry rather than concentrating it on the company that caused the harm. *See* KIM, *supra* note 83, at 171–72. The risk-spreading effect is significant for catastrophic risks because a single bad actor—e.g., a careless oil driller—could be responsible for the environmental damages rather than the industry as a whole. A variant of taxes, designed to address this problem, are risk-based fees particularized to the safety attributes of particular wells. *See* Cohen et al., *supra* note 98, at 1902–03. Making these particularized determinations is complex, however, and it is unclear whether the informational requirements would be greater or less than for regulation. *See id.*

288 This discussion of asymmetric preferences is brief. As emphasized by Cohen et al., other differences in preferences, such as agency relationships—between contractors and subcontractors, shareholders and companies—may also justify government intervention in offshore drilling. Cohen et al., *supra* note 98, at 1874–75.

289 Information gathering is costly, both for industry and the regulator, so a firm that does not anticipate shouldering the full cost of catastrophic harm may forego expending the resources to plan for it in advance. To the extent industry fails to plan, regulators' use of information-forcing tools may have limited effect because the firm also may be ignorant as to the risks.

290 There are other reasons for favoring regulation over liability. Ex ante regulation can head off harms before they occur, where liability operates ex post and relies on deterrence mechanisms to prevent harms from occurring. The ex post nature of liability may not be satisfactory for environmental catastrophic harms, which often have near irreversible effects on

Yet regulation has limitations of its own. A central challenge of regulation is overcoming information asymmetries, the second element introduced above. The offshore drilling literature indicates that many of the information imbalances plaguing regulator–industry relationships generally[291] also affect industries exhibiting catastrophic risks.[292] In fact, information asymmetries may be greater in high-risk industries to the extent those industries are more technologically sophisticated than the norm.[293]

The third and final element is governmental failures in acting as society's agent. The short-term politics of disaster and behavioral bias in estimating the likelihood of a major oil spill indicate that government may underplan for oil spills.[294] Underplanning in the oil spill context is consistent with research on disaster planning generally.[295]

These three elements, when pulled together, lead to a specific set of policy debates.[296] Consider the question of policy instrument choice for curbing catastrophic risks. The pervasiveness of asymmetric preferences, asymmetric information, and government's imperfections suggest that any single policy instrument may be insufficient.[297] Multiple policy tools, such as joint use of regulation and liability, may help overcome the limitations in any

species and habitats that may not be easily corrected through compensation. Second, regulation may have a public goods nature and overcome coordination problems by forcing firms to take certain actions—like industry-wide safety systems—that would not occur without regulation, due to free-rider problems. *See* KIM, *supra* note 83, at 175–76.

291 Empirical research suggests that assumption holds across a wide range of conditions. *See, e.g.*, Macher et al., *supra* note 195, at 49–52 (finding the existence of information asymmetries affecting regulation by the Food and Drug Administration). Indeed, this assumption of information asymmetry is so strong that it has undergirded much of the move toward market-based environmental regulation in recent decades. *Cf.* Bruce A. Ackerman & Richard B. Stewart, Comment, *Reforming Environmental Law*, 37 STAN. L. REV. 1333, 1335–37 (1985) (arguing that tailoring environmental regulation to risk and need will yield a more economically efficient result).

292 *See supra* note 222 (discussing the existence of information asymmetries in the offshore drilling industry).

293 *See* Viscusi & Zeckhauser, *supra* note 278, at 6, 16.

294 *See supra* Part IV.C.

295 *See, e.g.*, Roger G. Noll, *The Complex Politics of Catastrophe Economics*, 12 J. RISK & UNCERTAINTY 141 (1996) (discussing how the threat of catastrophe causes decisionmakers, including politicians, to suffer from the same cognitive and perceptual limitations suffered by the public); Kunreuther & Heal, *supra* note 281, at 3–9 (considering such behavioral problems as myopia, procrastination, underweighting of future events, underestimation of risk, and interdependencies in risk-management strategies).

296 This framing of the problem simplifies many complexities. One complexity is that politics, ideologies, and existing institutional arrangements deeply infuse the policy choices that are ultimately made. *See, e.g.*, Terry M. Moe, *The Politics of Bureaucratic Structure*, *in* CAN THE GOVERNMENT GOVERN? 267 (J. E. Chubb & P. E. Peterson eds., 1989); Michael M. Ting, *A Theory of Jurisdictional Assignments in Bureaucracies*, 46 AMER. J. POL. SCI. 364 (2002). Another complexity is that firms are heterogeneous. Thus, information asymmetries and preference asymmetries between government and firms are not uniform and invite potential for case-specific approaches.

297 It is commonly the case that no single policy instrument or institutional arrangement operates perfectly. For some problems, however, a single instrument may work well enough such that adding another instrument is not worth the cost—e.g., the liability system may work well enough to deter against minor industrial accidents.

single policy instrument; such an approach would mirror the redundancy strategy that companies employ to reduce the risk of failure in industrial processes.[298] However, adopting multiple policy tools is administratively costly, and undesirable policy interactions may occur.[299] The choice of policy strategies may thus depend on the degree of asymmetric preferences, asymmetric information, and government imperfections in a particular case.

Or consider the question of regulatory model: The problem of asymmetric information suggests that risk-based regulations may provide a better way of prioritizing regulatory interventions relative to a prescriptive model,[300] since risk-based regulations tie interventions to a data-driven picture of safety hazards.[301] However, government imperfections raise the possibility that risk-based regulations simply repackage regulation in a less transparent and more industry-dependent way.[302] Again, the degree of

298 *See* KIM, *supra* note 83, 176–78 (espousing joint use of liability and regulation). Other mechanisms include whistleblower protections, see *supra* notes 241–246, individual criminal liability reforms, see *supra* note 218, and management level verification of company safety procedures. One issue for exploration is how mechanisms designed to change the incentives of top officials within a firm—e.g., by exposing them to criminal liability—alter the behavior of the firm as a whole.

299 For scholarship that takes a critical view of regulation in combination with other policy tools, see, for example, PERROW, *supra* note 279 (discussing the adverse effect of redundant arrangements on the complexity); Viscusi & Zeckhauser, *supra* note 99, at 1721–22 (proposing a combination of liability and tax, in a so-called two-tiered liability system, that minimizes the regulatory role); Viscusi & Zeckhauser, *supra* note 278, at 18–21 (making a similar argument for "human-caused" fat-tail risks generally). As discussed above, there are at least two limitations to overlapping policy arrangements. First, at some point the cost of such arrangements outweighs the benefits, particularly if such arrangements are imposed ex ante, regardless of whether an accident occurs—as is often case with regulation. Second, it is possible that multiple policy tools, though intended to be complementary, may in fact work at cross-purposes. For instance, a regulatory entity that is designed to complement the liability system may in fact hinder it by working at the behest of the regulated entities rather than the public. *See, e.g.*, Stacey L. Dogan & Mark A. Lemley, *Antitrust Law and Regulatory Gaming*, 87 TEX. L. REV. 685, 687 (2009) (noting, in the context of antitrust law, that "the very regulatory structure that exists to promote competition can create gaming opportunities for competitors bent on achieving anticompetitive goals").

300 *See* May, *supra* note 230 (exploring advantages and drawbacks of each approach); *see also* VINCE JENKINS, GOAL/RISK BASED DESIGN—BENEFITS AND CHALLENGES (Interferry 2012), *available at* http://www.interferry.com/2012papers/10-1bJenkins_LR-Risk_based_design.pdf (discussing risk-based as compared to prescriptive approaches).

301 *See* John S. Applegate, *The Perils of Unreasonable Risk: Information, Regulatory Policy, and Toxic Substances Control*, 91 COLUM. L. REV. 261, 315–18 (1991) (discussing approach for toxic substance regulation); DANIEL CARPENTER, *Reputation, Information and Confidence—The Political Economy of Pharmaceutical Regulation*, *in* PUBLIC CHOICE AND PUBLIC LAW (Daniel Farber & Anne Joseph O'Connell, eds. 2010), *available at* http://www.healthpolicyfellows.org/pdfs/ReputationInformationandConfidencebyDanielCarpenter.pdf (considering approach for pharmaceutical regulation). For broader discussion, see Steven L. Schwarcz, *Controlling Financial Chaos: The Power and Limits of Law*, 2012 WISC. L. REV. 815, 818–21 (2012) (discussing limitations of risk-based regulation in context of financial crisis regulation); Fanto, *supra* note 236, at 754–55.

302 *See, e.g.*, BALDWIN ET AL., UNDERSTANDING REGULATION: THEORY, STRATEGY, AND PRACTICE 281–95 (2d ed. 2012) (exploring how risk-based regulations require regulators to rely on "meta-regulation" that involves monitoring the firm's internal controls rather than the specifics of the

government imperfection or asymmetric information in a particular case may counsel in favor of a particular regulatory model.

As I show below, the frontier nature of Arctic offshore drilling adds new texture to these policy questions. Debates over risk-based and prescriptive regulation sound in a different key when, as in the Arctic, access to information is scant and reliance on industry is high. Similarly, the question of whether to use more or fewer policy tools to combat a perceived problem may have a different answer when, as in the Arctic, the institutions needed to implement those tools are nascent or poorly developed. To make this discussion more concrete, I focus on two ways in which the Arctic casts new light on catastrophic risk regulation: uncertainty and lack of benchmarking.

B. Uncertainty

Uncertainty occurs when a party—in this case a regulator—lacks information about what will occur.[303] Legal scholars have devoted extensive treatment to uncertainty,[304] including for catastrophic events.[305] However, much of that work focuses on the systemic unknowns, like ecosystem changes, that may be intractable.[306] Less scholarship has considered the uncertainty that arises when an industry capable of causing catastrophic harm, like offshore drilling, moves into a new frontier. Oil companies may have little incentive to reduce the uncertainty in frontier operations due to weaknesses in the liability regime.[307] Therefore, conventional information-

industry); May, *supra* note 230, at 21–22 (discussing accountability shortfalls of system-based regulation).

303 Aagaard, *supra* note 20, at 88 n.3; *see also* Farber, *supra* note 20, at 901.

304 For example, Daniel Farber has explored the inherent uncertainty in complex systems like ecosystems and advocated "adaptive management" principles, which involves careful monitoring of those systems and repeated interventions. *See, e.g.*, Daniel A. Farber, *Probabilities Behaving Badly: Complexity Theory and Environmental Uncertainty*, 37 U.C. DAVIS L. REV. 145, 147–52 (2003) (arguing that the problem of uncertainty in environmental law derives in part from complex, dynamic systems); *see also* Mary Jane Angelo, *Embracing Uncertainty, Complexity, and Change: An Eco-Pragmatic Reinvention of a First-Generation Environmental Law*, 33 ECOLOGY L.Q. 105 (2006) (drawing on Farber's work and arguing that EPA pesticide regulation should be based on open-ended balancing principles, rather than on strict cost-benefit analysis, in light of the complex and uncertain ecosystem risks created by pesticides); G.A. Bradshaw & Jeffrey G. Borchers, *Uncertainty as Information: Narrowing the Science-Policy Gap*, CONSERVATION ECOL., 2000, at 4, 7, *available at* http://www.ecologyandsociety.org/vol4/iss1/art7/ (reviewing scientific gaps in environmental issues such as climate change, and advocating environmental adaptive management policies that incorporate uncertainty into decision making).

305 *See* Farber, *supra* note 20, at 920–35 (examining the various attributes of catastrophic uncertainty); Macey, *supra* note 85, at 2088–95 (discussing "anarchy" in inter-organizational response to oil spills).

306 *See, e.g.*, Farber, *supra* note 20, at 906 (adopting a strong notion in which problems are truly uncertain when they are inherently intractable).

307 When industry lacks an incentive to research uncertainties, government is left with the undesirable choice of conducting its own research—and thereby effectively subsidizing oil companies for the planning that they were unwilling to do—or letting the unknowns persist. For an overview of information problems, see Bradley C. Karkkainen, *Bottlenecks and Baselines: Tackling Information Deficits in Environmental Regulation*, 86 TEX. L. REV. 1409, 1414–15

forcing tools to reveal information, like those sketched above, may have little effect.[308]

For several reasons, Arctic oil spill planning[309] is likely to be more uncertain than planning for oil spills generally.[310] One reason is the Arctic's extreme weather conditions, which include hostile weather, frigid water, and frequent incursions of ice.[311] Recent U.S. government reports raise questions about Arctic oil spill prevention,[312] containment,[313] and response.[314]

(2008). Karkkainen develops a typology that sorts uncertainty and asymmetrically held information into different categories of information failures in environmental regulation. *See id.* Specifically, he identifies four categories of information failures: regulating when 1) "asymmetrically held information" is at issue, i.e. information the company knows but the government does not; 2) the information burden for developing and justifying regulation is placed on government and there are many environmental unknowns; 3) there is a lack of good information on environmental baselines and stressors; and 4) there are scientific gaps related to ecosystems that are the objects of regulation. *Id.* at 1412–13.

308 *See id.* at 1412–13 (distinguishing between "asymmetrically-held information" and uncertainty, among other things); *see also supra* Part IV.B.

309 For discussion of other forms of offshore drilling uncertainty, see Livermore, *supra* note 190 (identifying several dimensions of uncertainty in offshore drilling: uncertainty as to 1) the environmental and social costs, 2) the price of oil, and 3) the costs of extracting the oil).

310 I emphasize two points in the foregoing discussion. First, uncertainty is value neutral; it is conceivable that Arctic oil spill prevention and response may be easier than expected. The key point, for present purposes, is that regulators *do not know*. Second, this discussion focuses on uncertainty rather than on known risks. I make no claim as to whether the risks of Arctic offshore drilling are greater than in other settings. Indeed, in some respects Arctic risks are lesser; the Macondo well, drilled by the *Deepwater Horizon* rig, was 5,000 feet beneath the sea surface, whereas those contemplated for the Beaufort and Chukchi seas would be at depths of less than 200 feet. U.S. GOV'T ACCOUNTABILITY OFFICE, GAO-12-244, OIL AND GAS: INTERIOR HAS STRENGTHENED ITS OVERSIGHT OF SUBSEA WELL CONTAINMENT, BUT SHOULD IMPROVE ITS DOCUMENTATION 23 n.27 (2012) [hereinafter GAO FEB. 2012 REPORT]; Nat'l Comm'n Staff Report on the Arctic, *supra* note 135, at 2 n.7. Because of these differing depths, the upward pressure in the event of an Arctic well blowout is likely to be lower than the pressure from a deepwater blowout. *See* GAO FEB. 2012 REPORT, at 23 n.27; Nat'l Comm'n Staff Report on the Arctic, *supra* note 135, at 2. My claim is that uncertainty, but not necessarily risk, is greater in the Arctic.

311 *See* NAT'L COMM'N REPORT, *supra* note 1, at 302 ("The Alaskan Arctic is characterized by extreme cold, extended seasons of darkness, hurricane-strength storms, and pervasive fog—all affecting access and working conditions. The Chukchi and Beaufort Seas are covered by varying forms of ice for eight to nine months a year."). These extreme conditions are likely to persist through at least mid-century despite the effects of climate change. *See* USGS, ARCTIC REPORT, *supra* note 11, at 89 (explaining climate change model projects through 2050 and concluding that "[s]ea ice will still be present in the Beaufort and Chukchi Seas for most of the year.").

312 *See* GAO FEB. 2012 REPORT, *supra* note 310, at 24 (stating that floating ice could obstruct or damage the wellhead, blowout preventer, and other equipment along the seafloor through ice scouring). In discussing oil spill planning in terms of prevention, containment, and response, I adopt the framework in Nathan D. Richardson et al., *Managing Risk Through Liability, Regulation, and Innovation: Organizational Design for Spill Containment in Deepwater Drilling Operations*, 2 RISK, HAZARDS & CRISIS IN PUBLIC POL'Y, no. 2, 2011, at 2, 3.

313 *See supra* Parts III.B–C.

314 At the response stage, the Arctic's extreme conditions create uncertainty in several ways. First, cold temperatures limit the human resources available in the event of an oil spill. *See* Nat'l Comm'n Staff Report on the Arctic, *supra* note 135, at 11 (noting that Shell acknowledged those limitations in the Alaska state equivalent of its OSRP). Second, cold, ice-filled waters complicate the use of commonly employed oil spill response methods, such as locating the oil,

To highlight one example: Shell's OSRPs for the Beaufort and Chukchi Seas propose, in the event of a major late season spill, that spilled oil sit in the ice for the winter, even though such an approach has never before been attempted and would have unpredictable ecosystem effects.[315]

The inaccessibility of the drilling sites in question introduces further uncertainty into oil spill response planning.[316] Compared to offshore drilling elsewhere, drilling sites in the Beaufort and Chukchi Seas have fewer human resources available and are much farther from airports, seaports, and government response infrastructure—the nearest Coast Guard base is roughly 1,000 miles away.[317] The Arctic's isolation presents major

mechanical recovery methods—e.g., skimming or boom, use of chemical dispersants—which spread the oil to promote faster natural degradation of oil through smaller surface areas—and burning of the oil on the surface of the water—known as "in-situ" burning. *See id.* at 10–12 (noting that existing methods to detect oil in or under ice are "expensive, dangerous, and not always possible based on ice conditions"); USGS, ARCTIC REPORT, *supra* note 11, at 132 (stating that "[t]he effectiveness of mechanical countermeasures, particularly in ice-infested waters, poses an ongoing challenge" and that "[s]caling up test results from laboratory and mesoscale testing into practical field recovery rates is a recognized information need"); U.S. GOV'T ACCOUNTABILITY OFFICE, GAO-12-585, OIL DISPERSANTS: ADDITIONAL RESEARCH NEEDED, PARTICULARLY ON SUBSURFACE AND ARCTIC APPLICATIONS 23–24 (2012) (noting one expert's comment that dispersants are currently designed for temperate and tropical climates and may have different effects in the Arctic). As emphasized elsewhere, Arctic conditions are not uniformly negative—ice could, for example, act as a natural barrier to prevent oil from spreading—but they are highly uncertain. *See Detecting Oil Spills: Trouble Beneath the Ice*, ECONOMIST, Dec. 1, 2012, at 16 (discussing potential benefits of Arctic conditions on oil spill response and the many uncertainties); USGS, ARCTIC REPORT, *supra* note 11, at 133 (reviewing studies suggesting positive effects from in-situ burning but adding that "it remains to be determined whether these results translate into real-world conditions.").

315 *See* SHELL EXPLORATION & PRODUCTION, BEAUFORT SEA OIL SPILL RESPONSE PLAN H-20, H-21 (2011); SHELL EXPLORATION & PRODUCTION, CHUKCHI SEA OIL SPILL RESPONSE PLAN H-16, H-17 (2011); Nat'l Comm'n Staff Report on the Arctic, *supra* note 135, at 13 (noting that if ice concentrations are sufficiently high, oil spill response would be thwarted altogether and likely be suspended until the next thaw—a strategy never before attempted).

316 *See, e.g.*, NAT'L COMM'N REPORT, *supra* note 1, at 302 (stating that oil spill response efforts are complicated by the remote location); GAO FEB. 2012 REPORT, *supra* note 312, at 24–25 (noting that Alaska lacks the Gulf of Mexico's *infra*structure, availability of equipment, and availability of vessels to respond in the event of a subsea blowout); *Detecting Oil Spills: Trouble Beneath the Ice*, *supra* note 314 (noting that "whatever advantages the Arctic offers for oil-spill response, they are overwhelmingly outweighed by the difficulty of access").

317 *See* Nat'l Comm'n Staff Report on the Arctic, *supra* note 135, at 18 (noting the Coast Guard is responsible for overseeing the response but "lacks ice-class vehicles capable of responding to a spill under Arctic conditions"); Rear Admiral Gene Brooks, *Arctic Journal* (Apr. 7, 2008), *available at* http://www.uscgalaska.com/go/doc/780/230836/ ("[W]e are not prepared for a major oil spill [over 100,000 gallons] in the Arctic environment. The Coast Guard has no offshore response capability in Northern or Western Alaska and we only dimly understand the science of recovering oil in broken ice."); Ronald O'Rourke, CONG. RESEARCH SERV., R41153, CHANGES IN THE ARCTIC: BACKGROUND AND ISSUES FOR CONGRESS 32–33 (2010) (discussing spill response and cleanup challenges in the Arctic); Kroh, *supra* note 19, at 6 (comparing oil spill response capacity in the Gulf of Mexico and the Arctic). Some recent improvements have occurred, however. *See* DEP'T OF THE INTERIOR, REPORT ON SHELL'S 2012 EXPLORATION PROGRAM, *supra* note 23, at 24–25 (noting the Coast Guard has "increased its presence above the Arctic Circle during the summer and early fall").

complications in the event search and rescue operations become necessary.[318]

From a comparative perspective, the uncertainties of Arctic offshore drilling are likely more severe than elsewhere given the paucity of oil spills[319] and field testing.[320] In other settings—including deepwater—companies have carried out exploration and development for decades, oil spills have ensued, and regulators have learned about the effects of such spills on the environment.[321] The United States and other governments have committed resources to improving their understanding of Arctic-specific effects, but progress remains modest at best.[322]

It is important to note that uncertainty alone does not spoil prospects for effective government oversight.[323] During the *Deepwater Horizon*

318 *See* NAT'L COMM'N REPORT, *supra* note 1, at 304 (discussing difficulties and search and response in the Arctic).

319 *See* BOEM, CHUKCHI SEA ENVIRONMENTAL ASSESSMENT, *supra* note 67, at A-2, A-6, A-7 (noting that 35 oil spills have occurred in U.S. Arctic waters, and all were very small (20 barrels or less); a larger spill (2,440 barrels) occurred in the Canadian Arctic when a facility fuel tank on an island eroded into the sea); Nuka, *supra* note 19, at 38–40 (listing worldwide major oil well blowouts through 2010, none of which were in the offshore Arctic). As discussed *supra*, at 5, a reason for the lack of major spills in the Arctic is that so little drilling has taken place there to date. *See, e.g.*, Eckle et al., *supra* note 2 (discussing the frequency of major spills and noting their repeated occurrence over long time scales).

320 *See, e.g.*, 2012 OIL SPILL COMM'N REPORT, *supra* note 3, at 13 (stating that in-situ burning "ha[s] not been successfully tested in the extreme weather conditions that are often present in Arctic waters" and further noting that various response methods had not "been evaluated in any significant way by government entities" as of April 2012—two months before Shell's exploratory activities began).

321 *See, e.g.*, NAT'L COMM'N REPORT, *supra* note 1, at 21–54 (recounting the history of offshore drilling in the United States). Before the *Deepwater Horizon* disaster, the effect of oil on deepwater environments was highly uncertain. *See, e.g.*, USGS, ARCTIC REPORT, *supra* note 11, at 116–19. One small benefit of the disaster was that it greatly enhanced regulators' understanding of the effects of oil spills in such environments. *Id.* (noting existence of studies following the *Deepwater Horizon* on oil in deepwater environments and the need for similar studies in the Arctic).

322 *See* U.S. ARCTIC RESEARCH COMMISSION, OIL SPILLS IN ARCTIC WATERS: AN INTRODUCTION AND INVENTORY OF RESEARCH ACTIVITIES AND USARC RECOMMENDATIONS 3, 9–15 (2012) *available at* http://www.ukpandi.com/fileadmin/uploads/uk-pi/Documents/Polar___ice_navigation/US_WhitePaper_ArcticOilSpills_2012.pdf. (documenting shortcomings in existing research on Arctic spill response and quoting George Orwell's comment that "'[w]e have now sunk to a depth at which restatement of the obvious is the first duty of intelligent men'"). MMS had previously touted U.S. government research into understanding Arctic oil spill response. *See* MMS, ARCTIC OIL SPILL RESPONSE RESEARCH AND DEVELOPMENT PROGRAM (2009) *available at* http://cmsdata.iucn.org/downloads/wgwap_9_inf_1_mmsarcticresearch.pdf. However, that claim was disputed even before the *Deepwater Horizon* disaster. WORLD WILDLIFE FUND, NOT SO FAST: SOME PROGRESS IN SPILL RESPONSE, BUT US STILL ILL-PREPARED FOR ARCTIC OFFSHORE DEVELOPMENT (2009), *available at* http://assets.worldwildlife.org/publications/401/files/original/Not_So_Fast_Some_Progress_in_Spill_Response__but_US_Still_Unprepared_for_Arctic_Offshore_Development.pdf?1345754373.

323 I make no claim as to whether an Arctic oil spill would be more damaging to the environment than elsewhere. Nevertheless, a major Arctic oil spill would have far-reaching effects on native species. *See* USGS, ARCTIC REPORT, *supra* note 11, at 53 (noting that the Beaufort and Chukchi Seas are home to three endangered species—the bowhead whale, the fin whale, and the humpback whale—and one threatened species—the polar bear); Nat'l Comm'n

disaster, many untested oil spill response methods were used, and they often proved successful.[324] The challenge posed by uncertainty is not that untested technologies will fail, but that government lacks ready metrics for regulating them effectively.[325] This piece explores *how* regulators might respond in the face of uncertainty in Part VI below.

C. Benchmarking Gaps

In addition to incomplete knowledge, another problem making regulation of Arctic offshore drilling distinct, relative to offshore drilling generally, is the lack of benchmarking available.[326] Various studies have examined how regulators use benchmarking to compare one company's experience to another[327] to draw out useful information.[328] Lack of

Staff Report on the Arctic, *supra* note 135, at 20 (discussing adverse effects of offshore drilling on bowhead whale feeding and spawning patterns). In addition to effects on species, offshore oil drilling has important repercussions for Native Alaskan populations. *See id.* at 20, 21 n.145 (citing study that found that nearly 69% of native Alaskan respondents reported that the bowhead whale makes more than half their subsistence food diet, and further noting that offshore drilling may alter bowhead whale migratory patterns and thus cause Native Alaskans to pursue whale hunting in more dangerous waters).

324 *See, e.g.*, Memorandum from Admiral R.J. Papp, Jr., Final Action Memorandum—Incident Specific Preparedness Review (ISPR) Deepwater Horizon Oil Spill 112 (Mar. 18, 2011) (noting that in the response to the *Deepwater Horizon* disaster, untested technologies, such as applying oil dispersants directly to the spill source, proved more effective than known mechanical oil recovery technologies like boom and skimmers).

325 These uncertainties would become magnified at the development stage, when oil extraction activities would likely occur year-round. *See* Charles W. Schmidt, *Offshore Exploration in the Arctic: Can Shell's Oil-Spill Response Plans Keep Up?*, 120 ENVTL. HEALTH PERSP. A194 (May 2012), *available at* http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3346799/pdf/ehp.120-a194.pdf (noting uncertainties surrounding year-round development and production and quoting Shell spokesman Curtis Smith as follows: "'We're looking at [year-round development] now, but we haven't made any fixed decisions about what we're going to do.'").

326 I distinguish uncertainty from benchmarking gaps by focusing on the lack of information with respect to uncertainty and the difficulty in gathering information when there are benchmarking gaps. *See generally* Andrei Shleifer, *A Theory of Yardstick Competition*, 16 RAND J. OF ECON. 319, 319–20 (1985) (discussing the use of benchmarking to infer firm-level cost data).

327 Much of this scholarship is in the context of cost-of-service regulation, where the regulator sets the price at which a regulated monopoly sells goods or services by relying on cost data from other firms to benchmark the policy choice. *See id.* at 319–20 (developing a model for benchmarking identical firms and firms with heterogeneous characteristics). Benchmarking and yardstick regulation are often used synonymously, though not always. *See* BALDWIN ET AL., *supra* note 302, at 496–501. For an analysis of benchmarking in environmental law, see Karkkainen, *supra* note 227, at 286–94 (discussing the U.S. Environmental Protection Agency's Toxics Release Inventory (TRI) that mandates industrial facilities disclose release of certain toxic chemicals and thereby provide for regulatory benchmarking).

328 *See* Shleifer, *supra* note 326, at 320, 326 (exploring advantages of benchmarking). Benchmarking also has downsides. Firms may collude among one another, explicitly or implicitly, to manipulate the information being provided. *See id.* at 327. Even robust benchmarking may fail to yield optimal results if all companies being benchmarked are inefficient—as may occur in less than perfectly competitive markets like offshore drilling. *See* BALDWIN ET AL., *supra* note 302, at 497 (discussing this limitation of benchmarking generally). The company activities being benchmarked may also differ, complicating the usefulness of

benchmarking may skew regulatory decision making because regulators are reliant on one or few firms' experience.[329] As a result, the regulated entity may "frame" policy making options[330] in advantageous ways,[331] causing the regulator to suffer behavioral bias.[332] Little research has explored how lack of benchmarking affects regulation of offshore drilling[333] and other hazardous, technologically dynamic industries where alternative reference points are missing.[334]

There are several reasons benchmarking is a challenge in the Arctic. First, almost no activity has occurred to date. Shell is virtually the only company to drill there in the past two decades,[335] and only Shell's

comparison. *See id.* at 501. Nevertheless, benchmarking is an often useful, if imperfect, tool because it provides some basis for comparison.

329 While lack of benchmarking may have pernicious effects regardless of whether the regulated entity exerts pressure on the regulator, the problems of lack of benchmarking and industry pressure work hand in hand. *See, e.g.*, Broder & Krauss, *supra* note 9, at A21 (stating that "[s]ome bureaucrats felt under siege by the relentless lobbying" by Shell in approving offshore drilling plans).

330 The problem of framing is commonly studied in decision theory. *See, e.g.*, Amos Tversky & Daniel Kahneman, *The Framing of Decisions and the Psychology of Choice*, 211 SCI. 453, 453 (1981) (adopting the term "decision frame" for a "decision-maker's conception of the acts, outcomes, and contingencies associated with a particular choice"); Daniel Kahneman, *Maps of Bounded Rationality: Psychology for Behavioral Economics*, 93 AM. ECON. REV. 1449, 1458–60 (2003) (discussing framing effects). Commentary has examined the effects of framing on consumer choice, but the effects on *regulatory choice* have received less attention. *See, e.g.*, Jonathan Remy Nash, *Framing Effects and Regulatory Choice*, 82 NOTRE DAME L. REV. 313, 319-20 (2006) (analyzing the effects of framing on public perceptions of environmental policies, rather than framing effects on regulators directly); *see also* Hunt Allcott & Sendhil Mullainathan, BEHAVIORAL SCI. & ENERGY POL'Y, Feb. 2010, at 2 (longer supporting version of Hunt Allcott & Sendhil Mullainathan, *Behavior and Energy Policy*, 327 SCI. 1204, 1205 (2010)) (discussing framing at the individual level as a justification for government intervention in energy policy); Michael P. Vandenbergh et al., *Regulation in the Behavioral Era*, 95 MINN. L. REV. 715, 749 (2011) (discussing effects of individual level framing on policy choice).

331 Lack of benchmarking and framing work hand in hand. A regulator may issue imperfect regulations because the regulated entity frames, or scripts, policy-making options in a certain way –and, relatedly, because the regulator cannot check the regulated entity's script against the experience of other companies—due to a lack of benchmarking opportunities.

332 For insights on how behavioral bias may affect regulators, see Stephen J. Choi & A.C. Pritchard, *Behavioral Economics and the SEC*, 56 STAN. L. REV. 1, 27–28 (2003) (discussing how the framing of an issue affects policy response by the Securities and Exchange Commission); *see also* Oskari Juurikkala, *The Behavioral Paradox: Why Investor Irrationality Calls for Lighter and Simpler Financial Regulation*, 18 FORDHAM J. CORP. & FIN. L. 33, 81 (2012).

333 *See generally* Osofsky, *supra* note 123, at 1098 ("BP and other assisting companies played a lead role in framing the options in the aftermath of the [*Deepwater Horizon*] spill. In addition, BP controlled access to the site itself, which limited the government and independent scientists' ability to assess the flow rate and containment solutions.").

334 *See, e.g.*, Sylves & Comfort, *supra* note 246, at 77 (examining regulatory oversight of offshore drilling through the lens of behavioral economics by comparing the governmental response to the 2010 BP *Deepwater Horizon* oil spill with the 1989 Exxon Valdez oil spill). This study does not address framing specifically; it instead focuses on the effects of government agency interdependence and complex socio-technical systems on regulatory decision making. *Id.* at 77–81.

335 Nat'l Comm'n Staff Report on the Arctic, *supra* note 135, at 8 (noting that, as of 2011, "Shell is the only company to have made a proposal for drilling in the Chukchi, so there are

Exploration Plans and OSRPs received regulatory approval recently.[336] Other oil companies, such as ConocoPhillips or Statoil, may enter U.S. Arctic waters, but the total number of operating companies likely will remain small for the foreseeable future.[337] These factors create a danger that government will regulate Arctic offshore drilling by looking through the prism of few firms' perspectives.

Second, regulators overseeing the Arctic have limited guideposts or comparative experiences on which to draw. In the United States, the only Arctic-specific basis for comparison is the oil industry's activities there during the 1980s and 1990s.[338] Those activities offer little guidance because they were limited in number, certain technologies were different, MMS oversight was light,[339] and OSRPs were not put into use.[340] Outside the United States, Russia is the only Arctic country where drilling is underway and where operating conditions resemble those in the Beaufort and Chukchi Seas.[341] However, Russia's environmental framework for regulating offshore drilling is notoriously lax.[342]

unfortunately no competing plans with which to compare the response plans Shell proposes"). The only recent cases, apart from Shell's, were BP's near-shore projects in the Beaufort Sea.

336 *See supra* Part III.B. ConocoPhillips, another player in the Arctic, submitted a Chukchi Sea OSRP on or before February 2012 but BSEE had not approved it or made it public at the time of Shell's 2012 drilling season. *See* Shogan, *supra* note 94.

337 *See* Darya Korsunskaya & Braden Reddall, *Exxon, Rosneft Tie Up in Russian Arctic, U.S.*, REUTERS, Aug. 30, 2011, http://www.reuters.com/article/2011/08/30/us-rosneft-exxon-idUSTRE77T2OM20110830 (last visited July 26, 2014) (discussing limited number of oil companies with the technological expertise to drill in the Arctic). In addition, many of the companies poised to enter the Arctic may do so in the form of joint-venture arrangements, reducing the number of data points for regulatory benchmarking. *See, e.g.*, Alan Bailey, *Wait and See for Shell*, PETROLEUM NEWS, July 11, 2010, http://www.petroleumnews.com/pntruncate/295400639.shtml (last visited July 26, 2014) (discussing possible joint venture in the Arctic between Shell and Italian oil company Eni).

338 *See supra* Part II.A. Although ConocoPhillips submitted an OSRP in February 2012, *supra* note 94, this submission virtually coincided with the time BSEE *approved* Shell's OSRPs, and there is no indication that BSEE used ConocoPhillips's OSRP as a basis for comparison.

339 No known study has examined the quality of MMS's OSRP reviews for the Arctic. However, legal scholarship has criticized the quality of MMS review for the OSRP covering the Macondo well in the *Deepwater Horizon* disaster. *See, e.g.*, Hartsig, *supra* note 19, at 313 (criticizing BOEM for not questioning BP's OSRP for the Macondo well in the Gulf of Mexico even though it "referenced walruses, sea lions, and sea otters—species that do not occur in the Gulf of Mexico"); Barsa & Dana, *supra* note 90, at 223 n.28 (noting that BP's OSRP was "full of errors").

340 *See supra* text accompanying notes 143–145 (discussing lack of major Arctic oil spills).

341 *See supra* text accompanying notes 124–132. Oil companies are drilling in Norway's Arctic waters, but, due to the Gulf Stream, those waters are considerably warmer than waters in the U.S. Arctic or Russia. *See supra* text accompanying notes 128–129.

342 Maria Ivanova, *Oil Spill Emergency Preparedness in the Russian Arctic: A Study of the Murmansk Region*, 30 POLAR RES. 7285 (2011) (characterizing Russian oil spill regulations as "not coherent" and concluding that "[t]he lack of a well-defined state strategy on oil spill protection and response reflects the overall state of Russian environmental policy"); *see also* Andrew E. Kramer & Clifford Krauss, *Russia Embraces Arctic Drilling*, N.Y. TIMES, Feb. 16, 2011, at B1 (further discussing Russian regulation). *But see Strict Regulations Protects* [sic] *Russian Oil Offshore Platforms from a* [sic] *Oil Disaster*, NEFTEGAZ.RU, June 3, 2010, http://neftegaz.ru/en/news/view/95200 (last visited July 26, 2014) (quoting Russian government official's

Third, Shell's 2012 exploratory drilling season evidences the effects caused by benchmarking gaps.[343] Consider regulatory approval of Shell's ACS for containing spilled oil. Shell's 2012 Exploration Plans and OSRPs for the Beaufort and Chukchi Sea committed to having a first-of-its-kind containment dome for collecting spilled oil in Arctic conditions.[344] Shell's commitment to implementing the ACS was, according to the Department of the Interior, "a key basis for [BOEM and BSEE's] approval" of Shell's Exploration Plans and OSRPs for the 2012 season.[345] Yet the ACS containment dome failed spectacularly during a mid-2012 test and was never used.[346] Although BSEE modified its drilling approvals in the wake of the containment dome failure,[347] the fact that regulators approved drilling on the basis of a never-before-used technology is indicative of the company's power to sway regulator decisions.

Lack of benchmarking may infect decision making even when regulators "get tough" on industry. As noted previously, BOEM conditioned its approval of Shell's 2012 Chukchi Sea Exploration Plan on Shell ceasing operations thirty-eight days before the date of likely ice encroachment,[348] a condition that Shell unsuccessfully sought to modify.[349] The logic behind BOEM's thirty-eight-day limitation was to give Shell enough time to stop the flow of oil, deploy its capping and containment technologies, and drill a relief well before ice interfered with operations.[350] Underpinning BOEM's logic was a series of assumptions that Shell could: 1) deploy capping and containment technology within fifteen days;[351] 2) send the secondary drilling rig from the Aleutian Islands—if it was located there at the time—to the

claim that "Russia today probably has the world's strictest environmental regulations for oil companies operating on the [OCS]").

343 Admittedly, BSEE's regulatory oversight of Shell's 2012 exploratory activities is a limited data point from which to draw conclusions. It is nevertheless suggestive of the power of framing to affect regulatory choice.

344 *See supra* Part III.C.

345 DEP'T OF THE INTERIOR, REPORT ON SHELL'S 2012 EXPLORATION PROGRAM, *supra* note 23, at 17. *See* Letter from Susan Childs, AK Venture Support Integrator, Manager, Shell, to David M. Moore, Chief, Oil Spill Div., BSEE 4 (Jan. 26, 2012) (discussing the ACS); *see also* GAO FEB. 2012 REPORT, *supra* note 310, at 23 (stating that the Arctic-specific capping stack was planned as Shell's primary response in the event of a well blowout); BSEE Fact Sheet, *supra* note 94 (discussing Shell's commitment to make a capping stack available in the event of a spill).

346 *See supra* note 167 and accompanying text.

347 *See supra* text accompanying note 180 (discussing BSEE's decision to limit Shell's maximum drilling depth so that the lack of a containment dome did not introduce further risks into Shell's operations).

348 *See supra* notes 162–163 and accompanying text.

349 *See* Tim Bradner, *Shell Will Try to Modify Chukchi Exploration Plan*, ALASKA J. OF COM., Dec. 21, 2011, http://www.alaskajournal.com/Alaska-Journal-of-Commerce/AJOC-December-25-2011/Shell-will-try-to-modify-Chukchi-exploration-plan/#ixzz2S7BG4ZH9 (last visited July 26, 2014) (discussing 38-day limitation and Shell's intent to end the limitation).

350 BOEM, CHUKCHI SEA ENVIRONMENTAL ASSESSMENT, *supra* note 67, at 7.

351 *Id.* at A-5.

Chukchi Sea in twenty days, based on company estimates;[352] and 3) drill a relief well in twenty-eight days, based also on company estimates.[353]

Shell's 2012 experience throws each of these assumptions into doubt. With respect to capping and containing the flow of oil within fifteen days, the ACS containment dome failed a performance test, prompting concern as to whether Shell could have contained the oil flow had the containment dome passed that test but still suffered from the underlying flaw. As for sending a secondary drilling rig from the Aleutian Islands to the Chukchi Sea, that rig, the *Kulluk*, ran aground near the Aleutian Islands in December 2012,[354] undermining Shell's assurance that it could safely deploy ships in the region. And with respect to drilling a relief well in eighteen days, the Department of the Interior's report following the 2012 drilling season criticized Shell's drilling time estimates as being consistently "unrealistic."[355]

This episode is indicative[356] of the perils when the regulated entity effectively scripts the policy-making choice.[357] And this challenge may become even more pronounced in the chaotic decision-making environment after a major oil spill occurs.[358]

D. Shortcomings in Existing Policy Tools

The frontier challenges of benchmarking and uncertainty undermine many of the conventional approaches to addressing catastrophic risk. The Arctic's brief track record of drilling[359] undercuts the rationale for risk-based regulations because such regulations typically rely on historical track

352 Shell, Chukchi Sea Exploration Plan, *supra* note 50, at 2-4.

353 *Id.* The three time periods do not add up to 38 days because Shell could simultaneously seek to cap and contain the flow of oil and send a secondary drilling rig to the drill site.

354 *See supra* note 171.

355 *See* DEP'T OF THE INTERIOR, REPORT ON SHELL'S 2012 EXPLORATION PROGRAM, *supra* note 23, at 23 ("In submissions to DOI, Shell consistently underestimated the length of time required to complete each step of its drilling operations. The timelines provided by Shell proved to be unrealistic and did not account for complications and delays that should be budgeted for when operating in the Arctic.").

356 This episode is merely suggestive because of the small sample size available—i.e., only one exploratory drilling season.

357 The examples cited above are not exhaustive. For example, research has shown that some oil response methods not discussed in Shell's OSRP may be promising in the Arctic. *See, e.g.*, USGS, ARCTIC REPORT, *supra* note 11, at 141–42 (discussing research that suggests the application of mineral powders could aid in the "natural removal and attenuation of hydrocarbons on the shoreline").

358 *See* Nat'l Comm'n Report on Unified Command, *supra* note 84, at 13–15 (discussing the tensions between government and BP in coordinating response efforts to the *Deepwater Horizon* disaster and the challenges created by differing incentives, industry expertise, and the need to move quickly in a rapidly unfolding disaster). The government would arguably be even more reliant on industry during an Arctic oil spill than it was during the *Deepwater Horizon* disaster. *See, e.g.*, Nat'l Comm'n Staff Report on the Arctic, *supra* note 135, at 19 (discussing ongoing questions about Shell's oil spill response).

359 *See supra* Part II.B (discussing Arctic offshore drilling history); *see also* USGS, ARCTIC REPORT, *supra* note 11, at 115 (noting that historic data on Arctic spills are not documented).

records of accidents and near-accidents as information inputs.[360] Moreover, risk-based regulations often govern a firm's internal controls rather than the underlying conduct.[361] Adopting such an approach in the Arctic may aggravate the problems of industry reliance and framing that already exist in regulating offshore drilling there. Uncertainty causes similar problems with respect to environmental review.[362] In the Beaufort and Chukchi Seas, regulators had a single reference point on which to rely—the one developed by Shell, the only company drilling in U.S. Arctic waters.[363] This narrow frame of reference may compromise the effectiveness of NEPA analysis.

An additional problem exists: Regulatory tools aimed at reducing uncertainty and lack of benchmarking in other contexts may not work well in the Arctic given the catastrophic risks. An example is adaptive management or "learning by doing," designed to improve agency decision making in the face of uncertainty.[364] Adaptive management embraces iterative decision making, constant re-evaluation of environmental baselines, and adoption of new regulatory approaches based on the information gleaned.[365] Government agencies commonly rely on adaptive management

360 *See supra* notes 231–233 (discussing information needs of risk-based regulations). Such data may be available or at least obtainable from the Gulf of Mexico. *See, e.g.*, David Izon et al., *Absence of Fatalities in Blowouts Encouraging in MMS Study of OCS Incidents 1992–2006*, DRILLING CONTRACTOR, July–Aug. 2007, at 84 (analyzing frequency of blowouts on the OCS from 1992 to 2006); Cooke et al., *supra* note 233, at 11 (discussing availability of data used in Izon's study and other data for developing risk-based regulations).

361 *See* May, *supra* note 230, at 21 ("System-based regulation places emphasis on monitoring adequacy of regulated firms' systems that . . . is undermined if inspectors do not have the expertise to fulfill their monitoring roles."); BALDWIN ET AL., *supra* note 302, at 289 (stating that risk-based regulations are a "regulatory method that focuses attention on the firm's internal controls").

362 *See supra* Part IV.C.

363 *See* BOEM, CHUKCHI SEA ENVIRONMENTAL ASSESSMENT, *supra* note 67, at 17 (BOEM stating that it relied on Shell's worst-case discharge estimates but that it independently verified Shell's estimates); BOEM, BEAUFORT SEA ENVIRONMENTAL ASSESSMENT, *supra* note 67, at A-2 to A-4. NEPA does not require that agencies consider the worst-case scenarios in an EA. BOEM's EAs for the Beaufort and Chukchi Seas include worst-case scenario information provided by Shell for its OSRPs. *See* BOEM, CHUKCHI SEA ENVIRONMENTAL ASSESSMENT, *supra* note 67, at A-4 to -5.

364 *See, e.g.*, Karkkainen, *supra* note 307, at 1442–44 (discussing core principles of adaptive management and application to restoration efforts in the Chesapeake Bay). For an overview and critique of adaptive management, see Holly Doremus, *Adaptive Management as an Information Problem*, 89 N.C. L. REV. 1455, 1456 (2011) (remarking that "[a]daptive management arouses both much enthusiasm and much skepticism"); J.B. Ruhl & Robert L. Fischman, *Adaptive Management in the Courts*, 95 MINN. L. REV. 424, 425 (2010) (commenting on adaptive management and "its mixed reviews").

365 *See* Doremus, *supra* note 364, at 1462–64; Ruhl & Fischman, *supra* note 364, at 428–31. Various commentary contrasts adaptive management with the traditional, and often NEPA inspired, view of anticipating environmental harms far in advance. *See* Ruhl & Fischman, *supra* note 364, at 429 (discussing tensions between NEPA and environmental management); Julie Thrower, *Adaptive Management and NEPA: How a Nonequilibrium View of Ecosystems Mandates Flexible Regulation*, 33 Ecology L.Q. 871, 884–85 (2006).

principles when carrying out ecosystem restoration,[366] and the idea has bled over to other contexts as well.[367]

As applied to Arctic offshore drilling, adaptive management could conceivably help structure decision making in the event of a major oil spill, when ad hoc crisis management techniques reign supreme.[368] But adaptive management may have less utility for oil spill planning because it would accept near-term uncertainties in the hope, possibly illusory, that experimental regulatory interventions would reduce those uncertainties over time.[369] Though offshore drilling is never a risk-free enterprise,[370] it may demand a more precautionary approach than adaptive management seems to provide.[371]

VI. PRINCIPLES FOR REFORM

In light of the problems of regulating catastrophic risks at the technological frontier, what solutions exist? One solution is to ban offshore drilling in U.S. Arctic waters altogether.[372] Such a tack would run into major implementation hurdles, including political opposition, legal challenge,[373] and a possible U.S. government obligation to reimburse oil companies for either the value of the cancelled rights or the value of the investments made,

366 *See* Doremus, *supra* note 364, at 1465 (citing such examples as management of the Florida Everglades, Chesapeake Bay, and California Bay-Delta).

367 *See* Ruhl & Fischman, *supra* note 364, at 424–25. In fact, BOEM has already invoked adaptive management as a strategy for regulating offshore drilling in the Arctic. *See, e.g.*, BOEM, CHUKCHI SEA ENVIRONMENTAL ASSESSMENT, *supra* note 67, at 8 (referring to its calculation of the 38-day "trigger date" for stopping Arctic offshore drilling as being "[c]onsistent with adaptive management principles").

368 For a study of crisis management decision making during the *Deepwater Horizon* disaster, see Nat'l Comm'n Report on Unified Command, *supra* note 84.

369 *See* Doremus, *supra* note 364, at 1470–77 (arguing that good opportunities for regulatory learning are among the prerequisites for effective use of adaptive management principles).

370 *See, e.g.*, Viscusi & Zeckhauser, *supra* note 99, at 1725–26 (discussing the riskiness of offshore drilling and asserting that "[a]t the most basic level, the optimal level of safety will seldom involve zero risk").

371 In addition, adaptive management may weaken the accountability needed in an industry where agency capture is an ever present threat. *See* Aagaard, *supra* note 20, at 124–25 (acknowledging promise of adaptive management but also generally noting dangers in giving agencies flexibility in light of the reduced transparency and increased bias that may result).

372 A permanent ban would reflect the ideals behind environmental law's precautionary principle, which in its simplest form is to "[a]void steps that will create a risk of harm." *See* Cass R. Sunstein, *Beyond the Precautionary Principle*, 151 PENN. L. REV. 1003 (2003) (explaining the precautionary principle and offering a critique of it). However, it is possible such a ban would have other undesired effects, such as inducing oil companies to push more aggressively for oil development and exploration in other offshore areas. These effects merit consideration as well. *See* Krupnick et al., *supra* note 102, at 11–12 (suggesting that a ban on deepwater oil drilling may lead to greater shallow-water drilling).

373 The Secretary of the Interior may cancel a lease if it determines that the activities cannot avoid "probably caus[ing] serious harm or damage to life (including fish and other aquatic life), to property, to any mineral (in areas leased or not leased), to the national security or defense, or to the marine, coastal, or human environment." 43 U.S.C. §§ 1334(a)(2)(A)(i), 1340(c)(1)(B) (2006).

which, in either case would be considerable.[374] Thus, a ban, while attractive, may be unlikely as a practical matter.[375]

However, several steps short of a ban could usefully reduce environmental and safety risks. I focus on three steps in particular, and the policy interactions among them: delaying the onset of offshore drilling until better coordination can occur; increasing the transparency of regulatory review; and potentially developing a more prescriptive approach to regulation.[376]

A. Delay and Coordination

The first recommendation is for regulators to *slow down and coordinate* the regulatory approval process. In the Arctic, press accounts play up the notion of a race among countries to develop the region's oil resources.[377] The U.S. government need not win this race.[378] The legal literature suggests that government may derive important benefits, or "real option" values, from delaying approval of offshore drilling activities.[379] Delay may enable the government to gather information and reduce the

374 *See* 43 U.S.C. §§ 1334(a)(2)(C), 1340(c)(1)(B) (entitling lessees to compensation and specifying criteria for compensation). In addition to the costs of cancelling a lease, a permanent ban could result in a loss of future revenues to the U.S. government, though effects on oil price would be negligible. *See* Krupnick et al., *supra* note 102, at 9–10 (projecting the reduction in total U.S. oil production and consumption under a permanent ban for deepwater drilling).

375 *See, e.g.*, Robertson, *supra* note 19, at 120 (discussing political challenges of a ban). As Livermore notes: "Lease cancelations [sic] are sufficiently rare that when they do occur, it can be national news." Livermore, *supra* note 190, at 594 n.40.

376 For other examples of policy interactions, see Cohen et al., *supra* note 98, at 1903–04 (discussing policy interactions in the context of oil drilling between liability and financial responsibility, and between liability and mandatory insurance). For political economy analysis of policy reform, see Nathaniel O. Keohane et al., *The Choice of Regulatory Instruments in Environmental Policy*, 22 HARV. ENVTL. L. REV. 313, 353–56 (1998) (developing a theoretical framework to explain the choice of environmental policy instruments that is based on the "demand" for such instruments—from firms, environmental interest groups, etc.—and the "supply" of those instruments from legislators).

377 *See, e.g.*, ECONOMIST, *supra* note 146; Dawson, *supra* note 18 (quoting Christopher Smith, Principal Deputy Assistant at the U.S. Department of Energy, as stating, "We have to realize that we are in an international game . . . We have to balance the challenges of caution with our desire to make sure the U.S. is taking a true leadership role").

378 A perverse feature of U.S. tax policy is that it has long subsidized and incentivized offshore drilling despite its riskiness, lost revenues due to government assistance, and caused harmful environmental effects from oil consumption. For an overview, see Temi Kolarova, Comment, *Oil and Taxes: Refocusing the Tax Policy Question in the Aftermath of the BP Oil Spill*, 42 SETON HALL L. REV. 351, 357–66 (2012) (discussing the tax code's deductions, credits, and other provisions favoring the oil industry, many of which have existed since the early 1990s and have cost the U.S. government billions of dollars).

379 *See generally* Livermore, *supra* note 190. Livermore's reference to the value of waiting to develop an oil resource as the "real option" takes its inspiration from economic theories of natural resource extraction. *See id.* at 591–93. Political scientist Daniel Carpenter has coined a related concept: the scarcity of quick approval. *See* Daniel P. Carpenter, *Protection Without Capture: Product Approval by a Politically Responsive, Learning Regulator*, 98 AM. POL. SCI. REV. 613, 619 (2004).

uncertainties of oil drilling before making the effectively irreversible decision to allow oil extraction to proceed.[380] Delay is not cost free: The government gives up near-term revenues and, possibly, some first-mover innovation advantages to oil companies and society.[381] But any losses may be smaller than the gains from waiting.[382]

A further pause in offshore drilling activities may be constructive in the Arctic. As discussed above, the effects of Arctic offshore drilling are arguably more unsettled than elsewhere because so little drilling and no major oil spills have occurred.[383] Delaying the onset of drilling would give regulators time to close some knowledge gaps. Doing so could also mitigate benchmarking problems by giving other oil companies, and other countries contemplating Arctic offshore drilling in their own waters, time to catch up. The U.S. government could then leverage the benefit of comparative regulatory[384] and company[385] experiences, and reduce its reliance on a single frame of reference, to improve the quality of its regulatory design.[386]

Delaying Arctic offshore drilling is also viable. A suspension or temporary prohibition of offshore drilling activities, while far from routine, does not create the same difficulties created by an outright ban.[387] Indeed,

380 *See* Livermore, *supra* note 190, at 605–14 (discussing three dimensions of uncertainty: environmental and social costs, price, and extraction costs).

381 *See generally* Linda Cohen, *When Can Government Subsidize Research Joint Ventures? Politics, Economics, and Limits to Technology Policy*, 84 AM. ECON. REV. 159 (1994) (explaining conditions under which government subsidization of high technology research is justifiable).

382 The merits of approving industrial activity at the frontier depend in part on the spillover effects of such an approval. In situations of acute scarcity—where, for example, the capital available for large-scale investments is limited—prompt approval may provide a "first-mover advantage." However, prompt approval deprives government of the ability to use delay in order gather more information about the risks of the industrial activity. For general discussion of the first-mover advantage, see Fernando F. Suarez & Gianvito Lanzolla, *The Role of Environmental Dynamics in Building a First Mover Advantage Theory*, 32 ACAD. MGMT. REV. 377 (2007).

383 *See supra* Part V.B–C.

384 A large body of research has explored convergence in regulatory models and the reason why it does or does not occur. For discussion, see Ragnar E. Löfstedt & David Vogel, *The Changing Character of Regulation: A Comparison of Europe and the United States*, 21 RISK ANALYSIS 399, 400–02 (2001) (discussing exchange of regulatory processes between Europe and the United States).

385 In making this recommendation, I do not suggest that the U.S. government allow *more* offshore drilling to occur; the point is that more examples of Arctic offshore drilling would arguably increase the quality of regulation by providing alternative frames of reference.

386 *See supra* note 328 and accompanying text; Mark Armstrong & David E.M. Sappington, *Recent Developments in the Theory of Regulation*, *in* 3 HANDBOOK OF INDUSTRIAL ORGANIZATION, 1560, 1641–45 (Mark Armstrong & Robert H. Porter eds., 2007) (discussing yardstick competition); PER J. AGRELL & PETER BOGETOFT, CENTER FOR OPERATIONS RESEARCH AND ECONOMETRICS DISCUSSION PAPER 2013/38, BENCHMARKING AND REGULATION 7, 28–29 (2013) (summarizing research on the effects of benchmarking).

387 *Compare* 43 U.S.C. § 1334(a)(1)(B) (2006) (providing for suspension or temporary prohibition of offshore drilling activities "*if there is a threat* of serious, irreparable, or immediate harm or damage . . .") (emphasis added) *with* 43 U.S.C. § 1334(a)(2)(A)(i) (2006) (providing for cancellation of a lease if "continued activity pursuant to such lease or permit *would probably cause* serious harm or damage . . .") (emphasis added); *see also id.* § 1334(a)(2)(C) (entitling lessees to compensation for cancellation of a lease but not discussing compensation in the context of suspensions or temporary prohibitions). It is, of course,

the Department of the Interior postponed Arctic offshore drilling once already,[388] and Shell has abandoned plans to drill in 2014.[389]

The ideal length of delay is dependent on various factors beyond the scope of this piece. At minimum, the Department of the Interior should delay Arctic offshore drilling until another country authorizes drilling in conditions similar to the Beaufort and Chukchi Seas, and until a company other than Shell is ready to drill. The key is for regulators to proceed, if at all, with "utmost care."[390]

B. Transparency and Accountability

The second recommendation is for regulators to *open* regulatory decision making to outside scrutiny, particularly approval of OSRPs and other regulatory reviews[391] of company preparedness. OPA provides for little public participation in OSRPs, and regulators have been reluctant to seek it independently.[392] In fact, MMS did not solicit public comment on OSRPs, and the first time BSEE did so was for Shell's 2012 exploratory drilling season in the Beaufort and Chukchi Seas.[393] It is unclear whether BSEE will repeat this decision. Its recent guidance on OSRPs, issued following approval of the Beaufort and Chukchi Sea OSRPs, encourages—but does not require—oil companies to prepare a public version of OSRPs for release *after* BSEE approval.[394] Opportunities for future interagency input[395] or meaningful judicial review[396] are even murkier.

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possible the oil industry could successfully challenge a suspension of Arctic drilling activities, as they challenged the government's six-month moratorium on deepwater oil drilling activities after the *Deepwater Horizon* disaster. *See* Hornbeck Offshore Servs., LLC v. Salazar, 696 F. Supp. 2d 627, 638–39 (E.D. La. 2010) (enjoining the Interior Secretary's enforcement of a moratorium on offshore drilling on new deepwater wells in the OCS in the immediate aftermath of the *Deepwater Horizon* disaster).

388 *See supra* Part III.D.

389 *See* Cockerham, *supra* note 184.

390 *See* NAT'L COMM'N REPORT, *supra* note 1, at 302. One objection is that industry pressure makes it politically untenable to delay drilling. To the extent this objection has merit, regulators might respond by requiring oil companies that desire rapid drilling approval to meet a higher threshold of safety for their operations. This approach has weaknesses, however, because notions of what is safe will be largely defined by the few companies involved.

391 These reviews include announced and unannounced inspections of company facilities, tests, and mock exercises. For discussion, see PEW REPORT, *supra* note 19, at 43–44 (recommending that the public be given online access to results of these inspections, tests, and exercises).

392 *See supra* notes 92–93 and accompanying text.

393 *See supra* note 94 and accompanying text.

394 *See* U.S. DEP'T OF INTERIOR, NTL NO. 2012-N06, *supra* note 269, at 6. Notably, the Notice to Lessees provides that the public version of OSRPs may exclude certain trade secret information from the public version. *Id.* A similar issue has arisen in the context of hydraulic gas fracturing ("fracking"), where oil companies have resisted public disclosure of the chemicals used in their fracking activities by arguing that the chemical mix is trade secret information. *See* Keith B. Hall, *Hydraulic Fracturing: Trade Secrets and the Mandatory Disclosure of Fracturing Water Composition*, 49 ID. L. REV. 399, 400, 406 (2013).

395 The National Commission recommended that multiple agencies review OSRPs, and they did so for Shell's Beaufort and Chukchi Sea OSRPs, but BSEE did not institutionalize this

Outside scrutiny of OSRPs and other regulatory reviews would shed light on a part of the oil drilling process that has eluded much notice.[397] The values of transparency and accountability, which are important for offshore drilling generally,[398] take on greater significance in the Arctic because one or few firms frame much of the information generated. Hearing from other voices would add valuable new sources of information to the mix, provide a check against the threat of regulatory capture by the industry,[399] and improve the legitimacy of the process.[400] It might also give the courts, which generally defer to agency judgments "at the frontiers of science,"[401] an opportunity to undertake a more assertive role.[402]

approach in its 2012 Notice to Lessees on OSRPs. *See* U.S. DEP'T OF INTERIOR, NTL NO. 2012-N06, *supra* note 269; *see also* THE PEW CHARITABLE TRUSTS, ARCTIC STANDARDS: RECOMMENDATIONS ON OIL SPILL PREVENTION, RESPONSE, AND SAFETY IN THE U.S. ARCTIC OCEAN 124 (2013) *available at* http://www.pewenvironment.org/uploadedFiles/PEG/Publications/Report/Arctic-Standards-Final.pdf.

396 As discussed *supra*, note 93 and accompanying text, the District of Alaska held in August 2013 that OSRPs need not satisfy NEPA or ESA requirements.

397 Other documents that are publicly disclosed, such as Exploration Plans and DPPs, touch upon some aspects of oil spill response planning, but they are significantly less detailed than OSRPs on this subject. *See e.g.*, Shell, Beaufort Sea Exploration Plan, *supra* note 50, at 8-1 (explaining that the Alaska equivalent of the OSRP, the ODPCP, provides information on Shell's oil spill planning); Shell, Chukchi Sea Exploration Plan, *supra* note 50, at 8-1.

398 *See supra* Part IV.C (reviewing legal literature on this subject).

399 *See supra* note 223 and accompanying text.

400 *See* William M. Sage, *Regulating Through Information: Disclosure Laws and American Health Care*, 99 COLUM. L. REV. 1701, 1710–11 (1999) (discussing effect of regulatory transparency on democratic deliberation, among other values).

401 This language comes from *Baltimore Gas & Elec. Co. v. Natural Res. Defense Council, Inc.*, 462 U.S. 87, 103 (1983), which held in a case concerning scientific judgments by the Nuclear Regulatory Commission that "a reviewing court must remember that the [Nuclear Regulatory] Commission is making predictions, within its area of special expertise, at the frontiers of science. When examining this kind of scientific determination, as opposed to simple findings of fact, a reviewing court must generally be at its most deferential." *See also* Andrew D. Siegel, *The Aftermath of* Baltimore Gas & Electric Co. v. NRDC*: A Broader Notion of Judicial Deference to Agency Expertise*, 11 HARV. ENVTL. L. REV. 331 (1987) (providing analysis). For example, in *Native Vill. of Point Hope v. Salazar*, the Ninth Circuit relied extensively on BOEM's technical expertise in denying two Native American groups' petitions for expedited review of BOEM's approval of Shell Offshore Inc.'s plan for exploratory oil drilling in the Beaufort Sea. 680 F.3d 1123, 1133–34 (9th Cir. 2012). Deferring to "BOEM's interpretation of its own regulations," the court found it could not find BOEM acted arbitrarily and capriciously in finding that the information provided by Shell on the well-capping stack and containment system was sufficient, even though that system represented a "new and unusual technology" that has never been used in the Arctic and ultimately failed. *Id.* at 1132. BOEM's conclusions in these respects are very much open to doubt.

402 This notion of agency deference is based on the (contested) assumption that regulators have greater expertise and therefore are better positioned to make sound judgments about the appropriateness of scientific or technical actions. *See generally* Aaron Gershonowitz, *The Role of Science in Environmental Litigation: Courts Give Deference to Agency Experts Except When They Don't*, 39 SW. L. REV. 233 (2009); Emily Hammond Meazell, *Super Deference, the Science Obsession, and Judicial Review as Translation of Agency Science*, 109 MICH. L. REV. 733, 760–64 (2011) (critiquing "super deference" to agency decisions in the scientific context); Michael Burger, *Environmental Law Prof Blog: Emerging Issues in the Arctic, Part III: Competing*

Greater OSRP accountability might have some drawbacks. It could arguably add an expensive and time-consuming layer of review to a process that already offers opportunities for public engagement.[403] Another objection is that outside voices, bringing their own agendas, would trigger false positive alarm bells for regulators.[404]

The Arctic provides at least one data point to inform this analysis: BSEE imposed more significant requirements on Shell after it opened up the OSRPs to public and interagency review for the first time.[405] While this example is only illustrative and cause and effect are difficult to disentangle, it is suggestive of outside review's benefits. In any event, BSEE could readily provide for interagency and public input on OSRPs. Indeed, it recently did so for Shell's Beaufort and Chukchi Sea OSRPs. Though the specifics are beyond this piece's aims,[406] more openness in the OSRP process may well be beneficial.

C. Adopting a More Prescriptive Approach

A final step is to consider promulgating Arctic-specific regulations[407] that set the course of industrial development in the region.[408] The case for

Visions of Deference, http://lawprofessors.typepad.com/environmental_law/2012/05/emerging-issues-in-the-arctic-part-iii-competing-visions-of-deference.html (last visited July 26, 2014).

403 Industry affiliated groups have asserted this argument most aggressively. *See* Jeff Amy, *Report Says Faster Offshore Drilling Permits Would Create 230,000 Jobs*, MISS. PRESS, July 25, 2011, http://blog.al.com/press-register-business/2011/07/report_says_faster_offshore_dr.html (last visited July 26, 2014) (discussing reports by the American Petroleum Institute and IHS on the job-creating effects of a faster permitting process).

404 *See generally* Kuran & Sunstein, *supra* note 251, at 703–15 (discussing the effect of cognitive biases, such as availability heuristics and information cascades, on public perceptions).

405 BSEE Fact Sheet, *supra* note 94 (noting that BSEE required Shell to substantially rewrite its OSRP following public and interagency review but not clarifying the role of outside voices in influencing BSEE's choices).

406 Increased NEPA review for Arctic offshore drilling would have salutary effects for values of transparency and public participation in agency decision making, and it may improve the quality of regulation. *See supra* note 257. Nevertheless, NEPA review has many limitations, which reflect those of NEPA generally. For example, one of the motivations for NEPA review, discussed above, may be to delay and deter some projects from moving forward. *See supra* notes 257–259 and accompanying text.

407 Work on such regulations is underway. As this Article was going to press, U.S. regulators indicated that a new "Arctic Drilling Rule" would be released shortly. *See* Dawson, *supra* note 18.

408 An oft-cited success story of technology-based standards was the introduction of automobile emissions control technologies in the 1970s and 1980s. *See generally* David Gerard & Lester Lave, *Experiments in Technology Forcing: Comparing the Regulatory Processes of US Automobile Safety and Emissions Regulations*, 7 INT'L J. TECH., POL'Y & MGMT. 1, 2–3 (2007). Various commentaries have explored the adoption of technology-based standards for offshore drilling. *See, e.g.*, Barsa & Dana, *supra* note 24, at 55–57 (advocating Best Achievable Safety Technology standard for offshore drilling); Brittan J. Bush, Comment, *Addressing the Regulatory Collapse Behind the Deepwater Horizon Oil Spill: Implementing a "Best Available Technology" Regulatory Regime for Deepwater Oil Exploration Safety and Cleanup Technology*, 26 J. ENVTL. L. & LITIG. 535, 537 (2011).

prescriptive regulations may be strong at the frontier stage because such regulations help government escape a single company's framing of what is technologically achievable.[409] In addition, prescriptive regulations are arguably more transparent than those that are risk-based.[410] While prescriptive regulations tend to be inflexible,[411] those problems are mitigated[412] if the regulator stays abreast of current technological developments.[413]

A wide swath of literature, spanning several disciplines, has analyzed the particular elements that enable regulators to learn from past experiences and improve policy interventions over time.[414] Although some environmental

409 *See* May, *supra* note 230, at 24 (discussing trade-off between regulatory expertise and professional accountability for prescriptive and system or performance-based regulations, respectively).

410 Among other things, prescriptive regulations risk becoming a sort of "checklist" whereby companies satisfy the stated requirements but go no further. *See* Dahle et al., *supra* note 199, at 39 (discussing prescriptive regulations generally); *see also id.* at 23–24 (elaborating on the effects of regulation type on transparency).

411 *See* Dogan & Lemley, *supra* note 299, at 687–88 (noting, in the context of industry standards, that "[i]f the government requires that products include particular features or perform in particular ways, private parties can sometimes hoodwink regulators into adopting standards that favor their proprietary technologies and exclude their competitors"); Ackerman & Stewart, *supra* note 291, at 1335–37 (criticizing the inflexibility of prescriptive environmental regulation in the form of BAT controls); Daniel A. Farber, *Environmental Protection as a Learning Experience*, 27 LOY. L.A. L. REV. 791, 794 (1994) (documenting further criticisms of the prescriptive regulatory system). Development of such regulations invites new forms of regulatory capture and will be costly for regulators and the regulated entity. *See generally* BALDWIN ET AL., *supra* note 302, at 106–11 (cataloging a "series of weaknesses" associated with command and control regulation).

412 A subject for further research is whether risk-based regulatory models are more appropriate for mature industry sectors whereas the prescriptive approach is better for the early stages of industry development. *See generally* MARC G. LASSAGNE ET AL., PRESCRIPTIVE AND RISK-BASED APPROACHES TO REGULATION: THE CASE OF FPSOS IN DEEPWATER GULF OF MEXICO, OFFSHORE TECHNOLOGY CONFERENCE (2001) (exploring the costs and benefits of each regulatory approach in the context of deepwater oil drilling).

413 *See generally* Heimann, *supra* note 279, at 2 (arguing that bureaucrats typically rely "on a trial-and-error process" to oversee new technologies and acknowledging limitations of such an approach when agencies are prohibited from committing any errors); Brent Hueth & Tigran Melkonyan, *Standards and the Regulation of Environmental Risk*, 36 J. REG. ECON. 219, 241–42 (2009) (finding that the effectiveness of technology-based standards depends in large part on the quality of the regulator's information regarding appropriate strategies); Adam B. Jaffe et al., *Environmental Policy and Technological Change*, 22 ENVTL. & RESOURCE ECON. 41, 50 (2002) (explaining that rigid technology-based pollution standards tend to be out of step with technological advancement).

414 *See generally* George J. Busenberg, *Learning in Organizations and Public Policy*, 21 J. PUB. POL'Y 173 (2001) (identifying learning arrangements and focusing on events that facilitate learning); Carpenter, *supra* note 380, at 616 (developing a model in which a regulator learns more about the adverse effects of consumer drugs through clinical trials); Nori Tarui & Stephen Polasky, *Environmental Regulation with Technology Adoption, Learning and Strategic Behavior*, 50 J. ENVTL. ECON. & MGMT. 447 (2005) (developing an economic model in which regulator learns about environmental damages of emissions); Bruce G. Carruthers, *When is the State Autonomous? Culture, Organization Theory, and the Political Sociology of the State*, 12 SOCIOLOGICAL THEORY 19 (1994) (using a sociological lens to examine increasing administrative capacity through resource-based, cultural, and relational means). Regulatory learning focuses

law scholarship likens learning to adaptive management—a concept that, for reasons discussed above, may be ill-suited to regulation of risky industries like offshore drilling[415]—steps short of full-blown adaptive management may be helpful. One step is to require experiments or clinical trials before the regulated activity is permitted.[416] Another step, benefiting from the insights of whistleblower regulations and other information-forcing tools, is to incentivize contractors and subcontractors to report industry hazards to regulators.[417]

These tools hold promise for the Arctic. BOEM and BSEE already carry out field tests for Arctic oil spill prevention and response.[418] Those efforts could expand on a wider scale while offshore drilling remains on hold.[419] As for other information-forcing tools, BSEE has incorporated whistleblowing into the most recent version of SEMS and would be well advised to consider other incentive programs.[420]

These steps, geared towards the problems of catastrophic risk at the frontiers, do not cover the array of beneficial reforms. Other steps advocated for offshore drilling generally might also have positive effects,[421] such as

less on the reasons why regulators lack information or how to generate it and more on the way regulators can use previous outcomes to improve public policy decisions over time. *See generally* James C. Cooper & William E. Kovacic, *Behavioral Economics: Implications for Regulatory Behavior*, 41 J. REG. ECON. 41, 50 (2012) (discussing feedback mechanisms between outcomes and public policy development).

415 *See supra* Part IV.C.

416 *See, e.g.*, Carpenter, *supra* note 380, at 616 (describing this approach in the context of prescription drugs).

417 I draw here from the antitrust enforcement context, where regulators incentivize participants in a price-fixing conspiracy to reveal information to regulators by offering amnesty to the first company to report. *See* Bruce H. Kobayashi, *Antitrust, Agency, and Amnesty: An Economic Analysis of the Criminal Enforcement of the Antitrust Laws Against Corporations*, 69 GEO. WASH. L. REV. 715, 716 (2001) (describing success of the DOJ's corporate amnesty policy).

418 Testing to date reveals some progress and persistent gaps. *See* 2013 OIL SPILL COMM'N REPORT, *supra* note 3, at 14 ("According to DOI, approximately half of the BOEM environmental studies program budget is now being spent on the Chukchi and Beaufort Seas, establishing baseline data in the region. However, many unanswered questions remain about how the Arctic marine ecosystem functions."); 2012 OIL SPILL COMM'N REPORT, *supra* note 3, at 13 (noting that Shell conducted a "tabletop" exercise but that various recovery techniques had not been evaluated in Arctic conditions in any significant way); USGS Arctic Report, *supra* note 11, at 128 (stating that the U.S. Geological Survey is "not aware of any large-scale field testing of the types of assets and communications that must come together rapidly and successfully for a spill event in the Beaufort or Chukchi Seas").

419 Field-testing has limitations. While individual components of offshore drilling—such as the ACS—may be amenable to testing, it may be impractical to field test the operation of the system as a whole.

420 *See supra* Part III.C (discussing Shell's disastrous foray into exploratory drilling in 2012); *see also* TRANSPORTATION RESEARCH BOARD, EVALUATING THE EFFECTIVENESS OF OFFSHORE SAFETY AND ENVIRONMENTAL MANAGEMENT SYSTEMS 8 (2012), *available at* http://onlinepubs.trb.org/onlinepubs/sr/SR309.pdf (recommending BSEE whistleblower program).

421 *See supra* Part III (describing problems that have plagued Arctic drilling in the past generally); *see also* Kristen Korosec, *Gulf Oil Spill: Why Liability Should Be Tied to Risk*, CBS NEWS, Jan. 11, 2011, http://www.cbsnews.com/news/gulf-oil-spill-why-liability-should-be-tied-to-risk/ (last visited July 26, 2014) (describing other recommendations).

increasing the liability and financial responsibility thresholds under OPA[422] or imposing stronger insurance requirements.[423] Part VII next speculates, among other topics, on whether long-term reform will materialize.

VII. IMPLICATIONS

The questions raised by Arctic offshore drilling echo beyond its immediate context. This Part extends the analysis to other contexts where the Arctic experience might offer contributions. I discuss three extensions in particular: regulation of other high-risk industries; the long-term outlook for offshore drilling regulation; and other regulatory concerns that may arise for the Arctic in the future.

A. Comparisons to Other High-Risk Industries

The technological sophistication and risky nature of offshore drilling parallel such industries as nuclear power, pharmaceuticals, and commercial air travel.[424] These industries, widely dispersed yet tied by common threads, bear on the discussion of Arctic offshore drilling above, and the Arctic experience may offer lessons for those industries as well.

Two points deserve emphasis: First, public feedback differs crucially among industries facing the risk of catastrophic accident. Consider, for example, the 1979 Three Mile Island near disaster[425] and the 2010 *Deepwater Horizon* actual disaster.[426] Following the Three Mile Island accident, the nuclear power industry did not pursue construction of a new reactor in the United States for more than thirty years.[427] The U.S. oil industry, by contrast,

422 *See supra* Part III; *see also* Consumer Price Index Adjustments of the Oil Pollution Act of 1990 Limit of Liability for Offshore Facilities, 79 Fed. Reg. 10,056 (Feb. 24, 2014) (to be codified at 30 C.F.R. pt. 553) (proposing increased liability limits).

423 *See supra* Part IV (discussing the potential for insurance companies to deter risks by issuing catastrophe bonds); *see also* Norton Rose Fulbright, *Tougher Marine Pollution Laws for Offshore Oil and Gas Industry*, http://www.nortonrosefulbright.com/knowledge/publications/100473/tougher-marine-pollution-laws-for-offshore-oil-and-gas-industry (last visited July 26, 2014) (discussing possible increases in insurance requirements). Note that these reforms are not either–or. It may be the case that using multiple policy tools at once will be more effective in preventing oil spills than any single policy approach.

424 For a survey, see generally ROBERT A. BARI ET AL., STUDY OF RISK ASSESSMENT PROGRAMS AT FEDERAL AGENCIES AND COMMERCIAL INDUSTRY RELATED TO THE CONDUCT OR REGULATION OF HIGH HAZARD OPERATIONS, BROOKHAVEN NATIONAL LABORATORY PIECE BNL-94587-2011-CP (2011) *available at* http://www.bnl.gov/isd/documents/74833.pdf (assessing risk-management programs in multiple industries).

425 For a review of the Three Mile Island accident, see, for example, NAT'L COMM'N REPORT, *supra* note 1, at 229 (discussing the public reaction to the Three Mile Island incident); Babcock, *supra* note 222, at 65–67 (comparing precautionary measures in the nuclear power plant and offshore drilling industries).

426 In making this comparison, I do not contend that nuclear power and offshore drilling disasters are comparable. My point is in fact the opposite; the differing public perceptions of those industries have significant effect on the regulation of the sectors.

427 Jason Koebler, *Commission OKs First New Nuclear Reactors Since 1970s*, U.S. NEWS, Feb. 10, 2012, http://www.usnews.com/news/articles/2012/02/10/commission-oks-first-new-nuc

applied for new deepwater drilling projects shortly after the *Deepwater Horizon* disaster, and received approval ten months after the disaster began.[428] Differing public perceptions may explain some of the divergence.

The presence or absence of reputational effects, in turn, may have consequences for industrial and regulatory behavior. Where reputational effects are powerful, as arguably is the case for nuclear power or passenger airlines, robust industry self-policing mechanisms may emerge.[429] Such mechanisms reduce information imbalances and uncertainties endemic to hazardous, technologically advanced industries by drawing upon companies' deep expertise and research budgets.[430] Reputational effects may also facilitate the rise of a strong safety regulator, such as is arguably true of the U.S. Food and Drug Administration for prescription drugs,[431] or the National Transportation Safety Board and Federal Aviation Agency for passenger airline travel.[432]

By contrast, industry may be less likely to voluntarily adopt self-policing or accept strong regulators if the reputational effects of disaster are minimal.[433] Offshore drilling arguably falls into this category, whether

lear-reactors-since-1970s (last visited July 26, 2014) (quoting U.S. National Regulatory Commission (NRC) spokesman Scott Burnell as stating the reason no licenses had been granted since Three Mile Island was because "nobody had asked [the NRC] for permission to start a project since 1978"). The long gap ended in 2012, when the NRC approved the new nuclear reactors on the border of Georgia and South Carolina. *Id.*

428 Jennifer A. Dlouhy, *Houston's Noble Energy Lands First Post-Ban Offshore Drilling Permit*, HOUS. CHRON., Feb. 28, 2011, http://www.chron.com/business/energy/article/Houston-s-Noble-Energy-lands-first-post-ban-1687958.php (last visited July 26, 2014). By November 2011, BSEE approved 13 applications for permits to drill in a single month, higher than the average in the years immediately before the *Deepwater Horizon* disaster. Jennifer A. Dlouhy, *U.S. Approval of Offshore Drilling Picks Up,* HOUS. CHRON., Nov. 2, 2011, http://www.chron.com/business/article/U-S-approval-of-offshore-drilling-picks-up-2249230.php (last visited July 26, 2014).

429 *See, e.g.*, NAT'L COMM'N REPORT, *supra* note 1, at 234–42 (discussing industry self-policing in the nuclear industry and the limitations of such an approach); Cohen et al., *supra* note 98, at 1859–65 (comparing industries with a "strong safety culture," such as nuclear power and aviation, to those with a "weak safety culture," such as railroads). Industry self-policing mechanisms build off industries' shared concern about the repercussions of a major accident.

430 *See generally* NAT'L COMM'N REPORT, *supra* note 1, at 229–31 (discussing safety improvements in civil aviation and U.S. Navy nuclear submarines and noting "[t]he primary motivation for improving safety in each instance is that neither the public (as consumers and as voters) nor the government would allow such enterprises to operate if they suffered many accidents").

431 *See generally*, DANIEL CARPENTER, REPUTATION AND POWER: ORGANIZATIONAL IMAGE AND PHARMACEUTICAL REGULATION AT THE FDA 9–15 (2010) (providing analysis of the Food and Drug Administration's power over the pharmaceutical industry).

432 NAT'L COMM'N REPORT, *supra* note 1, at 230 (explaining that "[i]n the 1950s, only 20 percent of Americans were willing to fly" and that, because of this, "Boeing had a strong incentive to improve . . . attitudes toward aviation" and therefore worked hand-in-hand with government regulators to achieve this result); *see also* Lawrence E. McCray et al., *Planned Adaptation in Risk Regulation: An Initial Survey of US Environmental, Health, and Safety Regulation*, TECHN. FORECASTING & SOC. CHANGE 951, 955 (2010) (discussing U.S. aviation regulation as one of several case studies).

433 As the National Commission notes, the leading industry safety organization for offshore drilling—and the oil industry generally—is the American Petroleum Institute (API). *See* NAT'L

because of the infrequency of major oil spills, the relatively constant—i.e., price inelastic—consumer demand for oil, or oil spills' distant and sometimes opaque environmental effects.[434] Indeed, reputational incentives may be even weaker in the Arctic than elsewhere because an oil spill there would be far removed from large population areas. The variation in industry reputational effects may instruct where comparisons to the offshore drilling industry carry the most weight.[435]

A second consideration is that the relevant risks differ. Many agencies regulate hazardous industries[436] on the basis of tolerable risk thresholds.[437] These agencies, ranging from the Nuclear Regulatory Commission to the Federal Aviation Administration, tend to assign thresholds based on the risk of losing human life.[438] Offshore drilling involves mortality risks, as demonstrated by the *Deepwater Horizon* disaster, and environmental risks, for which the appropriate valuation is complex.[439] These differences do not

COMM'N REPORT, *supra* note 1, at 241. The API also acts as a lobbyist and has historically opposed new safety regulations for the industry. *Id.*

434 *See* Cohen et al., *supra* note 98, at 1878 (noting that some evidence suggests firms suffer no reputational penalty from even major oil spills, such as those resulting from the *Exxon Valdez* or *Deepwater Horizon* disasters). *But see* NAT'L COMM'N REPORT, *supra* note 1, at 239 (explaining that "the entire industry's reputation, and perhaps its viability, ultimately turn on its lowest performing members" and that "[n]o one, in industry or government, can afford a repeat of the Macondo explosion and spill"); Richardson et al., *supra* note 312, at 18 (suggesting short-term reputational penalty were another catastrophic oil spill to occur). There are many reasons reputational effects may be powerful in one industry but not another. *See generally* Babcock, *supra* note 222, at 66–67 (acknowledging that the nuclear power plant and offshore drilling industries differ because: a nuclear accident is more likely to critically affect people for a longer period of time than an oil spill; pass through of costs to consumers from an accident are easier in the case of an oil spill than a nuclear accident; and nuclear accidents tap into a public fear of radiation that does not exist for oil spills); NAT'L COMM'N REPORT, *supra* note 1, at 240–41 (listing differences between the nuclear industry and oil extraction industry in creating a strong, industry-wide self-policing entity).

435 Other points of comparison for the offshore drilling industry may be to the electric utility and finance industries, where public opposition was muted and efforts at industry self-policing failed. *See* NAT'L COMM'N REPORT, *supra* note 1, at 234–35 (noting the failures of the global investment banks' voluntary risk assessment program and electric utility companies' voluntary action plans for managing generation of toxic coal ash and other residues); Paul Lasell Bonewitz, *Implications of Reputation Economics on Regulatory Reform of the Credit Rating Industry*, 1 WM. & MARY BUS. L. REV. 391, 391–92 (2010) (arguing that reputation mechanisms did not induce credit rating agencies to provide accurate ratings because regulations and market factors limit the long-term profitability of reputation building).

436 Note that high-risk industries differ in whether the harm caused is primarily to contractual parties—as may be the case for passenger travel—or to innocent victims—as is true for a nuclear accident. These differences may, in turn, affect the choice of contract or tort instruments employed, respectively.

437 For discussion of risk thresholds, see Scarlett et al., *supra* note 189, at 3. This discussion of tolerable risks overlaps with my previous overview of risk-based regulations discussion, *supra* Part IV.B.

438 *See* I. Linkov et al., *Risk Management Practices: Cross-Agency Comparisons and Tolerable Risk, in* CLIMATE: GLOBAL CHANGE & LOCAL ADAPTATION 135, 150–51 (I. Linkov and T.S. Bridges, eds. 2011); *see also* Scarlett et al., *supra* note 189, at 3.

439 For one discussion of environmental valuation in the context of offshore drilling, see Scarlett et al., *supra* note 189, at 24–25. One useful model in this vein is regulation of the

make offshore drilling sui generis, but they counsel for caution in making comparisons.

Some comparisons are nevertheless possible. The emergence of Arctic offshore drilling and regulatory efforts to stay up to speed mirror recent developments in the hydraulic fracturing, or "fracking" industry,[440] despite differences in the federal–state law interaction, capital investment required, and degree of public engagement.[441] More speculatively, the frontier nature and many unknowns of Arctic offshore drilling invite comparisons to the nascent commercial space flight industry, though the public feedback effects and scope of potential harm are distinct.[442] In both industries, regulators may face a tension between encouraging innovation and reducing the risk of accident.[443] Further research might flesh out the conceptual links.

B. Long-Term Outlook for Offshore Drilling Regulation

The same factors that inhibit offshore drilling self-policing—the infrequency of disaster and public attention to the industry—also affect the long-term regulatory dynamics of the sector. The history of offshore drilling suggests a pattern in which interest skyrockets in the aftermath of a major oil spill and then declines as attention drifts elsewhere.[444] Fitting this pattern

Norwegian oil industry, which has employed a regulatory risk framework for some time. *Id.* at 17–18.

440 *See generally* David B. Spence, *Federalism, Regulatory Lags, and the Political Economy of Energy Production*, 161 PENN. L. REV. 431, 438–47 (2013) (explaining that fracking, while an old technique, has recently become cost-effective, expanded significantly, and raised a host of uncertain and disputed environmental effects); Norimitsu Onishi, *Vast Oil Reserve May Now Be Within Reach, and Battle Heats Up*, N.Y. TIMES, Feb. 4, 2013, at A9.

441 *See* Spence, *supra* note 440, at 477–97 (discussing federalism questions raised by fracking); Hilary Boudet et al., *"Fracking" Controversy and Communication: Using National Survey Data To Understand Public Perceptions of Hydraulic Fracturing*, 65 ENERGY POL'Y (2014) 57, 57 (analyzing public attitudes towards fracking); Babcock, *supra* note 222, at 66–67 (discussing limited public engagement in offshore drilling).

442 Various factors weaken comparisons between commercial space flight and offshore drilling. For one, the commercial space flight industry may face significant public feedback effects because it captures the public imagination in a way that offshore drilling does not. For another, the scope of potential harm is different because a commercial space flight accident would mainly harm passengers who agree to be on the flight, whereas offshore drilling may affect unwitting victims. For an overview of commercial space flight regulation, see Mark Flores, *Blast Off?—Strict Liability's Potential Role in the Development of the Commercial Space Market*, 17 RICH. J.L. & TECH. 1 (2010).

443 *See id.* at 6–8 (discussing tension and recommending a liability-based solution).

444 For example, both NEPA and OPA were enacted on the heels of major oil spills. *See* NAT'L COMM'N REPORT, *supra* note 1, at 28–29 (noting that the Santa Barbara oil spill set the stage for NEPA); Marilyn Helman, *What Exxon Valdez Spill Can Still Teach Us*, CNN, Mar. 24, 2010, http://www.cnn.com/2011/OPINION/03/24/heiman.exxon.valdez/ (last visited July 26, 2014) (noting that Congress passed the Oil Pollution Act of 1990 in response to the Exxon Valdez oil spill). This trend plays out in other environmental contexts as well and may reflect the transformation of law in general. *See* Mark C. Niles, *Punctuated Equilibrium: A Model for Administrative Evolution*, 44 J. MARSHALL L. REV. 353, 356–58 (2011) (arguing that administrative law exhibits a pattern of long stasis punctuated by brief periods of rapid change); Eric R. Pogue, *The Catastrophe Model of Risk Regulation and the Regulatory Legacy of Three Mile Island and*

are the rate of new regulations,[445] commitments to oil spill research—whether by the U.S. government[446] or by industry[447]—and public attention to the issue.[448] The pattern even extends to legal scholarship on offshore drilling, which had been in a long period of dormancy until the *Deepwater Horizon* disaster.

The ebb and flow of public attention to offshore drilling do not augur well for government oversight of the industry. Although the U.S. government reorganized the regulating institutions after the *Deepwater Horizon* disaster, industry can bring political pressure in a variety of ways, and regulators may bend to that pressure eventually.[449] The traditional bulwarks against outside

Love Canal, 15 PENN. ST. ENVTL. L. REV. 463, 465 (2007) (reviewing regulatory responses to the Three Mile Island nuclear accident and the toxic contamination of New York's Love Canal and "[o]bserving the government's reaction to catastrophes over time demonstrates that regulatory advancements often fail to develop along a steady, straight-line trajectory, but instead occur in sporadic leaps, which correspond to notable catastrophes"); Matthew E. Kahn, *Environmental Disasters as Risk Regulation Catalysts? The Role of Bhopal, Chernobyl, Exxon Valdez, Love Canal, and Three Mile Island in Shaping U.S. Environmental Law*, 35 J. RISK & UNCERTAINTY 17 (2007) (exploring the significance of five environmental disasters and their ensuing media coverage in catalyzing the passage of environmental laws). One debate is whether the disasters create a window of opportunity for public interests to surmount private ones or provoke poorly thought out overreaction to immediate events. *See* Pogue, *supra*, at 477 (noting that when policy making follows catastrophe "advancement in risk regulations are more closely tied to randomly spaced sensational events than steadily accruing genuine health and safety risk data" and may result in "regulatory fixes to a problem that never even existed").

445 *See* Ian Ostrander & William R. Lowry, *Oil Crises and Policy Continuity: A History of Failure to Change*, 23 J. POL'Y HIST. 384, 385 (2012) (arguing that, with respect to government policies toward alternative energy sources, major oil spills throw the spotlight on energy policy but "this attention fades just as fast once the stimulus has been removed from sight").

446 *See* U.S. GOV'T ACCOUNTABILITY OFFICE, GAO-12-585, OIL DISPERSANTS: ADDITIONAL RESEARCH NEEDED, PARTICULARLY ON SUBSURFACE AND ARCTIC APPLICATIONS 39–40 (May, 2012) (stating that government funding on dispersant research increased in the short-term after the *Exxon Valdez* disaster but then dried up "because support for dispersant research tends to increase in the immediate aftermath of a major oil spill and decrease in the years following a spill"); *id.* at 29 (noting that OPA directed an interagency committee to develop a plan for oil pollution research and that the committee released a plan in 1992, updated it in 1997, and was finally revising it again in 2013); *see also* Murchison, *supra* note 75, at 301–02 (describing intermittent pattern of research and advocating greater consistent funding).

447 *See, e.g.*, NAT'L COMM'N REPORT, *supra* note 1, at 243 (pointing out that the oil industry made commitments of "significant funds" for research and development of oil spill response technology after the *Exxon Valdez* disaster but that "those commitments were soon forgotten as memories dimmed").

448 *See, e.g.*, Flatt, *supra* note 262, at 39 (suggesting that "many of our own environmental watchdogs were asleep at the wheel" before the *Deepwater Horizon* disaster). While environmental groups challenged Arctic offshore drilling before the *Deepwater Horizon* disaster, those challenges did not stop offshore drilling from moving forward in 2012. *See* BURGER, *supra* note 19, at 11–23 (discussing history of litigation over Shell's Arctic drilling efforts).

449 *See, e.g.*, Dogan & Lemley, *supra* note 299, at 686 (2009) (noting that, in the context of antitrust regulation, "[p]ublic choice theory and long experience both suggest that agencies that start out trying to limit problematic behavior by industries often end up condoning that behavior and even insulating those industries from market forces."). For example, the Notice to Lessees (NTL) may be tempting targets for policy backsliding in the future. Regulators often issue NTLs without a notice-and-comment process. *See* ROBERT P. THIBAULT, BSEE AND ITS

influence, such as judicial challenge and public transparency, provide little succor if the public, following recent patterns, disengages.

C. The Next Arctic Frontier?

In addition to being one of the last untapped sources of oil, the Arctic holds other resources that may be exploited in the future. Various studies indicate significant energy potential from deposits called gas hydrates—also known as methane hydrates or "fire ice"[450]—lying beneath the Beaufort and Chukchi Seas, in the Alaskan permafrost, and some areas outside the Arctic.[451] In fact, the U.S. Department of Energy's National Energy Technology Lab has anointed gas hydrates as "the world's largest untapped fossil energy resource."[452] Commercialization of gas hydrates is years away, should it ever come to pass.[453] Yet the prospect of gas hydrate development fuels climate change concerns because hydrates contain methane, an especially potent greenhouse gas[454] that may be inadvertently released during hydrate production.[455]

ASSERTION OF JURISDICTION OVER SERVICE COMPANIES: THE PERFECT REGULATORY STORM: EQUIPMENT SUPPLIERS ARE IN THE SAME BOAT WITH EVERYONE ELSE, (Mar. 26, 2013) *available at* http://www.pesa.org/site_uploads/publications/2013_PESA_Legal_Seminar_-_Thibault.pdf (criticizing BSEE's issuance of NTLs without public notice and comment). It is conceivable that BOEM or BSEE may choose to weaken NTLs when public pressures for regulation subside.

450 Methane hydrates "are ice-like crystalline substances occurring in nature where a solid water lattice accommodates gas molecules (primarily methane, the major component of natural gas) in a cage-like structure, also known as clathrate." *See* USGS, ARCTIC REPORT, *supra* note 11, at 29.

451 Methane hydrate is not unique to Arctic environments, but it is abundant there. *See* U.S. GEOLOGICAL SURVEY, ASSESSMENT OF GAS HYDRATE RESOURCES ON THE NORTH SLOPE, ALASKA, 2008, FACT SHEET 2008-3073 3–4 (2008), *available at* http://pubs.usgs.gov/fs/2008/3073/pdf/FS08-3073_508.pdf (estimating quantity of undiscovered, technically recoverable gas hydrates on Alaska's North Slope and acknowledging the possibility of more such resources offshore); *see also* Dan Joling, *Arctic's Methane Hydrate Supply May Be Tested for Energy Use in New Study*, ASSOCIATED PRESS, Apr. 16, 2013.

452 Press Release, U.S. Department of Energy, National Energy Technology Laboratory, Energy Department Advances Research on Methane Hydrates—the World's Largest Untapped Fossil Energy Resource (Aug. 31, 2012), http://energy.gov/node/387289 (last visited July 26, 2014).

453 *See* Brad Plummer, *Are Methane Hydrates the Next Big Energy Source? Japan Hopes So.*, WASH. POST, Mar. 12, 2013, http://www.washingtonpost.com/blogs/wonkblog/wp/2013/03/12/japan-tries-to-unlock-the-worlds-biggest-source-of-carbon-based-fuel/ (last visited July 26, 2014) (citing sources in the Japanese government—which has conducted gas hydrate experiments—stating that commercial extraction from methane hydrates is five years away).

454 Carolyn D. Ruppel, *Methane Hydrates and Contemporary Climate Change*, 3 NATURE EDUC. KNOWLEDGE 29 (2011) (explaining that methane is 20 times more potent than carbon dioxide, though it oxidizes more quickly).

455 *See, e.g.*, J. Y. Lee et al., *Volume Change Associated with Formation and Dissociation of Hydrate in Sediment*, 11 GEOCHEMISTRY, GEOPHYSICS, GEOSYSTEMS 1, 11 (2010) (showing that gas production, particularly when depressurization methods are used, may cause disassociation of gas hydrates). Indeed, some scholars hypothesize that methane hydrates may explain previous abrupt global warming episodes in Earth's history. The hypothesis is that mild warming of permafrost and sea basins melted solid form methane hydrates, releasing large amounts of methane into the atmosphere and triggering much more rapid climate change. *See* JAMES P.

Key aspects of gas hydrate development, e.g., the use of cutting-edge technology and the great perils involved, mirror those of Arctic offshore drilling. Therefore, some reforms discussed above may prove instructive for gas hydrate development as well. For example, industry has complained that the U.S. government is not moving fast enough to capitalize on hydrates as a new energy source.[456] As is the case for Arctic offshore drilling, the U.S. government would be well served by balancing those calls for action against the potentially substantial benefits of waiting.

VIII. CONCLUSION

This Article considers the formidable challenges of regulating Arctic offshore drilling. I identify two challenges that take on a heightened role in the Arctic, relative to offshore drilling generally: the deep uncertainties of Arctic oil spill response planning, and the limited benchmarks available. I argue these two problems stymie reforms proposed for offshore drilling in other settings, such as in the implementation of risk-based regulations. I advocate for a supplementary approach, focused on delaying government approval of offshore drilling activities; greater openness to the public, particularly at the oil spill planning stage; and possibly adopting a more prescriptive approach to regulation. These proposals, while motivated by the Arctic, have implications for other risky industries operating at the technological frontier.

Major oil spills are historically infrequent. It may be that no major spills will happen in the Arctic even if the quality of regulation there is poor. This feature of offshore drilling creates both opportunity and dangers. The opportunity is that regulators may have time to get up to speed, particularly if approvals for new drilling slow down. The Department of the Interior closely regulated Arctic offshore drilling in 2012 and has taken a guarded stance toward allowing it to proceed. However, this moment of regulatory vigilance may not last. The danger of offshore drilling is that the complacency and industry influence that weakened previous regulation may re-emerge as the last disaster recedes in memory.

KENNETT ET AL., METHANE HYDRATES IN QUATERNARY CLIMATE CHANGE: THE CLATHRATE GUN HYPOTHESIS 6–7 (2003). More recent research has called this hypothesis into question. *See, e.g.*, Todd Sowers, *Late Quaternary Atmospheric CH_4 Isotope Record Suggests Marine Clathrates Are Stable*, 311 SCI. 838 (2006) (finding that marine hydrates have remained stable during abrupt global warming episodes).

456 Margaret Kriz Hobson, *Methane Hydrates: U.S. Reports Huge Potential for 'Fire in the Ice' as Japan Hurries to Production*, ENV'T & ENERGY PUBLISHING, Mar. 19, 2013, http://www.eenews.net/energywire/stories/1059978042 (last visited July 26, 2014). Some of industry's complaints are rooted in the idea that the United States is falling behind other countries pursuing gas hydrate development, such as Japan. *See id.*

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