Boston College Environmental Affairs Law Review

Volume 41 | Issue 1 Article 3

1-30-2014

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DEEPWATER HORIZON AND THE LAW OF THE SEA: WAS THE CURE WORSE THAN THE DISEASE?

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Abstract: The number 4.9 million is commonly known as the number of barrels of crude oil that entered the Gulf of Mexico during the Deepwater Horizon oil spill in 2010. Less known, but perhaps equally disconcerting, is the number 1.7 million—the number of gallons of Corexit, a toxic dispersant used to mitigate oil spills, that was also released into the Gulf of Mexico. Some observers claim that Corexit spared shorelines, wetlands, and beaches from the worst of the oil spill. Others, however, argue that Corexit was at best a massive ecotoxicological experiment that could impair the marine environment for years. With a focus on the use of Corexit during the Deepwater Horizon oil spill, this Article concludes that laws and regulations in the United States do not meet the standards set by Article 194 and Article 195 of the United Nations Convention on the Law of the Sea (UNCLOS). In light of the overall purpose of UNCLOS to "protect and preserve the marine environment," however, the United States might be able to meet the standards of at least Article 194 by ensuring that the use of dispersants is authorized only if the dispersants result in a net environmental benefit and are the optimal dispersants to use for the unique situation of an oil spill. Finally, the future of oil spill remediation could involve genetically engineered microorganisms to clean up spills, but the United States regulatory regime does not seem to protect the marine environment from bioengineered microbes and therefore falls short of meeting the standards of Article 196 of UNCLOS, which regulates the introduction of alien or new species. Because UNCLOS represents customary international law, the United States should strive to meet the marine pollution provisions of the treaty.

Introduction

Between April 20 and July 15, 2010, a series of human and mechanical errors caused approximately 4.9 million barrels of crude oil to

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gush into the Gulf of Mexico.[1] The spill began when a surge of gas from the Macondo Well—operated by the oil and gas behemoth British Petroleum (BP)—caught fire and caused explosions on the mobile offshore drilling unit Deepwater Horizon, whose crew was unable to close or disconnect the wellhead.[2] On a fundamental level, the spill was caused by industry shortcuts and carelessness, the United States's inadequate regulatory scheme, a culture of rubber stamping oil leases in the Gulf of Mexico, a conflict of interest between protecting the environment and profiting from oil drilling, and bad luck.[3]

In response to the spill, an unprecedented amount of the dispersant Corexit—totaling more than 1.7 million gallons—was used in two locations: first, on the surface of the Gulf of Mexico, and second, approximately 5,000 feet underwater at the Macondo wellhead.[4] The long-term ecological effects of dispersants are essentially unknown and have a potential to cripple ocean ecosystems.[5] The short-term effects of dispersants might result in net-toxicity levels that are greater than that of the spilled oil itself.[6] Therefore, the use of dispersants should receive intense scrutiny.

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[1] *See* Envtl. Prot. Agency, Comparative Toxicity of Louisiana Sweet Crude Oil (LSC) and Chemically Dispersed LSC to Two Gulf of Mexico Aquatic Test Species 2 (2010), *available at* http://www.epa.gov/bpspill/reports/phase2dispersant-toxtest.pdf and http://perma.cc/0qEt1rhkMgX.

[2] U.S. Coast Guard, Report of Investigation into the Circumstances Surrounding the Explosion, Fire, Sinking and Loss of Eleven Crew Members Aboard the Mobile Offshore Drilling Unit Deepwater Horizon, at ix (2011), *available at* http://goo.gl/xscNVs and http://perma.cc/0qW8hXyXHQb.

[3] *See generally* 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 (2011), *available at* http://www.gpo.gov/fdsys/pkg/GPO-OILCOMMISSION/pdf/GPO-OILCOMMISSION.pdf and http://perma.cc/0JE6uYc9DL9 (detailing regulatory shortcomings preceding the Deepwater Horizon blowout).

[4] U.S. Coast Guard Incident Specific Preparedness Review Team, BP Deepwater Horizon Oil Spill Incident Specific Preparedness Review (ISPR) 43 (2011) [hereinafter U.S. Coast Guard ISPR Team], *available at* http://www.uscg.mil/foia/docs/DWH/BPDWH.pdf and http://perma.cc/0QyJE68BcNd.

[5] Artin Laleian & Thomas Azwell, Deepwater Horizon Study Group, The Tradeoffs of Chemical Dispersant Use in Marine Oil Spills 4 (Jan. 2011) (unpublished manuscript), *available at* http://goo.gl/Ycb8OC and http://perma.cc/0wx5y4Am7Ys (long-term effects of dispersants); Susan D. Shaw, Consensus Statement: Scientists Oppose the Use of Dispersant Chemicals in the Gulf of Mexico 3–4 (2010), *available at* http://goo.gl/n3Tyfh and http://perma.cc/0ZCe3PG7Jvj (effects of dispersants on marine ecosystems).

[6] Roberto Rico-Martinez et al., *Synergistic Toxicity of Macondo Crude Oil and Dispersant Corexit 9500A to the* Brachionus Plicatilis *Species Complex (Rotifera)*, 173 Envtl. Pollution 5, 5–10 (2013), *available at* http://goo.gl/NOErXC and http://perma.cc/HAK7-XAH2; *see also* Shaw, *supra* note 5.

One way to analyze the use of dispersants in response to the Deepwater Horizon oil spill is through the framework of the United Nations Convention on the Law of the Sea (UNCLOS).[7] UNCLOS is an international treaty commonly known as the "the Constitution of the Oceans."[8] Although UNCLOS is not enforceable against the United States because America is not a party to the convention,[9] the treaty is useful for determining whether the United States's laws and regulations related to dispersants meet the standards set by international law. Furthermore, UNCLOS provides a framework by which researchers, environmentalists, and other interested parties may gauge the United States's failure to protect the marine environment.

This Article first analyzes the background of dispersants, including Corexit, the dispersant used in the Deepwater Horizon oil spill.[10] Next, this Article explores the regulatory scheme of the National Contingency Plan (NCP), which governs the use of dispersants in the United States.[11] This Article then analyzes UNCLOS as it applies to the use of dispersants and argues that the United States should abide by the treaty because it represents customary international law.[12] This analysis leads to a conclusion that the United States's failure to regulate the use of dispersants properly in response to oil spills likely falls short of the standards in Article 194 of UNCLOS.[13] This Article then recommends a series of modifications to the United States's regulation of dispersants that could allow the United States to authorize dispersant use in observance of Article 194.[14] Finally, this Article concludes that the United

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[7] *See generally* Jon M. Van Dyke, *A Constitution for the Oceans: A Closer Look at the United Nations Law of the Sea Convention*, Am. Bar Ass'n Insights on Law & Soc'y, Spring 2006, *available at* http://www.americanbar.org/content/dam/aba/publishing/insights_law_society/constitution_Insightsspring06.authcheckdam.pdf and http://perma.cc/0ypXKn63RWf (providing a historical and practical overview of UNCLOS).

[8] Patricia C. Bauerlein, *The U.N. Convention on the Law of the Sea & U.S. Ocean Environmental Practice: Are We Complying with International Law?*, 17 Loy. L.A. Int'l & Comp. L. Rev. 900, 922 (1995).

[9] United Nations, Status of the United Nations Convention on the Law of the Sea, of the Agreement Relating to the Implementation of Part XI of the Convention and of the Agreement for the Implementation of the Provisions of the Convention Relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks 8 (2010), *available at* http://www.un.org/depts/los/reference_files/status2010.pdf and http://perma.cc/0JXz66ovkHW.

[10] *Infra* notes 23–81 and accompanying text.

[11] *Infra* notes 82–179 and accompanying text.

[12] *Infra* notes 185–214 and accompanying text.

[13] *Infra* notes 231–295, 300–308, 315–342 and accompanying text.

[14] *Infra* notes 296–299, 309–314, 343–352 and accompanying text.

States's authorization of dispersants falls short of the requirements of Article 195 of UNCLOS.[15]

Looking to the future, this Article briefly explores potential dangers of using genetically engineered microorganisms (GEMs), either as biosurfactants or as a form of bioremediation, to clean up oil spills.[16] This Article discusses "global catastrophic risks" (GCRs)—the risk of significant harm to humans on a global scale—and determines that although GEMs do not present a GCR in the short-term, they might pose such a risk in the long-term, even though such risks are not currently well-understood.[17] Next, this Article examines Article 196 of UNCLOS, which regulates the introduction of "alien or new" species that might cause significant and harmful changes to the marine environment.[18] This section of the Article concludes that the United States's laws pertaining to the release of GEMs into the marine environment do not seem to meet the standards imposed by Article 196 of UNCLOS.[19]

I. Dispersants

An understanding of dispersants is necessary to comprehend the shortcomings of the laws and regulations related to their use. This part first discusses the general background behind dispersants used in oil spill cleanups.[20] Then it discusses Corexit, the dispersant used in response to the Deepwater Horizon oil spill.[21] Finally, this part explores the environmental costs, benefits, and unknowns of dispersant use in marine environments.[22]

A. *Dispersant Background*

Dispersants are one of three primary remedial response mechanisms to an oil spill, the other two being mechanical processes, which primarily consist of skimming oil from the water surface, and in-situ burning, or controlled burns of surface oil.[23] Dispersants were used in

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[15] *Infra* notes 353–389 and accompanying text.
[16] *Infra* notes 390–438 and accompanying text.
[17] *Infra* notes 418–438 and accompanying text.
[18] *Infra* notes 439–513 and accompanying text.
[19] *Infra* notes 514–524 and accompanying text.
[20] *Infra* notes 23–32 and accompanying text.
[21] *Infra* notes 33–39 and accompanying text.
[22] *Infra* notes 40–81 and accompanying text.
[23] Reg'l Response Team 6, FOSC Dispersant Pre-Approval Guidelines and Checklist 1 (2001), *available at* http://www.losco.state.la.us/pdf_docs/RRT6_Dispersant_Preapproval_2001.pdf and http://perma.cc/0y1fpFzhTXD.

two distinct settings in the Gulf of Mexico in response to the Deepwater Horizon oil spill.[24] The first was on the water's surface, where approximately 1 million gallons of surface dispersants were applied, primarily by airplane and boat.[25] The second was near the seafloor, where about 770,000 gallons of dispersants were piped directly into the oil spewing from the Macondo wellhead.[26]

Most dispersants have two main ingredients: solvents and surfactants.[27] Generally speaking, surfactants coat the outside of oil droplets and prevent them from clumping, and solvents work to break up the oil.[28] The intended effect is to break down an oil slick into small oil droplets that drift from the water's surface into the water column[29] as a result of low "rise velocity," which is essentially buoyancy.[30] The separated oil droplets form a light brown or gray oil plume—or more accurately, an oil *cloud*—that drifts into the water column.[31] Microorganisms can more easily biodegrade the resultant small droplets of oil.[32]

B. *Corexit and Basic Toxicity Theory*

Corexit was the only dispersant used in response to the Deepwater Horizon oil spill, both on the surface and subsurface waters of the Gulf of Mexico.[33] BP used two types of Corexit: EC9527A (Corexit 9527) and

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[24] *See* U.S. Coast Guard ISPR Team, *supra* note 4, at 43.

[25] *Id.*

[26] *Id.* The official numbers of both surface and subsurface dispersants have been questioned, and some researchers estimate that as many as 4 million gallons of dispersants were used in response to the Deepwater Horizon oil spill. Sen. A.G. Crowe, *"Clean Our Gulf" Petition*, Louisiana Senate, http://www.agcrowe.com/pg-51–47-Clean-The-Gulf-Petition.aspx, *available at* http://www.perma.cc/0Log8jtV4zT.

[27] Peter Lane, The Use of Chemicals in Oil Spill Response 299 (1995).

[28] Tom Levitt & Nicole Edmison, *Toxic Dispersants in Gulf Oil Spill Creating Hidden Marine Crisis*, Ecologist (Sept. 6, 2010), http://www.theecologist.org/News/news_analysis/583740/toxic_dispersants_in_gulf_oil_spill_creating_hidden_marine_crisis.html, *available at* http://perma.cc/0ZBkwcX5K9p.

[29] The water column is essentially the opposite of the ocean surface; it is the water below the ocean surface all the way down to the ocean floor. *See Water Column*, Ecologydictionary.com, http://www.ecologydictionary.org/water_column (last visited Nov. 11, 2013), *available at* http://perma.cc/02pY7JcSoGW.

[30] SINTEF, Oil Spill Dispersants 7 (2007), *available at* http://documents.plant.wur.nl/imares/dispersants/08sintef.pdf and http://perma.cc/0Fi9TkgySEr.

[31] *Id.* at 8.

[32] Int'l Tanker Owners Pollution Fed'n, Use of Dispersants to Treat Oil Spills 2 (2011), *available at* http://www.itopf.com/information-services/publications/documents/TIP4UseofDispersantstoTreatOilSpills.pdf and http://perma.cc/0qjMHPhU9xM.

[33] Norwegian Inst. for Water Research, Environmental Effects of the Deepwater Horizon Oil Spill: Focus on Effects on Fish and Effects of Dispersants 12 (2012), *available at* http://goo.gl/BmLFcI and http://perma.cc/0EvIYF2LcTf.

EC9500 (Corexit 9500).[34] Nalco Energy Services, L.P., based in Sugar Land, Texas, manufactures both types.[35]

Testing has found Corexit 9500 and Corexit 9527 to have some level of toxicity.[36] The toxicity of Corexit 9500 and Corexit 9527, like all chemical dispersants, varies based on conditions such as water temperature and length of exposure.[37] The toxicity of dispersants also differs significantly among different marine species and according to other variables such as a species' size and maturity.[38] For example, fish are generally less sensitive to the toxicity of dispersants than are mollusks, and young animals are more sensitive to the toxicity of dispersants than are adults.[39]

C. *Environmental Impacts of Dispersants*

Experts, scientists, and commentators frequently use the word "trade-off" to describe the effect of dispersants on the marine environment.[40] In general, the environmental tradeoff is shoreline and surface damage (when no dispersants are used) for pelagic and deep-sea damage (when dispersants are used).[41] David Smith, professor of oceanography at the University of Rhode Island, has stated, "Moving oil below the sea surface presents significant challenges to the organisms residing in this habitat. Impacts will be less noticeable, but could be as devastat-

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[34] Timothy R. Kelley, *Environmental Health Insights into the 2010 Deepwater Horizon (BP) Oil Blowout,* 4 Envtl. Health Insights 61, 62 (2010), *available at* http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2934613/ and http://perma.cc/UP28-56XA.

[35] Envtl. Prot. Agency, National Contingency Plan Product Schedule 3 (2010), *available at* http://goo.gl/zlmFVX and http://perma.cc/0gc7V3z9see.

[36] Envtl. Prot. Agency, Guide to Using the NCP Subpart J Product Schedule Technical Notebook 3, 13 (2013), *available at* http://www.epa.gov/oem/docs/oil/ncp/notebook.pdf and http://perma.cc/0LQBeLrZkEY.

[37] Anita George-Ares & James R. Clark, *Acute Aquatic Toxicity of Three Corexit Products: An Overview*, 1 Int'l Oil Spill Conference Proceedings 1007, 1007 (1997), *available at* http://ioscproceedings.org/doi/pdf/10.7901/2169-3358-1997-1-1007 and http://perma.cc/0sYhMr4j9Sn.

[38] *Id.*

[39] *Id.*

[40] *See, e.g.*, Associated Press, *Dispersants Used on Gulf Oil Spill an Ecological Trade-Off, Experts Say*, AL.Com (May 5, 2010), http://blog.al.com/live/2010/05/dispersants_used_on_gulf_oil_s.html, *available at* http://perma.cc/0DC3y1nSTNh; *see also* Matthew L. Wald, *The Politics of Dispersants*, N.Y. Times (Aug. 4, 2010), http://green.blogs.nytimes.com/2010/08/04/the-politics-of-dispersants/?_r=0, *available at* http://perma.cc/0Ls53mpLsCq (noting that government witnesses at a Senate hearing on the Deepwater Horizon oil spill "repeatedly described the use of dispersants as a trade-off").

[41] *See* Envtl. Prot. Agency, *supra* note 1, at 2 (mentioning the tradeoff between shoreline and deep sea damage).

ing as oil washing ashore."[42] So, if BP and the U.S. government chose in favor of sweeping the oil under the carpet, so to speak, the question remains: Was it a good tradeoff? In other words, did the use of dispersants result in net environmental neutrality (a *fair* tradeoff), a net environmental benefit (a *favorable* tradeoff), or a net environmental loss (a *bad* tradeoff)?[43] Overall, the answer is unclear. Although there are many positive and negative environmental consequences of dispersant use, the unknowns are such that it is currently impossible to conclude definitively whether the use of dispersants in the Deepwater Horizon oil spill resulted in a net environmental benefit.[44]

1. Positive Environmental Effects

Dispersants, including Corexit, have many positive effects that should be considered in determining whether their use results in a net environmental benefit.[45] For example, dispersants reduce the amount of oil that reaches shorelines and wetlands, where oil removal is more difficult than at sea.[46] Dispersants also help to protect salt marshes, coral reefs, sea grasses, and mangroves.[47] Even if dispersed oil washes ashore, it has a less detrimental effect on the shoreline than does non-dispersed oil.[48] Dispersants also reduce the amount of oil that surface-dwelling and shoreline species contact and ingest.[49] For example, dis-

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[42] *Oversight Hearing on the Use of Oil Dispersants in the Deepwater Horizon Oil Spill Before the Senate Committee on Environment and Public Works*, 111th Cong. 1 (2010) (statement of David C. Smith, professor at University of Rhode Island, Graduate School of Oceanography), *available at* http://goo.gl/b5cG2w and http://perma.cc/MG2Z-67SW; Jonathan Tilove, *EPA Official Defends Role of Dispersants in Gulf of Mexico Oil Spill Response*, Times-Picayune (Aug. 4, 2010), http://www.nola.com/news/gulf-oil-spill/index.ssf/2010/08/epa_official_defends_role_of_d.html, *available at* http://perma.cc/0SqAdRxjeY4.

[43] *See, e.g.*, Wald, *supra* note 40 (dispersants in the Deepwater Horizon oil spill as a tradeoff).

[44] Jonathan L. Ramseur, Congressional Research Service, Deepwater Horizon Oil Spill: The Fate of the Oil 6 (2010), *available at* http://www.fas.org/sgp/crs/misc/R41531.pdf and http://perma.cc/0CVvQrDBXyK ("While dispersants have proven effective in breaking up the oil, impacts from the chemically dispersed oil (and the chemical dispersants) are unknown."); *see also Questions and Answers on Dispersants*, Envtl. Prot. Agency, http://www.epa.gov/bpspill/dispersants-qanda.html (last visited Oct. 29, 2013), *available at* http://perma.cc/0QRyTPCWHsz.

[45] *See, e.g.*, Region IV Reg'l Response Team, Use of Dispersants in Region IV 39 (2010), *available at* http://www.nrt.org/production/NRT/RRTHome.nsf/Resources/DUP/$file/1-RRT4DISP.PDF and http://perma.cc/0tVzi8V4XXb.

[46] *See id.*

[47] *Id.*

[48] *Id.* at 35.

[49] *Id.* at 39.

persants can help to prevent the formation of tar balls, which sea turtles have been known to ingest.[50]

Furthermore, even though dispersants cause some oil to drift into the water column and harm subsurface species, such oil has been diluted into small droplets that mix with ocean water, and the result is that subsurface species are exposed to a lower oil concentration for a shorter duration than surface species would be in the absence of dispersants.[51] Also, because dispersed oil has a lower oil concentration and persists for a shorter amount of time, pelagic organisms (those in the water column) might not accumulate the oil dispersed in the water column in significant amounts.[52] Even if species do ingest toxic dispersants, "biomagnification" might not be a significant problem.[53] One study has concluded that the "metabolism of surfactants is rapid enough that there is little likelihood of food chain transfer from marine invertebrates and fish to predators . . . ."[54]

2. Negative Environmental Effects

Dispersants, including Corexit, have many known negative environmental effects that might not outweigh the benefits.[55] First, dispersants are toxic and can be fatal to a wide array of marine species.[56] Although many dispersants, including Corexit, are intended to biodegrade relatively quickly, this outcome does not always occur.[57] One year after the Deepwater Horizon oil spill, researchers discovered that dioctyl sulfosuccinate sodium salt (DOSS), Corexit's active ingredient, has not "significantly degraded," while the fate of other Corexit components remains unknown.[58]

Marine species are especially vulnerable to the negative effects of dispersants.[59] Dispersants can destroy the protective waterproofing and

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[50] *Id.*

[51] SINTEF, *supra* note 30, at 23.

[52] *See* J.M. Neff, Sea Mammals and Oil: Confronting the Risks 24 (J.R. Geraci & D.J. St. Aubi eds., 1990); Region IV Reg'l Response Team, *supra* note 45, at 40.

[53] *See* Region IV Reg'l Response Team, *supra* note 45, at 40.

[54] *Id.*

[55] *See* Rico-Martinez et al., *supra* note 6, at 5–10; Shaw, *supra* note 5, at 3–4; Ramseur, *supra* note 44, at 6; *Questions and Answers on Dispersants*, *supra* note 44.

[56] David Biello, *One Year After BP Oil Spill, At Least 1.1 Million Barrels Still Missing*, Sci. Am. (Apr. 25, 2011), http://www.scientificamerican.com/article.cfm?id=one-year-after-bp-oil-spill-millions-of-barrels-oil-missing, *available at* http://perma.cc/04VfnvNNqQd.

[57] *See id.*

[58] *Id.*

[59] *See, e.g.*, Craig Pittman, *Three Years After BP Oil Spill, USF Research Finds Massive Die-Off*, Tampa Bay Times (Apr. 3, 2013), http://www.tampabay.com/news/environment/water/

insulating features common to many birds and mammals.[60] The solvents found in many dispersants, including Corexit, are also carcinogenic to some animals.[61] Unfortunately, dispersants have started to appear in marine species: Tulane University discovered small amounts of Corexit in the larvae of blue crabs, for example.[62] And although surface-dwelling and shoreline species are exposed to less oil when dispersants are used, water column-dwelling species, such as larval fish and shrimp, experience increased exposure to oil as a consequence of their habitat's location.[63] A 2013 study of the effects of oil and Corexit 9500 on coral larvae found that Corexit 9500 increased larval mortality for certain species and can impact coral reef resilience and recovery from oil and dispersant exposure.[64]

Dispersants also create oil plumes that present their own risks because of a significantly larger surface area as compared to oil slicks.[65] For example, large plumes of oil droplets and dispersant—one plume was reportedly "200-meters high, two-kilometers wide, and 35-kilometers long"[66]—can potentially cause significant harm to small ocean species such as bacteria, phytoplankton, zooplankton, and larvae.[67] Larvae in particular are extremely susceptible to these harms because contact with oil plumes and dispersants often results in death.[68] Perhaps most alarming is that dispersants and the oil-degrading organisms feasting on giant oil plumes might have contributed to a "thick layer of oil" found on the seafloor of the Gulf of Mexico, which could

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gulf-oil-spill-killed-millions-of-microscopic-creatures-at-base-of-food/2113157, *available at* http://perma.cc/0AreQv7fVsE.

[60] Region IV Reg'l Response Team, *supra* note 45, at 39.

[61] Biello, *supra* note 56.

[62] Rick Jervis, *Research Team Finds Oil on Bottom of Gulf*, USA Today (Oct. 25, 2010), http://www.usatoday.com/news/nation/2010–10–25-oilresearch25_ST_N.htm, *available at* http://perma.cc/07yUv8jBBMa.

[63] Envtl. Prot. Agency, Use of Chemical Dispersants for Marine Oil Spills 29 (1993), *available at* http://goo.gl/SXm98h; *see also* Shaw, *supra* note 5, at 3.

[64] *See generally* Gretchen Goodbody-Gringley et al., *Toxicity of Deepwater Horizon Source Oil and the Chemical Dispersant, Corexit 9500, to Coral Larvae*, 8(1) PLOS ONE 1 (2013), *available at* http://goo.gl/Kr92VD and http://perma.cc/S7TQ-WAWA (analyzing effects of Corexit on coral larvaee and the resulting impact on coral reefs).

[65] *See* Sara Kennedy, *Researchers Confirm Subsea Gulf Oil Plumes Are from BP Well*, McClatchy DC (July 23, 2010), http://www.mcclatchydc.com/2010/07/23/98088/researchers-confirm-subsea-gulf.html, *available at* http://perma.cc/0XpgbLZCa4c.

[66] Biello, *supra* note 56.

[67] Naomi Klein, *The Search for BP's Oil*, Nation (Jan. 13, 2011), http://www.thenation.com/article/157723/search-bps-oil, *available at* http://perma.cc/VRV3-NVN6.

[68] *See id.* (quoting a government fisheries biologist as stating that "any larvae that came into contact with the oil doesn't have a chance").

threaten ocean floor-dwelling species and potentially disrupt the entire marine food chain.[69]

Finally, by dispersing and submerging oil, dispersants increase the difficulty of "skimming" oil from the ocean's surface, which is the most environmentally friendly of all oil spill remediation techniques.[70] Likewise, dispersants also increase the difficulty of conducting in-situ burning of oil slicks.[71]

3. Unknown Environmental Effects

Although the positive and negative effects of dispersants are documented, scientists actually have very little knowledge about the overall effects of dispersants on the marine environment.[72] The testimonies of leading experts at a 2010 Senate researchers panel about the Deepwater Horizon oil spill were largely focused on the uncertainties surrounding dispersant usage.[73] For example, Professor Ronald Kendall of Texas Tech University commented that "we are conducting a massive ecotoxicological experiment."[74] On the same panel, David Smith of the University of Rhode Island remarked that "we know nothing of how the deep sea works."[75] Previous studies on dispersants have focused primarily on oil spill cleanup workers,[76] and very few have addressed the issue of how low-dose dispersants affect the marine ecosystem over a long time period. The widespread use of dispersants in the Gulf of Mexico will have *some* environmental impact, but the precise scope and severity of this impact remains unknown.[77]

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[69] *See* Richard Harris, *Scientists Find Thick Layer of Oil on Seafloor,* NPR (Sept. 10. 2010), http://www.npr.org/templates/story/story.php?storyId=129782098&ft=1&f=1007, *available at* http://perma.cc/07V6L2B1JCp.

[70] *See* Prince William Sound Reg'l Citizens' Advisory Council, Observations, Questions and Recommendations Regarding Use of Dispersants on the BP Deepwater Horizon Spill 4 (2010), *available at* http://goo.gl/IxPySa and http://perma.cc/0GUHf2myTSr; *see also* Nat'l Comm'n on the BP Deepwater Horizon Oil Spill and Offshore Drilling, *supra* note 3, at 169.

[71] Prince William Sound Reg'l Citizens' Advisory Council, *supra* note 70, at 2; Nat'l Comm'n on the BP Deepwater Horizon Oil Spill and Offshore Drilling, *supra* note 3, at 169.

[72] *See Use of Dispersants in Gulf Oil Spill, Researchers Panel*, C-SPAN (Aug. 4, 2012), http://www.c-spanvideo.org/program/294897-2, *available at* http://perma.cc/0QrUbA4QGqN (statement from Ronald Kendall, to the Senate Environment & Public Works Subcommittee on Oversight, regarding the uncertainty surrounding dispersant use).

[73] *See id.*

[74] *Id.*

[75] *See id.* (statement from David Smith).

[76] Courtney Farrell, Gulf of Mexico Oil Spill 67–68 (2011).

[77] *Id.* at 63.

Before 770,000 gallons of Corexit were piped directly into the leaking Macondo wellhead, subsurface dispersants had never been used, so there is essentially no scientific data on the effects of dispersants applied anywhere but on the surface water.[78] In fact, none of the Regional Contingency Plans that pre-authorize dispersants even contemplate the use of subsurface dispersants.[79] There are significant unknowns about the biodegradation of dispersants in the deep ocean, and a 2013 study suggests that Corexit 9500 biodegrades more slowly in the colder temperatures of the deep ocean.[80] Many scientists agree that significant research must be conducted to determine the long-term and short-term effects of subsurface dispersant use.[81]

II. National Oil and Hazardous Substances Pollution Contingency Plan (NCP)

The NCP regulates the use of dispersants during oil spills.[82] This part first introduces Subpart J of the NCP ("Subpart J"), which regulates the listing of dispersants in the NCP Product Schedule.[83] This part then examines the "high level organizations" and "regional plans" that carry out the NCP, including a discussion of the "pre-authorization" of dispersants listed in the NCP Product Schedule by Regional Response Teams (RRTs) and Area Committees (ACs).[84] This part then analyzes certain aspects of the Dispersant Use Plans of RRT IV and RRT VI, which are the RRTs for the two Federal Regions of primary relevance during the Deepwater Horizon oil spill.[85] Finally, as part of a timeline of events, this part analyzes how and why Corexit was chosen as the primary dispersant for the Deepwater Horizon oil spill.[86]

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[78] U.S. Gov't Accountability Office, Oil Dispersants: Additional Research Needed, Particularly on Subsurface and Arctic Applications 12, 22 (2012), *available at* http://www.gao.gov/assets/600/591232.pdf and http://perma.cc/02nT2vNc1SD.

[79] *Id.* at 12.

[80] Mark Schrope, *Oil Dispersants Used During Gulf Spill Degrade Slowly in Cold Water*, Chemical & Engineering News (Feb. 13, 2013), http://cen.acs.org/articles/91/web/2013/02/Oil-Dispersants-Used-During-Gulf.html, *available at* http://perma.cc/KJN4-QFW4.

[81] *See, e.g.*, Christopher Joyce, *Lasting Impact of Dispersants Unclear, Senate Told*, NPR (Aug. 4, 2010), http://www.npr.org/templates/story/story.php?storyId=128983162, *available at* http://perma.cc/5QU3-9H4N; *see also infra* notes 344–346 and accompanying text.

[82] *Infra* notes 88–91 and accompanying text.

[83] *Infra* notes 88–99 and accompanying text.

[84] *Infra* notes 100–136 and accompanying text.

[85] *Infra* notes 137–145 and accompanying text.

[86] *Infra* notes 146–184 and accompanying text.

A. *Subpart J*

The Clean Water Act,[87] the Oil Pollution Act of 1990, and the NCP require the Regulatory and Policy Division of the EPA's Office of Emergency Management to develop an "NCP Product Schedule" that lists dispersants pursuant to the requirements of Subpart J.[88] Dispersants are pre-authorized for use primarily because they are most effective when used immediately after an oil spill.[89] Listing a dispersant in the NCP Product Schedule, however, does not mean that it is automatically authorized for use in an oil spill.[90] Rather, the NCP Product Schedule contains dispersants that *may* be approved for use in response to an oil spill.[91]

The NCP Product Schedule is comprised of five product categories: dispersants, surface washing agents, surface collecting agents, bioremediation agents, and miscellaneous oil spill control agents.[92] For the EPA to approve a dispersant, the producer must satisfy a series of "data requirements," which include, *inter alia,* testing for toxicity and effectiveness.[93] Test results are sent to the EPA's Product Schedule Manager for approval.[94] The only requirement is that the dispersant must achieve forty-five percent effectiveness; that is, forty-five percent of the oil must be dispersed by a "swirling test" that mixes oily seawater with a dispersant in a flask.[95] Many commentators have argued that the approval process for dispersants is inadequate for protecting the marine environment.[96]

As discussed below, once a dispersant is listed in the NCP Product Schedule, the use of that dispersant may be pre-authorized by an RRT

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[87] *See* Clean Water Act, 33 U.S.C. § 1321(d)(2) (2006).

[88] *See* Envtl. Prot. Agency, *supra* note 36, at i.

[89] U.S. Coast Guard ISPR Team, *supra* note 4, at 43.

[90] As the EPA's NCP Product Schedule states on the first page, "This listing does NOT mean that EPA approves, recommends, licenses, certifies, or authorizes the use of [Product Name] on an oil discharge. The listing means only that data have been submitted to EPA as required by Subpart J of the National Oil and Hazardous Substances Pollution Contingency Plan, Section 300.915." *See* Envtl. Prot. Agency, National Contingency Plan Product Schedule 1 (2013), *available at* http://www.epa.gov/oem/docs/oil/ncp/schedule.pdf and http://perma.cc/APC7-FSDB.

[91] *See* 40 C.F.R. § 300.900 (2013).

[92] *Id.*

[93] *Id.* § 300.920(a)(1) (establishing how to add dispersants to the NCP Product Schedule); *id.* § 300.915(a) (providing the data requirements for dispersants).

[94] *Id.* § 300.900.

[95] *See* Region IV Reg'l Response Team, *supra* note 45, at 115.

[96] *See* U.S. Coast Guard ISPR Team, *supra* note 4, at 40–44.

or an AC in any Federal Region.[97] If a particular dispersant is pre-authorized, then the Federal On-Scene Coordinator (FOSC) may unilaterally permit that dispersant's use in response to an oil spill. [98] On the other hand, if a particular dispersant is *not* pre-authorized, then the FOSC must seek approval from RRT representatives from the EPA and, as appropriate, the affected state; the FOSC must also consult with U.S. Department of Commerce (DOC) and U.S. Department of Interior (DOI) natural resource trustees.[99]

B. *The NCP's High-Level Organizations and Regional Plans*

The basic function of the NCP is to ensure that there are sufficient resources available in the event of a spill or hazardous substance release that is too large for state and local resources to handle.[100] To achieve this goal, the NCP lays out a national response framework for oil and hazardous substance releases through the National Response System (NRS),[101] which is a group of federal, regional, and local teams and individuals.[102] The NCP is also carried out by several "high level organizations"[103]—the National Response Team (NRT), RRTs, and the FOSC.[104] The NCP is also carried out by regional "plans."[105]

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[97] *See infra* notes 109–115 and accompanying text.

[98] *See* 40 C.F.R. § 300.910(c).

[99] An exception is that an FOSC may authorize a dispersant without pre-authorization if the FOSC believes that "the use of the product is necessary to prevent or substantially reduce a hazard to human life." *See id.* § 300.900(a).

[100] *See* Region 6 Reg'l Response Team, Interim Regional Integrated Contingency Plan 4 (2010), *available at* http://goo.gl/JzK0Sd and http://perma.cc/ZT97-J8M8.

[101] *Id.*

[102] Nat'l Comm'n on the BP Deepwater Horizon Oil Spill and Offshore Drilling, Decision-Making Within the Unified Command (Draft) 2 (2010), *available at* http://www.courthousenews.com/2010/10/08/OilSpillReport.pdf and http://www.perma.cc/0YJmJFVxhf; *see also National Oil and Hazardous Substances Pollution Contingency Plan Overview,* Envtl. Prot. Agency, http://www.epa.gov/emergencies/content/lawsregs/ncpover.htm (last visited Dec. 31, 2013), *available at* http://www.perma.cc/0bcDAYKe9xZ.

[103] *National Response System,* National Response Center, http://www.nrc.uscg.mil/nrsinfo.html (last visited Dec. 31, 2013), *available at* http://www.perma.cc/0BaFYEJ45tH.

[104] Although there are many other relevant organizations that are integral in implementing the NCP, they are not pertinent to an analysis of the regulation of dispersants. *Id.* (describing the four "special force" components of the National Response System).

[105] Although the NCP deals with oil spills and hazardous waste releases, this Article only addresses elements of the NCP relating to oil spills.

1. National Response Team (NRT)

The NRT is comprised of representatives from sixteen federal departments and agencies.[106] The NRT's roles and responsibilities include "planning and coordinating responses to major discharges of oil or hazardous waste, providing guidance to Regional Response Teams, coordinating a national program of preparedness planning and response, and facilitating research to improve response activities."[107] NRTs are used in scenarios where, *inter alia,* the capabilities of regional response teams are exceeded, spills transcend regional boundaries, human or environmental health is substantially threatened, or the NRT's assistance is requested by a NRT member or the FOSC.[108]

2. Regional Response Teams (RRTs)

Although there is only one NRT, there are thirteen RRTs— "one for each of the ten federal regions" and three others.[109] An RRT consists of representatives from federal agencies, state governments, and local governments.[110] RRTs have a "standing team" and an "incident-specific team."[111] The standing team is responsible for planning "preparedness actions" in its respective Federal Region, which includes three major responsibilities: (1) planning for a spill; (2) training federal, state, tribal, and local agencies to react to a spill; and (3) coordinating responses.[112] An RRT is also responsible for creating a Regional Contingency Plan (RCP)[113] in which the RRT may pre-authorize dispersants for use in its respective Federal Region.[114] The U.S. Coast Guard leads an RRT for a spill in coastal or Great Lakes waters, while the EPA leads an RRT anywhere else.[115]

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[106] Nat'l Comm'n on the BP Deepwater Horizon Oil Spill and Offshore Drilling, *supra* note 102, at 2.

[107] *National Oil and Hazardous Substances Pollution Contingency Plan Overview, supra* note 102.

[108] Region 6 Reg'l Response Team, *supra* note 100, at 7.

[109] *RRT Home Pages,* National Response Team, http://www.rrt.nrt.org (last visited Dec. 31, 2013), *available at* http://www.perma.cc/0f4AWhonLut.

[110] Nat'l Comm'n on the BP Deepwater Horizon Oil Spill and Offshore Drilling, *supra* note 102, at 2.

[111] 40 C.F.R. § 300.115(b)(1)–(2) (2013).

[112] Region 6 Reg'l Response Team, *supra* note 100, at 8.

[113] *Id.*

[114] Envtl. Prot. Agency Office of Inspector General, Revisions Needed to National Contingency Plan Based on Deepwater Horizon Oil Spill 12 (2011), *available at* http://www.epa.gov/oig/reports/2011/20110825-11-P-0534.pdf and http://perma.cc/LA8K-VPUP.

[115] 40 C.F.R. § 300.120(a)(1)–(2).

3. Federal On-Scene Coordinator (FOSC)

During an incident, the main function of an RRT is to assist the FOSC,[116] who is the primary official that coordinates the federal response effort.[117] The FOSC is a federal official from the EPA for inland spills or the U.S. Coast Guard for coastal oil spills and oil spills in the Great Lakes.[118] The FOSC organizes, directs, and reviews several other actors, including local, state, tribal, and regional agencies, responsible parties, and contractors.[119] The FOSC is also in charge of ensuring compliance with the NCP, RCPs, Area Contingency Plans (ACPs), administrative orders, and other authoritative sources.[120] Notably, the FOSC may unilaterally allow the use of any dispersant pre-authorized by an RRT, provided that the FOSC adheres to any conditions imposed in an RRT's Dispersant Use Plan.[121] During the Deepwater Horizon oil spill, the FOSC initially approved the unlimited use of Corexit by British Petroleum (BP), as was permitted by RRT IV's and RRT VI's Dispersant Use Plans.[122]

4. Dispersant Use Plans in Regional Contingency Plans (RCPs), Area Contingency Plans (ACPs), and Regional Integrated Contingency Plans (RICPs)[123]

According to Subpart J, RRTs and ACs may pre-authorize the use of dispersants in an RCP or an ACP,[124] and specific conditions may be imposed on the use of those pre-authorized dispersants.[125] RCPs, created by RRTs in their respective Federal Regions, govern the response efforts of all federal, state, and local agencies within any one of the thirteen

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[116] *RRT Home Pages*, *supra* note 109.

[117] *See* 40 C.F.R. § 300.120(a).

[118] *Id.*; *id.* § 300.5.

[119] Region 6 Reg'l Response Team, *supra* note 100, at 12.

[120] *See, e.g.*, *id.* at 12–13.

[121] *See id.* at 41.

[122] *See Combating the BP Oil Spill: Hearing Before the House Subcommittee on Energy and Environment of the Committee on Energy and Commerce*, 111th Cong. (May 27, 2010) (statement of EPA administrator Lisa P. Jackson, discussing the initial approval of Corexit), *available at* http://www.gpo.gov/fdsys/pkg/CHRG-111hhrg76583/html/CHRG-111hhrg76583.htm and http://perma.cc/0s6fQekvSKm.

[123] Plans exist other than those listed here, but these are the plans most relevant to the use of dispersants in the Gulf of Mexico.

[124] *See* 40 C.F.R. § 300.910(a) (2013).

[125] U.S. Coast Guard ISPR Team, *supra* note 4, at 42.

Federal Regions.[126] One, several, or all of the dispersants listed in the NCP Product Schedule may be pre-authorized by an RRT in an RCP's Dispersant Use Plan. The EPA's RRT representative, states with jurisdiction over the water pre-authorized for dispersant use, and the DOC and DOI natural resource trustees must all approve pre-authorization of dispersants.[127] The RRT also has the authority to require dispersant manufacturers to conduct more testing of toxicity and effectiveness than is required for listing on the NCP Product Schedule.[128]

Like RCPs, ACPs pre-authorize a dispersant for use in response to an oil spill.[129] ACPs are created to remove, mitigate, and prevent a worst-case discharge.[130] There are one or more ACPs for every one of the thirteen Federal Regions.[131] Unlike an RCP, ACPs are created by ACs, which include representatives from certain federal, state, and local agencies.[132] A third type of plan, an RICP, may be used to integrate an RCP and ACP so that an FOSC and other authorities can respond to an oil spill with optimal speed.[133]

Although pre-authorization of a dispersant allows an FOSC to unilaterally permit the use of that dispersant in an oil spill, a Dispersant Use Plan may pre-authorize an FOSC to use it only in "specific contexts."[134] For example, pre-authorization can vary based upon the "potential sources and types of oil that might be spilled, the existence and location of environmentally sensitive resources that might be impacted by spilled oil, available product and storage locations, available equipment and adequately trained operators, and the available means to monitor the product application and effectiveness."[135] On the other hand, if not pre-authorized at all, dispersants may be used only when an

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[126] There are ten standard federal regions and three non-standard federal regions. The three non-standard federal regions with RCPs (and RRTs) are Alaska, the Caribbean, and the Pacific Basin. *See RRT Home Pages, supra* note 109.

[127] *See* 40 C.F.R. § 300.910(a).

[128] *See id.*

[129] *Id.*

[130] 33 U.S.C. § 1321(j)(4)(C) (2006).

[131] Envtl. Prot. Agency, Area Contingency Planning Handbook 6 (2013), *available at* http://www.epa.gov/osweroe1/docs/oil/frp/EPA_ACP_Handbook.pdf and http://perma.cc/09k23PmMsmb.

[132] Curry L. Hagerty & Jonathan L. Ramseur, Congressional Research Service, Deepwater Horizon Oil Spill: Selected Issues for Congress 8 (2010), *available at* https://www.fas.org/sgp/crs/misc/R41262.pdf and http://perma.cc/43VZ-KTGB.

[133] *See, e.g.*, Envtl. Prot. Agency, Regional Integrated Contingency Plan, EPA Region 7 § 300.1 (2012), *available at* http://www.epa.gov/region7/cleanup/superfund/pdf/ricp_complete.pdf and http://perma.cc/3MER-V9RQ.

[134] 40 C.F.R. § 300 app. E 4.4(a) (2013).

[135] *See id.* § 300.910(a).

FOSC seeks approval from the EPA and affected states and consults with DOC and DOI representatives.[136]

C. *Federal Regions IV and VI in the Deepwater Horizon Oil Spill*

Two RRTs whose RCPs were activated during the Deepwater Horizon oil spill, RRT IV (comprised of U.S. states on the northwest side of the Gulf of Mexico) and RRT VI (comprised of U.S. states on the northeast side of the Gulf of Mexico), both pre-authorized Corexit and many other dispersants with limited conditions.[137] For example, the RCP for RRT VI gave the FOSC full discretion to use Corexit at any volume in any pre-authorized location on the condition that the FOSC merely conduct a "test application" of the dispersant, the results of which do not have to be approved.[138] Otherwise, any dispersant listed in the NCP Product schedule may be used at any volume, so long as the water is more than ten meters deep and three miles offshore.[139]

Similarly, the RCP for RRT IV essentially provides blanket authorization for dispersant approval and requires only that the "dispersant must be included on the NCP Product Schedule and considered appropriate by the FOSC for existing environmental and physical conditions."[140] RRT IV did, however, exclude some particularly sensitive areas from its pre-authorization,[141] and the Dispersant Use Policy in RRT IV contains "information to be considered" by the FOSC, including, *inter alia,* laboratory testing, visual monitoring, water sampling, safety of dispersal (including wind speed and visibility), sufficiency of personnel for aerial dispersal, completion of a "site safety plan," and whether an "overflight" to consider visible endangered species has occurred.[142] Consideration of these precautionary measures is not obligatory, and therefore the FOSC may unilaterally approve the use of dispersants.[143] Otherwise, much like RRT VI, RRT IV's Dispersant Use Plan only requires that oil dispersants be used in water at least ten feet deep and three miles offshore.[144]

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[136] *See id.* § 300.910(b).
[137] *Infra* notes 138–145 and accompanying text.
[138] U.S. Coast Guard ISPR Team, *supra* note 4, at 42.
[139] *Id.*
[140] *See* Region IV Reg'l Response Team, *supra* note 45, at 6–11.
[141] U.S. Coast Guard ISPR Team, *supra* note 4, at 40.
[142] Region IV Reg'l Response Team, *supra* note 45, at 96–103, 115.
[143] *See* U.S. Coast Guard ISPR Team, *supra* note 4, at 40.
[144] *See id.*

Finally, neither of the Dispersant Use Plans in RRT VI and RRT IV limits the amount of dispersant nor the method by which it would be dispersed, which thus permitted the novel application of subsurface dispersants at the Macondo wellhead.[145]

D. *Timeline of Events in Using the Dispersant Corexit*

On April 20, 2010, the Deepwater Horizon drilling unit exploded, and oil began spewing from the Macondo wellhead into the Gulf of Mexico.[146] The NCP applied at this point, and the U.S. Coast Guard designated an FOSC.[147] Pursuant to the Dispersant Use Plans for Federal Regions IV and VI, the FOSC authorized BP's request to use the dispersant Corexit, and more than 14,000 gallons were subsequently applied during the first week of the spill.[148] On April 29, 2010, Secretary of Homeland Security Janet Napolitano designated the spill a "Spill of National Significance," which resulted in the activation of the ACP.[149]

1. The FOSC Permits BP to Use Corexit

Dispersants were applied in significant amounts to both the surface and subsurface areas of the Gulf of Mexico.[150] Because subsurface dispersants had never been used before, some officials were uncertain[151] whether the subsurface application was permitted under RRT VI and RRT IV's respective Dispersant Use Plans.[152] Nevertheless, the EPA

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[145] *Id.*

[146] U.S. Gov't Accountability Office, Deepwater Horizon Oil Spill: Preliminary Assessment of Federal Financial Risks and Cost Reimbursement and Notification Policies and Procedures 1 (2010), *available at* http://www.gao.gov/new.items/d1190r.pdf and http://www.perma.cc/0zV7XsfPVSE.

[147] *Deepwater BP Oil Spill*, White House, http://www.whitehouse.gov/deepwater-bp-oil-spill (last visited Dec. 31, 2013), *available at* http://perma.cc/J32E-ZHNN.

[148] Nat'l Comm'n on the BP Deepwater Horizon Oil Spill and Offshore Drilling, *supra* note 3, at 144.

[149] The activation of the ACP did not impinge on the FOSC's duties as established under the NCP. *See DHS Planning & Response: Preliminary Lessons from Deepwater Horizon, Hearing Before the House Committee on Homeland Security*, 111th Cong. 86 (2010) (testimony of Admiral Peter Neffenger, Deputy National Incident Commander, U.S. Coast Guard), *available at* http://www.gpo.gov/fdsys/pkg/CHRG-111hhrg66030/pdf/CHRG-111hhrg66030.pdf.

[150] *See supra* notes 24–26 and accompanying text.

[151] Nat'l Comm'n on the BP Deepwater Horizon Oil Spill and Offshore Drilling, The Use of Surface and Subsea Dispersants During the BP Deepwater Horizon Oil Spill 8 (2011).

[152] Nat'l Comm'n on the BP Deepwater Horizon Oil Spill and Offshore Drilling, *supra* note 3, at 7.

and Coast Guard jointly endorsed the use of subsurface dispersants on May 15, 2010.[153] By May 17, 2010, about 580,000 gallons of surface dispersants and 45,000 gallons of subsurface dispersants had already been used.[154]

2. Public Outcry and Prior Testing of Corexit from the NCP Product Schedule

Public outcry soon erupted over the use of Corexit.[155] The data on dispersants—related to the effectiveness and toxicity tests that a dispersant manufacturer sends to the EPA for listing on the NCP Product Schedule—showed several less toxic, more effective alternatives to Corexit.[156] Several types of dispersants were listed on the EPA's NCP Product Schedule, including the two types of Corexit used in the Deepwater Horizon oil spill.[157] The application for listing a dispersant in the NCP Product Schedule requires a dispersant manufacturer to test for toxicity[158] and effectiveness, as tested primarily with "No. 2 fuel oil."[159] For toxicity, tests are performed on two species and for two different durations: a 96-hour test on Menidia fish and a 48-hour test on Mysidopsis (a Gulf of Mexico-dwelling crustacean).[160] For the Menidia fish, Corexit 9500A mixed with No. 2 Fuel Oil is more toxic than any other dispersant on the NCP Product Schedule, while Corexit 9527A mixed with No. 2 Fuel Oil is the sixth most toxic of twenty-three listed

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[153] *Id.* at 8.

[154] *The Ongoing Administration-Wide Response to the BP Oil Spill*, White House (May 5, 2010, 5:55 AM), http://www.whitehouse.gov/blog/2010/05/05/ongoing-administration-wide-response-deepwater-bp-oil-spill, *available at* http://www.perma.cc/0nizUcJti88.

[155] *See, e.g.*, Elana Schor, *Ingredients of Controversial Dispersants Used on Gulf Spill Are Secrets No More*, N.Y. Times (June 9, 2010), http://www.nytimes.com/gwire/2010/06/09/09greenwire-ingredients-of-controversial-dispersants-used-42891.html, *available at* http://perma.cc/0GkKY2Y[Jzn.

[156] *See infra* notes 157–165 and accompanying text.

[157] The EPA does not appear to maintain previous NCP Product Schedules online.

[158] Toxicity is gauged by the parts per million of dispersant, when mixed with oil at a 1:10 ratio, that kills 50 percent of a given species within an allotted time period. *See National Contingency Plan Product Schedule Toxicity and Effectiveness Summaries,* Envtl. Prot. Agency, http://www2.epa.gov/emergency-response/national-contingency-plan-product-schedule-toxicity-and-effectiveness-summaries (last visited Jan 5, 2014), *available at* http://perma.cc/Q6GN-LDSC.

[159] No. 2 fuel oil is distinct from Louisiana sweet crude, which was the actual oil leaking from the Macondo Well. Different types of oil have different reactions with dispersants. *See id.*

[160] *Americamysis bahia (Mysidopsis bahia),* MBL Aquaculture, http://www.mblaquaculture.com/content/organisms/americamysis_bahia.php (last visited Jan. 1, 2014), *available at* http://www.perma.cc/0kKV1KYitCz.

dispersants.[161] For the dispersant alone, Corexit 9500A is the eleventh most toxic and Corexit 9527A is the ninth most toxic.[162] For the Mysidopsis, Corexit 9500A mixed with No. 2 Fuel Oil is the thirteenth most toxic of twenty-three listed dispersants, while Corexit 9527 mixed with No. 2 Fuel Oil is the sixteenth most toxic.[163] For the dispersant alone, Corexit 9500A is the sixteenth most toxic while Corexit 9527A is the fourteenth most toxic.[164] In terms of effectiveness, Corexit EC9500A and Corexit EC9527A have the second and fourth lowest effectiveness percentages on average at 50.00 and 50.40 percent, respectively.[165]

3. EPA Directive and BP Response

In response to the public outcry over the use of Corexit, on May 20, 2010, the EPA directed BP to identify a dispersant less toxic than Corexit within twenty-four hours, and then to begin using this newly-identified dispersant within the subsequent seventy-two hours.[166] BP quickly responded that there were no superior viable alternatives to Corexit.[167] While BP acknowledged that there were five other acceptable alternatives with advantages in effectiveness and toxicity, BP argued that knowledge gaps made them unreliable alternatives to Corexit.[168] BP also claimed that Corexit 9500 "appears to have fewer long term

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[161] *National Contingency Plan Product Schedule Toxicity and Effectiveness Summaries*, *supra* note 158. The Product Schedule Toxicity and Effectiveness Summaries have been updated since the decision-making period of the Deepwater Horizon oil spill, and previous versions do not appear to be available on the EPA website. An unofficial archived version of the 2010 NCP Product Schedule Toxicity and Effectiveness Summaries is available. *See* Jim White, *BP's Dispersant Filing Is Intellectually Dishonest*, My FDL Reader Diaries (May 24, 2010, 4:23 PM), http://my.firedoglake.com/jimwhite/2010/05/24/bps-dispersant-filing-is-intellectually-dishonest/, *available at* http://perma.cc/F9XY-JEAN; *see also EPA's Toxicity Testing of Dispersants*, Envtl. Prot. Agency, http://www.epa.gov/bpspill/dispersants-testing.html (last visited Nov. 27, 2013), *available at* http://www.perma.cc/0VBfxSSyBXq.

[162] *National Contingency Plan Product Schedule Toxicity and Effectiveness Summaries*, *supra* note 158.

[163] *Id.*

[164] *Id.*

[165] *Id.*

[166] Envtl. Prot. Agency, Dispersant Monitoring and Assessment Directive—Addendum 1 (2010), *available at* http://www.epa.gov/bpspill/dispersants/directive-addendum2.pdf and http://www.perma.cc/0hLDJzhDBL5.

[167] Letter From Douglas J. Suttles, BP, to Rear Admiral Mary Landry, Coast Guard, and Samuel Coleman, EPA (May 20, 2010), *available at* http://www.epa.gov/bpspill/dispersants/5-21bp-response.pdf and http://www.perma.cc/07FV3s2fKsb.

[168] While BP asserted that one such dispersant might have endocrine disruption effects, the manufacturer had not conducted tests to confirm this possibility. *Id.* at 2.

effects than the other dispersants evaluated,"[169] despite the absence of reliable science to support such a claim.[170] Finally, BP argued that Corexit and Sea Brat #4 were the only dispersants that BP possessed in quantities sufficient to be useful in cleanup efforts, and that Corexit was the superior of the two.[171] BP did not seem to consider the option of ceasing *all* dispersant use despite tests showing that oil alone might be less toxic than the combined toxicity of the oil mixed with Corexit.[172]

4. Subsequent EPA Testing

While BP continued to use Corexit for the remainder of the Deepwater Horizon oil spill, the EPA performed further tests on the effectiveness and toxicity of Corexit in a more robust and site-specific manner than any previous tests, including those submitted by Nalco, Corexit's manufacturer, per Subpart J of the NCP.[173] A July 2010 report from the EPA discussed the testing of eight dispersants with the specific type of oil that was leaking from the Macondo wellhead—Louisiana sweet crude.[174] The EPA also tested for endocrine disruption and con-

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[169] *See id.* at 9. The manufacturer's tests were also conducted by different laboratories and on dispersants mixed with No. 2 fuel oil, not Louisiana sweet crude. *See* ENVTL. PROT. AGENCY, DISPERSANTS TOXICITY TESTING—PHASE II: QUESTIONS AND ANSWERS 4 (Aug. 2, 2010), *available at* http://www.epa.gov/BPSpill/dispersants/qanda-phase2.pdf and http://www.perma.cc/0bp53STTQi6.

[170] *See, e.g.*, Letter from Lisa Jackson, EPA, to David Rainey, BP (May 26, 2010), *available at* http://www.epa.gov/bpspill/dispersants/Rainey-letter-052610.pdf and http://perma.cc/L9NV-DZDN (describing BP's failure to provide data on why Corexit was the best choice among dispersants).

[171] NAT'L COMM'N ON THE BP DEEPWATER HORIZON OIL SPILL AND OFFSHORE DRILLING, *supra* note 3, at 9. There is some doubt regarding the claim that other manufacturers could not provide sufficient amounts of dispersants. For example, the manufacturer of Dispersit issued a statement that it could immediately produce 20,000 gallons—and eventually 60,000 gallons—of Dispersit a day. *EPA: BP Must Use Less Toxic Oil Dispersant; BP Refuses Change and Continues Corexit Use*, BEFORE IT'S NEWS (May 23, 2010), http://beforeitsnews.com/environment/2010/05/epa-bp-must-use-less-toxic-oil-dispersant-bp-refuses-change-and-continues-corexit-use-48203.html, *available at* http://perma.cc/0eNHU36vUpG. By comparison, BP had more than 246,000 gallons of Corexit, and Nalco had 68,000 more gallons available. *Id.*

[172] The EPA's tests concluded that the oil alone was less toxic to certain marine species than the combined toxicity of the oil mixed with certain dispersants. ENVTL. PROT. AGENCY, *supra* note 41.

[173] ENVTL. PROT. AGENCY, *supra* note 36, at 13 (results from toxicity testing of Corexit 9500 on No. 2 fuel oil but not Louisiana sweet crude); ENVTL. PROT. AGENCY, *supra* note 41, at 2, 8.

[174] *See generally* ENVTL. PROT. AGENCY, *supra* note 1 (outlining the study's methodology and findings). Different reports have used slightly different names and capitalizations for the oil that leaked from the Macondo wellhead, including South Louisiana sweet crude oil,

cluded that none of eight dispersants showed signs of significant endocrine disruption properties.[175] The EPA did, however, limit testing to the same two species ordinarily tested by dispersant manufacturers for dispersants to be listed on the NCP Product Schedule, rather than testing the dispersants on a wider variety of species.[176]

The EPA's tests concluded that Corexit 9527 was "generally no more toxic" than other dispersants when mixed with Louisiana sweet crude, and that Corexit 9500 was "generally no more toxic to aquatic test species than oil alone."[177] Notably, the EPA also concluded that Louisiana sweet crude becomes less toxic when mixed with Corexit 9500, which was contrary to all previous findings.[178] Overall, the EPA found that Corexit was "generally no more toxic" for use in the Deepwater Horizon oil spill than alternative dispersants.[179]

III. Analysis of UNCLOS and the NCP Dispersant Legal Regime

This part examines several articles of the United Nations Convention on the Law of the Sea (UNCLOS) in relation to the duty to protect the marine environment and concludes that the United States failed to regulate dispersants effectively and thus fell short of the standards established by UNCLOS.[180] First, this part determines that the provisions regarding the marine environment contained in Part XII of UNCLOS are customary international law, and thus the United States should observe them.[181] Second, this part discusses Article 192 of UNCLOS, which is foundational to the interpretation of other articles in Part XII of UNCLOS.[182] Third, this part discusses two different UNCLOS articles—Article 194 and Article 195—and determines that the United States fell short of the standards represented by both articles due to an

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Louisiana sweet crude, South Louisiana crude oil, and Light Louisiana oil. *See, e.g.*, *id.* at 2; *National Contingency Plan Product Schedule Toxicity and Effectiveness Summaries, supra* note 158.

[175] *See* Envtl. Prot. Agency, *supra* note 169 (stating that "[n]one of the eight dispersants tested displayed biologically significant endocrine disrupting activity," with limited exceptions).

[176] Nat'l Comm'n on the BP Deepwater Horizon Oil Spill and Offshore Drilling, *supra* note 3, at 10.

[177] *Questions and Answers on Dispersants, supra* note 44.

[178] *See* Envtl. Prot. Agency, *supra* note 1, at 12–13 (showing a greater toxicity of a Louisiana sweet crude alone than when combined with Corexit 9500).

[179] *See Questions and Answers on Dispersants, supra* note 44; *see also* U.S. Envtl. Prot. Agency, *supra* note 1, at 13.

[180] *Infra* notes 185–389 and accompanying text.

[181] *Infra* notes 185–206 and accompanying text.

[182] *Infra* notes 221–230 and accompanying text.

insufficient legal and regulatory scheme as applied to dispersants.[183] Several recommendations follow for how the United States can meet the standards represented by Article 194 and Article 195 of UNCLOS.[184]

A. *UNCLOS Is Customary International Law for the United States*

The United States is not a party to UNCLOS.[185] Nevertheless, the United States, like most other nations, considers most of UNCLOS to reflect customary international law,[186] including Article 192, Article 194, and Article 195.[187] One definition of customary international law is "the general and consistent practices of [S]tates that they follow from a sense of legal obligation."[188] Customary international law is widely recognized as a binding primary source of international law.[189] Two elements of customary international law exist: (1) state practice and (2) *opinio juris*.[190] The United States meets both of these elements for the international laws reflected by UNCLOS Article 192, Article 194, and Article 195.[191] Therefore, the United States should comply with Article 192, Article 194, and Article 195 of UNCLOS.[192]

1. State Practice

State practice may be defined as "any act or statement by a state," including "any physical acts, claims, declarations *in abstracto* (such as General Assembly resolutions), national laws, national judgments and

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[183] *Infra* notes 231–295, 300–308, 317–342, 353–384 and accompanying text.

[184] *Infra* notes 296–299, 309–314, 343–352, 385–389 and accompanying text.

[185] United Nations, *supra* note 9, at 8.

[186] Sarei v. Rio Tinto PLC, 221 F. Supp. 2d 1116, 1121 n.3 (C.D. Cal. 2002).

[187] Philippe Sands & Jacqueline Peel, Principles of International Environmental Law 350 (2012).

[188] Jack L. Goldsmith & Eric A. Posner, The Limits of International Law 23 (2003).

[189] Statute of the International Court of Justice, art. 38(1)(b); *see also* Jack L. Goldsmith & Eric A. Posner, *A Theory of Customary International Law* 1 (John M. Olin Law & Economics Working Paper No. 63, 1998), *available at* http://papers.ssrn.com/sol3/papers.cfm?abstract_id=145972; William S. Dodge, *Withdrawing from Customary International Law: Some Lessons from History*, 120 Yale L.J. Online 169, 169–92 (2010), http://yalelawjournal.org/images/pdfs/920.pdf, *available at* http://perma.cc/0xDCvE7YcHD (describing the binding nature of customary international law).

[190] *Customary IHL*, Int'l Comm. of the Red Cross, http://www.icrc.org/customary-ihl/eng/docs/v1_rul_in_asofcuin (last visited Jan. 4, 2014), *available at* http://perma.cc/EZ39-SW3E.

[191] *Infra* notes 193–209 and accompanying text.

[192] *Infra* notes 211–214 and accompanying text.

omissions."[193] Duration and uniformity of a practice are also considerations for a state practice.[194] Several sources indicate that the United States abides by the provisions of UNCLOS such that America meets the element of state practice.[195] The simplest and strongest evidence of state practice is President Ronald Reagan's unambiguous 1983 directive that instructed all federal agencies to abide by UNCLOS, with the exception of Part XI.[196] Part XII of UNCLOS, which includes Articles 192, 194, and 195, was included in President Reagan's directive.[197] No U.S. president since Reagan has altered his position, and several presidents have reaffirmed the U.S. government's commitment to following the terms of UNCLOS.[198] Therefore, Part XII of UNCLOS almost certainly meets the element of state practice.[199]

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[193] J. Craig Barker, International Law and International Relations 55–58 (2000).

[194] *Id.*

[195] *See, e.g.*, Steven Groves, *The Law of the Sea: Costs of U.S. Accession to UNCLOS*, Heritage Foundation (June 14, 2012), http://www.heritage.org/research/testimony/2012/06/the-law-of-the-sea-convention-treaty-doc-103-39, *available at* http://perma.cc/0XVpJNZvZ96 (quoting Restatement (Third) of the Foreign Relations Law of the United States, vol. 2, at 5 (1987)) ("[B]y express or tacit agreement accompanied by consistent practice, the United States, and states generally, have accepted the substantive provisions of the Convention, other than those addressing deep sea-bed mining, as statements of customary law binding upon them apart from the Convention."); Current Status of the Convention of the Law of the Sea: Hearing Before the Senate Committee on Foreign Relations, 103rd Cong. 35 (1994) (statement of D. James Baker that "UNCLOS will support NOAA's role as a steward of the marine environment, because it sets forth the rights and obligations of States to protect and preserve the marine environment from all sources of marine pollution, including land-based sources, ocean dumping, atmospheric deposition, and vessel source pollution"), *available at* http://goo.gl/EyN0si and http://perma.cc/TFT8-SMJL.

[196] Even Part XI of UNCLOS might now meet the requirement of state practice, though this idea is not essential to this Article's analysis. Citizens for Global Solutions, The United States and the Law of the Sea 1, *available at* http://globalsolutions.org/files/public/documents/LOS_Factsheet.pdf and http://www.perma.cc/0gMn1ectdHE.

[197] *See id.* President Reagan evidently would not sign the treaty because of certain deep seabed mining provisions, which were distinct from provisions to protect the marine environment. *See* Ronald Reagan, *Statement on United States Ocean Policy, March 10, 1983*, http://www.reagan.utexas.edu/archives/speeches/1983/31083c.htm (last visited Jan. 1, 2014), *available at* http://perma.cc/0MKF5RqCjbF.

[198] For example, President George W. Bush and President Barack Obama have pushed Congress to ratify UNCLOS. *See* Thomas Wright, *Outlaw of the Sea: The Senate Republicans' UNCLOS Blunder*, Foreign Affairs (Aug. 7, 2012), http://www.foreignaffairs.com/articles/137815/thomas-wright/outlaw-of-the-sea, *available at* http://perma.cc/02cri3tNgU1 (discussing President George W. Bush's support); *The Convention on the Law of the Sea*, U.S. Navy Judge Advocate General's Corps, http://www.jag.navy.mil/organization/code_10_law_of_the_sea.htm (last visited Jan. 1, 2014), *available at* http://perma.cc/06jsf8StUWR (quoting a statement from President Obama regarding UNCLOS as potentially beneficial for U.S. national security).

[199] *Supra* notes 193–198 and accompanying text.

2. Opinio Juris

Opinio Juris may be defined as "the belief that an act is legally necessary," or in other words, that a nation conducts a state practice out of a sense of legal obligation.[200] Although resolutions in the United Nations General Assembly and other non-binding agreements do not create custom per se (because a nation's government might not necessarily feel *bound* by those agreements), such non-binding agreements can nevertheless evolve into *opinio juris* and thereby fulfill the second element of customary international law.[201] Evidence of *opinio juris* for Articles 192, 194, and 195 of UNCLOS can be found in 1972's nonbinding Stockholm Declaration on the Human Environment.[202] The Stockholm Declaration has been described as "complementary" to the marine pollution provisions of UNCLOS III.[203] The United States is a party to the Stockholm Declaration.[204] Closely mirroring the duty to protect the marine environment that underlies Part XII of UNCLOS, Principle 6 of the Stockholm Declaration states the following:

> The discharge of toxic substances or of other substances and the release of heat, in such quantities or concentrations as to exceed the capacity of the environment to render them harmless, must be halted in order to ensure that serious or irreversible damage is not inflicted upon ecosystems.[205]

Further evidence of *opinio juris* regarding Articles 192, 194, and 195 of UNCLOS can be found in 1992's Agenda 21, which is a nonbinding agreement that received global consensus.[206] Not only does

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[200] Barker, *supra* note 193, at 60.

[201] *Id.* at 60–61.

[202] *See* Declaration of the United Nations Conference on the Human Environment, Principle 6, June 16, 1972, U.N. Doc. A/Conf. 48/14, 11 I.L.M. 1416, *available at* http://www.unep.org/Documents.Multilingual/Default.asp?documentid=97&articleid=1503 and http://perma.cc/G9JQ-LJBD.

[203] *See* E.D. Brown, The International Law of the Sea: Volume I, Introductory Manual 337 (1994).

[204] Günther Handl, *Declaration of the United Nations Conference on the Human Environment*, United Nations, http://legal.un.org/avl/ha/dunche/dunche.html (last visited Dec. 27, 2013), *available at* http://perma.cc/5PT9-S2VJ. Note that the United States expressed opposition to some concepts unrelated to the ocean pollution provisions.

[205] Declaration of the United Nations Conference on the Human Environment, *supra* note 202.

[206] *See* U.N. Conference on Environment & Development, Agenda 21, Aug. 12, 1992, *available at* http://www.un.org/esa/sustdev/documents/agenda21/english/Agenda21.pdf and http://www.perma.cc/06eDHnFoLmL; *see also* Report of the Global Conference on the Sustainable Development of Small Island Developing States, Annex II Preamble, Oct. 1994, U.N. Doc. A/Conf. 167/9, *available at* http://www.un.org/esa/dsd/dsd_aofw_sids/

Agenda 21 mirror most of the obligations to protect the marine environment that Part XII of UNCLOS embodies, but Agenda 21 also explicitly indicates that international law is "reflected in the provisions of [UNCLOS]."[207] As a signatory to Agenda 21, the United States explicitly signed an agreement that declares certain marine protection provisions of UNCLOS to be international law, which is evidence of *opinio juris*.[208] Finally, the United States has also stated that it would adopt "uniform international measures" to enforce the duty to protect the marine environment, which indicates that the U.S. government considers itself bound by such measures.[209] Therefore, the United States meets the elements of state practice and *opinio juris* such that it should comply with customary international law embodied in Articles 192, 194, and 195 of UNCLOS.[210]

B. *The United States Should Enact Laws to Enforce UNCLOS*

Although the United States has not acceded to UNCLOS, it should nonetheless strive to meet the customary international law standards represented by UNCLOS Articles 192, 194, and 195 by enacting appropriate domestic laws and regulations.[211] Furthermore, many commentators and observers argue that the United States should ratify UNCLOS for reasons related to environmental protection, economic interests, and national security.[212] President George W. Bush and President Barack Obama have both supported Senate ratification of UN-

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sids_pdfs/BPOA.pdf and http://perma.cc/0qAsazuZhPw (describing Agenda 21 as a "global consensus").

[207] U.N. Conference on Environment & Development, *supra* note 206, ¶ 17.1.

[208] *Customary IHL*, *supra* note 190.

[209] Bauerlein, *supra* note 8, at 901.

[210] *See supra* notes 200–209 and accompanying text.

[211] There is debate over whether and to what extent customary international law is self-executing federal common law, so while Article XII of UNCLOS might be enforceable in the courts, the matter is unresolved. *See, e.g.*, Curtis A. Bradley et al., *SOSA, Customary International Law, and the Continuing Relevance of Erie*, 120 Harv. L. Rev. 869, 870–71 (2007).

[212] *See, e.g.*, John B. Bellinger III, *Should the United States Ratify the UN Law of the Sea?*, Council on Foreign Rel., http://www.cfr.org/treaties-and-agreements/should-united-states-ratify-un-law-sea/p31828 (last visited Nov. 22, 2013), *available at* http://perma.cc/RM7R-BMWX (arguing that the United States should ratify UNCLOS because doing so would provide several benefits, and citing the support of the George W. Bush and Obama administrations); Stewart M. Patrick, *(Almost) Everyone Agrees: The U.S. Should Ratify the Law of the Sea Treaty*, Atlantic (June 10, 2012), http://www.theatlantic.com/international/archive/2012/06/-almost-everyone-agrees-the-us-should-ratify-the-law-of-the-sea-treaty/258301, *available at* http://perma.cc/G869-9S4R (discussing how former Secretary of State Hillary Clinton, former Secretary of Defense Leon Panetta, and Chairman of the Joint Chiefs of Staff Martin Dempsey expressed support for ratifying UNCLOS).

CLOS for the numerous benefits that joining the convention would provide to the United States.[213] Although there is debate regarding the extent UNCLOS to which imposes binding legal obligations upon the United States, the United States should ratify the treaty and abide by its provisions in the interim.[214]

C. *Part XII of UNCLOS*

This section first discusses Article 192 of UNCLOS, which states the basic purpose of Part XII of UNCLOS: the duty of States "to protect and preserve the marine environment."[215] Next, this section determines that the United States failed to act in observance of the ordinary meaning of Article 194 of UNCLOS because the use of oil dispersants, as authorized under U.S. laws and regulations, constitutes "pollution of the marine environment."[216] Because the language of a treaty should be interpreted consistent with the object and purpose of the treaty,[217] this section further concludes that the United States *would* be observing Article 194 if its laws and regulations could ensure that oil dispersants are used only if they have a net environmental benefit on the marine environment, and if they are the *optimal* dispersant to be used in any given oil spill.[218] This section then recommends a series of legal reforms that would help the United States to ensure observance of UNCLOS Article 194.[219] Finally, this section determines that the United States failed to observe Article 195 of UNCLOS because the use of oil dispersants, as authorized under U.S. laws and regulations, (1) transfers oil damage from one place to another and (2) transforms pollution from one type into another.[220]

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[213] *See* Bellinger, *supra* note 212.

[214] *See id.*; Patrick, *supra* note 212.

[215] *See* United Nations Convention on the Law of the Sea art. 192, Dec. 10, 1982, *available* at http://www.un.org/depts/los/convention_agreements/texts/unclos/unclos_e.pdf and http://perma.cc/9SV3-AV97; *infra* notes 221–230 and accompanying text.

[216] *See* United Nations Convention on the Law of the Sea, *supra* note 215, art. 194; *infra* notes 231–269 and accompanying text.

[217] "The provisions of the treaty are to be given their ordinary meaning in their context. The object and purpose of the treaty are also to be taken into account in determining the meaning of its provisions." Appellate Body Report, *Japan—Taxes on Alcoholic Beverages,* ¶ 12, WT/DS8/AB/R (Oct. 4, 1996), *available at* http://goo.gl/ykn0kz. In other words, "the treaty's 'object and purpose' is to be referred to in determining the meaning of the 'terms of the treaty' and not as an independent basis for interpretation." *Id.*

[218] *Infra* notes 259–268 and accompanying text.

[219] *Infra* notes 296–299, 309–314, 343–352 and accompanying text.

[220] *Infra* notes 353–384 and accompanying text.

1. Article 192—Obligation to Protect and Preserve the Marine Environment

Article 192 of UNCLOS provides the foundational obligation for Part XII of UNCLOS.[221] Part XII of UNCLOS is the preeminent codification of customary international law related to the protection of the marine environment, which is why it was once described by the United Nations Office of Ocean Affairs as "constitutional in nature" and "the first comprehensive statement of international law on [the marine environment]."[222] As the backbone of Part XII, Article 192 declares, "States have the obligation to protect and preserve the marine environment."[223] Because the object and purpose of a treaty should be considered when interpreting the treaty's text,[224] Article 192 should be used when interpreting the remainder of Part XII of UNCLOS.[225]

First, an interpretation of the ordinary meaning of Article 192 is necessary.[226] In making such an interpretation, the word "have" in the phrase "have the obligation" indicates a mandatory legal obligation; that is, a country *must* protect and preserve the marine environment.[227] Furthermore, Article 192's duty to "protect" the marine environment should mean "abstaining from harmful activities and taking affirmative measures to ensure that environmental deterioration does not occur."[228] When this underlying purpose of UNCLOS is read into other provisions of the treaty, it is reasonable to conclude that the United States, in some circumstances, should pass and enforce laws and regulations such that cleanup responses to oil spills result in a *net environmental benefit,* which would ensure that further environmental deterioration does not occur as a result of cleanup efforts.[229] A net environmental

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[221] *Infra* notes 222–225 and accompanying text.

[222] The Law of the Sea Inst., Sustainable Development and Preservation of the Oceans: The Challenges of UNCLOS and Agenda 21, at 23–24 (Mochtar Kusuma-Atmadja et al. eds., 1995).

[223] *See* United Nations Convention on the Law of the Sea, *supra* note 215, art. 192.

[224] Appellate Body Report, *supra* note 217, ¶ 21.

[225] Jay E. Austin & Carl E. Bruch, The Environmental Consequences of War: Legal, Economic, and Scientific Perspectives 207 (2000) (describing how Article 192 frames the overall purpose of Part XII of UNCLOS).

[226] According to the Vienna Convention, which is customary international law, the provisions of a treaty should receive their ordinary meaning in their context. Vienna Convention on the Law of Treaties art. 31, May 23, 1969, 1155 U.N.T.S. 331.

[227] *See id.* art. 31(1).

[228] Alexandre Kiss & Dinah Shelton, Guide to International Environmental Law 92 (2007).

[229] A treaty should be interpreted in light of its object and purpose. *See* Vienna Convention, *supra* note 226, art. 31(1). Imposing a duty to refrain from engaging in any activity

benefit is an increase in environmental or ecological properties that is larger than the corresponding decrease in environmental or ecological properties caused by the same action.[230]

2. Article 194—Measures to Prevent, Reduce, and Control Pollution of the Marine Environment

First, this subsection analyzes Article 194 of UNCLOS and determines that the United States's use of Corexit dispersants in response to the Deepwater Horizon oil spill appears to fall short of the duty to use "all measures . . . necessary" to prevent, reduce, and control "pollution of the marine environment" within the plain meaning of Article 194.[231] Next, this subsection concludes that the United States *would* be in observance of Article 194 if it were to enact and enforce laws and regulations that allow the use of dispersants only if the use results in a net environmental benefit and the dispersants are the optimal dispersants for a particular oil spill.[232]

i. *"Any Sources" of Pollution Includes Airplanes, Spraying Mechanisms Aboard Vessels, and Pipes from Vessels*

First, the methods by which dispersants were dispensed—including by airplane, spraying mechanisms aboard vessels, and a pipe going underwater from a vessel—are within the scope of Article 194 because they fall within the meaning of "any source."[233] Interpreted according to the text's ordinary meaning,[234] "any" can be defined as "whatever or

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that pollutes the ocean is an unreasonable interpretation. For example, excess CO_2 has a negative impact on the oceans, but UNCLOS would not mandate shutting down the entire carbon economy. *See, e.g.*, Intl. Union for Conservation of Nature, The State of the Ocean 2013: Perils, Prognoses and Proposals 3–6 (2013), *available at* http://www.stateoftheocean.org/pdfs/IPSO-Summary-Oct13-FINAL.pdf and http://perma.cc/0ci8MTqDuxY. Oil spill cleanup is an affirmative measure, however, that serves an explicit purpose of reducing or limiting ocean pollution, and UNCLOS can be reasonably interpreted to dictate that such measures must present a net environmental benefit.

[230] *Net Environmental Benefit Analysis,* Envtl. Sci. Division of Oak Ridge Nat'l Lab., http://www.esd.ornl.gov/programs/ecorisk/net_environmental.html (last visited Jan. 5, 2014), *available at* http://www.perma.cc/0zDqLzWk9ZE (stating that "[n]et environmental benefits are the gains in environmental services or other ecological properties attained by actions, minus the environmental injuries caused by those actions.").

[231] *Infra* notes 233–258 and accompanying text.

[232] *Infra* notes 259–269 and accompanying text.

[233] *See infra* notes 234–242 and accompanying text.

[234] *See* Vienna Convention, *supra* note 226, art. 31.

whichever it may be."[235] Furthermore, "source" can be defined as "any thing or place from which something comes, arises, or is obtained."[236] These definitions demonstrate that the plain meaning of "any source" is extremely broad and, by the ordinary meaning of the phrase, would include essentially anything that produces pollution.[237] Therefore, airplanes, spraying mechanisms aboard vessels, and a pipe going underwater from a vessel are almost certainly "any sources" within the meaning of Article 194 of UNCLOS.[238]

Even if the plain meaning of "any source" is not entirely clear—for example, "source" could arguably have a unique meaning specific to marine pollution—the draft history[239] of UNCLOS confirms the broad scope intended to apply to the phrase "any source."[240] According to a 1973 draft article from Working Group 2 of Sub-Committee III of the Sea-Bed Committee, Article 194 "shall deal with all sources of pollution of the marine environment, whether land, marine, or any other sources, including rivers, estuaries, the atmosphere, pipelines, outfall structures, vessels, aircraft and sea-bed installations or devices."[241] Because vessels, aircraft, and pipelines were explicitly considered in the drafting of UNCLOS, all of the methods by which Corexit was dispersed into the Gulf of Mexico during the Deepwater Horizon oil spill should qualify as "any sources" under Article 195 of UNCLOS.[242]

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[235] *Any,* Dictionary.com, http://dictionary.reference.com/browse/any (last visited Jan. 1, 2014), *available at* http://www.perma.cc/04JBVQCBYcP.

[236] Jeff Weinrach, *Pollution Prevention and Waste Minimization: Back to Basics, in* Handbook of Pollution Control and Waste Minimization 1 (Abbas Ghassemi ed., 2001).

[237] *See Protecting and Preserving Marine Biodiversity, Including Through Sustainable Fisheries, in* Training Manual on International Environmental Law 225 (Lal Kurukulasuriya & Nicholas A. Robinson eds., 2006) (describing examples of sources such as "pollution by ships through dumping and operational discharges, from land (through rivers) or from the exploitation of the non-living resources on the sea-bed").

[238] *Supra* notes 232–235 and accompanying text.

[239] The Vienna Convention indicates that a treaty's preparatory work may serve as a supplementary means of interpretation when the meaning of a term is ambiguous. *See* Vienna Convention, *supra* note 226, art. 32.

[240] Center for Oceans Law and Policy, United Nations Convention on the Law of the Sea 1982: A Commentary 56 (vol. IV, 1990).

[241] *Id.*

[242] *See supra* notes 234, 240 and accompanying text.

ii. *The Use of Dispersants Is Likely "Pollution of the Marine Environment" by Its Ordinary Meaning*

The use of dispersants likely constitutes "pollution of the marine environment" within the meaning of UNCLOS.[243] UNCLOS specifically defines "pollution of the marine environment" as follows:

> the introduction by man, directly or indirectly, of substances or energy into the marine environment, including estuaries, which *results or is likely to result in such deleterious effects as harm to living resources and marine life,* hazards to human health, hindrance to marine activities, including fishing and other legitimate uses of the sea, impairment of quality for use of sea water and reduction of amenities . . . .[244]

The ordinary meaning of "pollution of the marine environment" considering the object and purpose of UNCLOS can clarify this phrase's meaning.[245] "Deleterious" can be defined as "harmful to health or well-being."[246] For example, Corexit (like most other dispersants) is toxic,[247] which generally means that it "can cause harmful effects to living organisms,"[248] or that it exceeds an acceptable concentration of contaminants.[249] Furthermore, Corexit has been shown to be carcinogenic to some living creatures.[250] Therefore, the use of disper-

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[243] Article 194 contemplates pollution of the "marine environment." Although the "marine environment" is not specifically defined in UNCLOS, evidence from Article 1 of a proposal during UNLOS's drafting stages brings clarity to its meaning: "The marine environment comprises the surface of the sea, the air space above, the water column and the sea-bed beyond the high tide mark including the biosystems therein or dependent thereon." Center for Oceans Law and Policy, *supra* note 240, at 42. Therefore, the area to which dispersants were deployed—the surface and subsurface of the ocean—are both part of the "marine environment." *See id.*

[244] United Nations Convention on the Law of the Sea, *supra* note 215, art. 1(4) (emphasis added).

[245] *See* Vienna Convention, *supra* note 226, art. 31.

[246] Webster's New World College Dictionary 382 (4th ed. 2008).

[247] For example, the EPA's testing of Corexit after the Deepwater Horizon oil spill showed that for Mysid Shrimp (*Americamysis bahia*) over 48 hours, a mixture of Corexit 9500A and South Louisiana sweet crude oil had an LC50 toxicity of 5.4 $(ppm)^3$, and for Inland Silverside (*Menidia beryllina*) over 96 hours, an LC50 toxicity of 7.6 $(ppm)^3$. *See* Envtl. Prot. Agency, *supra* note 1, at 13.

[248] *See Glossary of Terms,* Agency for Toxic Substances & Disease Registry, http://www.atsdr.cdc.gov/glossary.html (last visited Jan. 1, 2014), *available at* http://www.perma.cc/07SFYsWg3kn.

[249] *See Pollution Prevention Definitions,* Envtl. Prot. Agency, http://www.epa.gov/p2/pubs/p2policy/definitions.htm (last visited Jan. 1, 2014), *available at* http://www.perma.cc/0n39Gan84Up.

[250] Biello, *supra* note 56.

sants, such as Corexit, with toxic properties is "pollution of the marine environment."[251]

In addition to ordinary meaning, evidence of the broad scope of Article 194(3)(a) supports the conclusion that the use of dispersants is "pollution of the marine environment."[252] According to Article 194(3)(a), States have an affirmative obligation to "prevent, reduce, and control pollution of the marine environment" from "all sources of pollution."[253] Originally, the language of Article 194(3)(a) included substances that are "toxic *and* harmful."[254] This language, however, was changed to include substances that are "toxic, harmful, *or* noxious."[255] Unlike the original provision, which likely used the conjunction "and" to indicate that a substance must be both toxic *as well as* harmful, the modified provision's use of the conjunction "or" means that "pollution of the marine environment" covers a broader range of substances—those that are toxic *but not harmful,* or harmful *but not noxious,* for example.[256] Even if Corexit is determined not to be "harmful" per se, Corexit is undisputedly "toxic" within the ordinary meaning of the word.[257] Therefore, the use of dispersants with toxic properties, such as Corexit, constitutes "pollution of the marine environment."[258]

iii. *The Use of Dispersants Abides by Article 194 if Scientifically Determined to Result in a Net Environmental Benefit*

As established above, the object and purpose of UNCLOS—reflected in Article 192 as a State's "obligation to protect and preserve the marine environment"—can be used to interpret Article 194.[259] Article 194's obligation to use the "best practicable means" to prevent, reduce, and control "pollution of the marine environment" may be interpreted

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[251] *Supra* notes 243–250 and accompanying text.

[252] *Supra* notes 243–251, 253–258 and accompanying text.

[253] *See* United Nations Convention on the Law of the Sea, *supra* note 215, art. 194(1), (3).

[254] *See* Center for Oceans Law and Policy, *supra* note 240, at 66.

[255] United Nations Convention on the Law of the Sea, *supra* note 215, art. 194(3)(a) (emphasis added).

[256] The word "and" is generally used in the conjunctive, while the word "or" is generally used in the disjunctive. *See* Katharine Clark et al., A Guide to Reading, Interpreting, and Applying Statutes 11 n.34 (2006) (citing William N. Eskridge et al., Cases and Materials on Legislation: Statutes and the Creation of Public Policy 827 (2001)). In some circumstances, however, "or" can mean "A or B or both." *Id.* at 11 n.36.

[257] *See, e.g.*, Campbell Robertson & Elisabeth Rosenthal, *Agency Orders Use of a Less Toxic Chemical in the Gulf,* N.Y. Times, May 21, 2010, at A15.

[258] *Supra* notes 243–257 and accompanying text.

[259] *Supra* notes 222–225 and accompanying text.

to ensure that all such activities result in a net environmental benefit.[260] Although this interpretation of Article 194 would permit the "pollution of the marine environment" via toxic dispersants by its ordinary meaning (for example, if a toxic substance pollutes the marine environment but counteracts another toxic substance), the gain in environmental quality must outweigh the environmental injuries in accordance with the object and purpose of UNCLOS.[261] This interpretation can also be harmonized with the definition of "deleterious"—namely harm to living resources and marine life—because "deleterious" can be interpreted to mean harmful to health or well-being as a whole, not just on an individual level.[262]

Interpreting Article 194 as applying to all pollution regardless of the net environmental outcome would lead to absurd or unreasonable results. According to Article 32 of the Vienna Convention, supplementary means of treaty interpretation can be used to determine when one interpretation "leads to a result which is manifestly absurd or unreasonable."[263] It is unreasonable to conclude that Article 194's duty to prevent "pollution of the marine environment" is breached if, for example, the use of a small amount of a toxic substance eradicates millions of gallons of toxic sludge.[264]

In addition to only authorizing dispersant use that results in a net environmental benefit, Article 194 likely requires a dispersant to also result in the *optimal* net environmental benefit, as compared to other available dispersants. Article 194 of UNCLOS requires that a State must take "all measures . . . necessary" using the "best practicable means" to prevent, reduce, and control "pollution of the marine environment."[265] The ordinary meaning of the word *best*—"in or to the highest de-

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[260] Use of the word "reduce" supports the proposition that Article 194 permits measures that result in a net environmental, benefit because such measures would reduce the total amount of pollution. *See* United Nations Convention on the Law of the Sea, *supra* note 215, art. 194(1).

[261] *See supra* note 230 and accompanying text (definition of net environmental benefit).

[262] *See* United Nations Convention on the Law of the Sea, *supra* note 215, art. 1(4) (definition of "pollution of the marine environment"); Webster's New World College Dictionary, *supra* note 246, at 382.

[263] *See* Vienna Convention, *supra* note 226, art. 32(b).

[264] The object and purpose of a treaty is often used to help determine whether a certain interpretation is unreasonable. Oliver Dörr, *Interpretation of Treaties*, *in* Vienna Convention on the Law of Treaties: A Commentary 584 (Oliver Dörr & Kirsten Schmalenbach eds., 2011). Here, the object and purpose of Article 192 is to "protect and preserve the marine environment," which would seem to permit using a small amount of pollution to remedy a large amount of pollution.

[265] *See* United Nations Convention on the Law of the Sea, *supra* note 215, art. 194.

gree"[266]—indicates that a State should enact and enforce laws and regulations ensuring that only the dispersant with the *greatest* net environmental benefit is used in response to oil spills. Although the use of the word "practicable" and the phrase "in accordance with their capabilities" might seem to diminish the obligation to use the "best" means available, this language was inserted for *developing* countries,[267] which are held to lesser standards under Article 194 than developed countries—a caveat that is fairly commonplace in international environmental laws.[268] Therefore, nations should only use dispersants if they result in an *optimal* net environmental benefit such that (1) a net environmental benefit is achieved and (2) the dispersant used has a less harmful effect on the marine environment than other alternatives.[269]

iv. *The United States Did Not Observe Article 194 of UNCLOS*

Article 194's obligation to use all means necessary to prevent, reduce, and control pollution of the marine environment can be interpreted as an obligation to enact and enforce laws and regulations such that dispersants that cause "pollution of the marine environment" are used only if they result in a net environmental benefit and are the optimal dispersants.[270] Although dispersants may in some circumstances result in a net environmental benefit, the United States—through enacting and enforcing laws and regulations—has not used the "best practicable means at [its] disposal" to ensure that dispersants used in response to oil spills result in a net environmental benefit, let alone an *optimal* net environmental benefit.[271] Therefore, the United States did

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[266] *Best,* Dictionary.com, http://dictionary.reference.com/browse/best (last visited Jan. 1, 2014), *available at* http://www.perma.cc/09J8Wo4KVrM.

[267] Jon M. Van Dyke, *Allocating Fish Across Jurisdictions, in* Law of the Sea, Environmental Law and Settlement of Disputes 24 (Tafsir Malick Ndiaye & Rüdiger Wolfrum eds., 2007), *available at* http://www.fishallocation.com/papers/pdf/papers/JonVanDyke.pdf and http://perma.cc/07ZuXNavYae.

[268] *See* Rudiger Wolfrum et al., Conflicts in International Law 37 (2003). Examples of other international environmental treaties with lesser standards for developing countries are the Kyoto Protocol and the Montreal Protocol. *See* Mary J. Bortscheller, *Equitable but Ineffective: How the Principle of Common but Differentiated Responsibilities Hobbles the Global Fight Against Climate Change,* 10 Sustainable Dev. L. & Pol'y 49, 50 (2010).

[269] *Supra* notes 259–268 and accompanying text.

[270] *Supra* notes 259–268 and accompanying text.

[271] *See, e.g.*, Nat'l Comm'n on the BP Deepwater Horizon Oil Spill and Offshore Drilling, *supra* note 3, at 270–71 (concluding that the federal government did not adequately prepare for the use of dispersants in a large oil spill and had insufficient information about the effects of dispersants).

not observe customary international law as reflected in Article 194 of UNCLOS.

Further below, this section makes recommendations for how the United States can comply with Article 194 of UNCLOS.[272] The president has allocated the power to amend the NCP to the EPA, and therefore the EPA is the appropriate governmental body to effectuate this section's recommendations.[273] A preferable alternative, however, would be for Congress to pass laws to reform dispersant regulation so that the EPA has less discretion to deviate from optimal dispersant use.[274]

v. *The United States Approved Corexit for Use Despite Less-Toxic Alternatives*

The United States's failure to mandate that BP use the least toxic, most effective dispersant available was in conflict with the customary international law reflected by Article 194 of UNCLOS. In general, data shows that the use of dispersants on oil spills results in a fairly unpredictable "net toxicity," or the total toxicity of the oil and the dispersant.[275] For example, assuming that "1" equals one unit of toxicity, the toxicity of a mixture of oil and dispersants can result in a variety of *net* toxicity outcomes:[276]

L = Leaked Oil; D = Dispersant

> Outcome 1: Dispersants result in a net reduction in total toxicity (1 L + 1 D = .5 L + D).
> Outcome 2: Dispersants result in no change in total toxicity (1 L + 1 D = 1 L + D).
> Outcome 3: Dispersants result in an increase in total toxicity less than the sum of the oil and the dispersant (1 L + 1 D = 1.5 L + D).

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[272] *Infra* notes 309–314, 343–352 and accompanying text.

[273] *See* 42 U.S.C. § 9605 (2006) (conferring statutory authority on the president); Exec. Order No. 12,580, 3 C.F.R. 193 (1987), *available at* http://www.archives.gov/federal-register/codification/executive-order/12580.html and http://perma.cc/XP5-L8YX.

[274] Bills introduced to increase the regulation of dispersants were introduced in 2010 but died. *See* Safe Dispersants Act, S. 3661, 111th Cong. (2010); Better Oil Spill Response Plan Act, H.R. 5608, 111th Cong. (2010).

[275] *See* Richard Denison, *New EPA Data: Dispersant Likely Not Increasing Acute Lethality of Oil in BP Oil Disaster*, Envtl. Defense Fund (Aug. 2, 2010), http://blogs.edf.org/nanotechnology/2010/08/02/new-epa-data-dispersant-likely-not-increasing-acute-lethality-of-oil-in-bp-oil-disaster/, *available at* http://www.perma.cc/0ZcR4nXoDWh.

[276] These calculations are the author's work and are not an official gauge for toxicity.

> Outcome 4: Dispersants result in an increase in toxicity equal to or greater than the combined toxicity of the oil and the dispersant (1 L + 1 D = 2 L + D).[277]

The only outcome listed above that results in a net environmental benefit, at least in terms of toxicity, is "Outcome 1," where the net toxicity of the oil and dispersant is *less* than the oil alone. Many of the dispersants listed in the NCP Product Schedule, however, as well as those pre-authorized by the RRTs in Federal Region IV and Federal Region VI, have a net toxicity that is *greater* than the toxicity of the oil alone.[278] According to oil dispersant testing per the requirements of Subpart J, Corexit 9500 falls into Outcome 4 above: While Corexit alone has an LC50 (i.e. the concentration of a substance that kills 50 percent of a test organism, with higher values being less toxic[279]) of 25.2 on Menidia fish, and No. 2 fuel oil[280] alone has an LC50 of 10.7, Corexit combined[281] with No. 2 fuel oil has an LC50 of 2.6, which is approximately 4.1 times greater toxicity the No. 2 fuel oil by itself.[282] Similarly, when a mixture of Corexit and No. 2 fuel oil was tested on a Mysidopsis,[283] the resultant toxicity was 4.7 times greater than the No. 2 fuel oil alone.[284] On the other hand, several types of dispersants listed on the NCP Product Schedule resulted in a significantly *decreased* net toxicity when mixed with No. 2 fuel oil.[285] Although other factors besides toxicity might weigh toward determining that dispersants resulted in a net environmental benefit—for example, the wetlands that were spared from

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[277] Outcome 4 may be characterized as a *synergistic* outcome. "Synergy is strictly defined as occurring if the effect of the combined exposure is greater than the sum of the effects of the two or more individual components of the mixture . . . ." Joe L. Mauderly & Jonathan M. Samet, *Is There Evidence for Synergy Among Air Pollutants in Causing Health Effects?*, 117(1) Envtl. Health Persp. 1, 1 (2009).

[278] *See National Contingency Plan Product Schedule Toxicity and Effectiveness Summaries*, *supra* note 158.

[279] *See* 40 C.F.R. § 797.1950(a)(5) (1994).

[280] No. 2 fuel oil is the typical oil used in industry tests of dispersant toxicity per Subpart J of the NCP. *See, e.g.*, *Corexit EC9500A, Technical Product Bulletin #D-4*, Envtl. Prot. Agency, http://www.epa.gov/oem/content/ncp/products/corex950.htm (last updated Nov. 6, 2013), *available at* http://perma.cc/D7UC-Z4HC.

[281] The testing of dispersants uses a ratio of one part dispersant for ten parts oil under the EPA's testing requirements. 40 C.F.R. 300 app. C (2013).

[282] Denison, *supra* note 275.

[283] Mysidopsis, a type of shrimp, is one of two species on which dispersants are typically tested. *EPA's Toxicity Testing of Dispersants*, *supra* note 161.

[284] Denison, *supra* note 275.

[285] *See National Contingency Plan Product Schedule Toxicity and Effectiveness Summaries*, *supra* note 158.

greater oil damage should be weighed into the equation[286]—the United States still failed to enact and enforce laws such that it employed the "best possible means at [its] disposal" to prevent, reduce, and control "pollution of the marine environment." Doing so would require the United States to mandate the use of the *optimal* dispersant.[287]

During the Deepwater Horizon oil spill, one barrier to using dispersants superior to Corexit was that several less toxic, more effective dispersants were not readily available in sufficient supply.[288] Some oil spill experts claim that the oil industry keeps only one type of dispersant on hand at a time, which effectively made Corexit the only viable option during the Deepwater Horizon oil spill.[289] If a particular brand of dispersant is required to achieve an optimal environmental benefit during an oil spill, but laws and regulations do not ensure its use, then a nation is not satisfying its obligation to take all measures necessary to prevent, reduce, and control pollution of the marine environment under UNCLOS as customary international law.[290]

Finally, although EPA tests later showed that Corexit *did* in fact result a net reduction in total toxicity (Option 1 above), the United States still failed to observe UNCLOS Article 194 because the United States's laws and regulations do not *ensure* that dispersants will be used only if they result in an optimal net environmental benefit. The EPA's toxicity tests (released after the Macondo wellhead was capped) revealed that Corexit 9500, as applied to Louisiana sweet crude (rather than the No. 2 fuel oil used for the toxicity testing required by Subpart J of the NCP), results in a mixture that is at least two times less toxic than the

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[286] *See, e.g.*, Region IV Reg'l Response Team, *supra* note 45, at 39.

[287] *Supra* notes 265–269 and accompanying text.

[288] Margot Roosevelt & Carolyn Cole, *BP Refuses EPA Order to Switch to Less-Toxic Oil Dispersant*, L.A. Times (May 23, 2010), http://articles.latimes.com/2010/may/23/nation/la-na-oil-spill-20100523, *available at* http://perma.cc/36S8-ZG82 (describing BP's statement that only one alternative to Corexit was available in sufficient quantities).

[289] Paul Quinlan, *More Questions Than Answers on Dispersants a Year After Gulf Spill*, N.Y. Times (Apr. 22, 2011), http://www.nytimes.com/gwire/2011/04/22/22greenwire-more-questions-than-answers-on-dispersants-a-y-23354.html, *available at* http://www.perma.cc/0FtAV4HtDYq.

[290] *See* Shima Baradaran et al., *Does International Law Matter?*, 97 Minn. L. Rev. 743, 763 (2013) (discussing how a state must ratify and enforce international laws at the domestic level to comply with a treaty). Regarding customary international law, significant debate exists on whether customary international law has the status of federal law or general common law in the United States. *See, e.g.*, Carlos Manuel Vázquez, *Customary International Law as U.S. Law: A Critique of the Revisionist and Intermediate Positions and a Defense of the Modern Position*, 86 Notre Dame L. Rev. 1495, 1497–98 (2011).

oil alone for tested species.[291] In other words, Corexit 9500 resulted in a *decreased* net toxicity.[292] This result, however, might have merely been a lucky outcome despite poor planning. Data that was readily available, both when Corexit was pre-authorized in Region IV and Region VI and when the FOSC approved its use, showed that Corexit significantly increased the toxicity of some oil.[293] Thus, the EPA's tests could just as easily have shown that Corexit increases the toxicity of Louisiana sweet crude.[294] A fortunate outcome despite a flawed legal and regulatory system does not mean that the United States used the "best possible means at [its] disposal" to enact and enforce laws and regulations that prevent, reduce, and control "pollution of the marine environment." Therefore, the United States did not observe the standards established in Article 194 of UNCLOS.[295]

vi. *Recommendations for the United States's Observance of UNCLOS*

The United States should only authorize the use of dispersants in situations where the net toxicity of an oil and dispersant mixture is *less* than the toxicity of the oil alone.[296] Furthermore, the United States should only permit the use of an *optimal* dispersant, namely a dispersant that is less toxic, more effective, and has a better environmental impact than any of the alternatives.[297] One easy step that the United States could take to abide by UNCLOS Article 194 would be to make the EPA's discretionary Design for the Environment program, which recognizes some dispersants as "as a safer oil spill treatment," a mandatory requirement for a dispersant to be listed on Subpart J.[298]

Finally, oil drillers and transporters should be required to have a sufficient quantity of the optimum dispersant available for an oil spill based on the unique characteristics of the area in which they operate so that an inferior toxic dispersant does not cause unnecessary damage to

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[291] The LC50 for Corexit 9500A on Mysid Shrimp was 5.4 for the oil-dispersant mixture, versus 2.7 for Louisiana sweet crude. The LC50 for Corexit 9500A on Inland Silverside for the oil-dispersant mixture was 7.6, versus 3.5 for Louisiana sweet crude. *See* ENVTL. PROT. AGENCY, *supra* note 1, at 13.

[292] *Id.*

[293] *Corexit EC9500A, Technical Product Bulletin #D-4*, *supra* note 280.

[294] *See id.*

[295] *Supra* notes 291–294 and accompanying text.

[296] *See supra* notes 259–264 and accompanying text.

[297] *Supra* notes 259–269 and accompanying text.

[298] *NCP Product Schedule–Subpart J*, ENVTL. PROT. AGENCY, http://www.epa.gov/oem/content/ncp (last updated Nov. 21, 2013), *available at* http://www.perma.cc/0Le4bERWcZj.

the marine environment.[299] This was a major failure of the Deepwater Horizon oil spill that should be avoided in the future.

vii. *The United States Does Not Mandate Dispersant Testing During a Spill*

Despite the toxicity of Corexit, as reflected in the initial tests per Subpart J, the United States's laws and regulations permitted Corexit to be pre-authorized in Dispersant Use Plans in Federal Region IV and Federal Region VI.[300] Although an FOSC still must approve the use of a dispersant that is pre-authorized, which some might consider a safeguard, in reality the FOSC approves the use of dispersants almost immediately after an oil spill because dispersants are most effective when used within twenty-four hours of a spill.[301] Therefore, there is very little time for additional testing after an oil spill is reported.[302]

Even if an FOSC approves the use of a dispersant before any testing is done specific to the location of the spill, testing should still be conducted as soon as possible so that dispersant use can end if the dispersants are found to cause a negative net environmental impact.[303] During the Deepwater Horizon oil spill, even as thousands of gallons of Corexit were used every day, the U.S. government failed to mandate any additional testing of Corexit's toxicity or effectiveness until at least May 20, 2011—an entire month after the spill began, and after more than 600,000 gallons of Corexit had been used.[304] Even then, the United States stood idle as BP disregarded the EPA's directive to find a less toxic dispersant than Corexit.[305] Real-time testing was particularly important during the Deepwater Horizon oil spill because BP used dispersants at the bottom of the Gulf of Mexico, which was an unprecedented

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[299] Only one alternative to Corexit was available in adequate supply to use during the Deepwater Horizon oil spill. *See* Roosevelt & Cole, *supra* note 288. Having more alternatives could help to ensure that the best dispersant is chosen during future oil spills. *See id.*

[300] *See supra* notes 137–144 and accompanying text.

[301] Region 6 Reg'l Response Team, *supra* note 100, at app. A.

[302] U.S. Gov't Accountability Office, *supra* note 78, at 41.

[303] *Id.* at 47. BP began to use dispersants on April 26, 2010. *BP Oil Spill Timeline*, Guardian (July 22, 2010), http://www.theguardian.com/environment/2010/jun/29/bp-oil-spill-timeline-deepwater-horizon, *available at* http://perma.cc/0KrmhiiMKod. The EPA, however, did not release test results of the use of dispersants in response to the Deepwater Horizon oil spill until June 30, 2012, more than two months later. *EPA's Toxicity Testing of Dispersants*, *supra* note 161.

[304] *See, e.g.*, Envtl. Prot. Agency, *supra* note 166.

[305] *See* Elana Schor, *BP Continues to Use Surface Dispersants in Gulf Despite EPA Directive*, N.Y. Times (June 24, 2010), http://www.nytimes.com/gwire/2010/06/24/24greenwire-bp-continues-to-use-surface-dispersants-in-gul-80293.html, *available at* http://perma.cc/CBM6-JPHD.

and novel technique for which there was no prior research.[306] Overall, to abide by Article 194 of UNCLOS, the United States should have monitored dispersants that could potentially cause a net environmental harm, or dispersants for which there could be a superior alternative.[307] The U.S. government's failure to do so demonstrates that the United States did not use all means necessary to prevent, reduce, and control pollution of the marine environment.[308]

viii. *Recommendations for the United States's Observance of UNCLOS*

Laws and regulations in the United States should require the immediate and ongoing testing of dispersants after the FOSC approves their use.[309] If tests show that there will not be a net environmental benefit from dispersant use, or that there is an alternative dispersant that results in a superior net environmental benefit, then the use of the approved dispersants should cease immediately.[310]

One way that the United States could improve dispersant monitoring is through improvements to the Special Monitoring of Applied Response Technology (SMART) program, which is a joint project of several U.S. agencies that was implemented during the Deepwater Horizon oil spill.[311] Through the SMART program, dispersants are monitored in three primary ways: visually, mechanically with tools such as a "fluorometer," and analytically. [312] Toxicity testing, however, is not part of the SMART program, and special provisions for subsurface dispersant use are nonexistent.[313] For these reasons, the Coast Guard's ISPR Final Report recommends that the SMART program should continue to be enhanced.[314]

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[306] *See* U.S. Gov't Accountability Office, *supra* note 78, at 12, 22.

[307] *See supra* notes 259–269 and accompanying text.

[308] *See supra* notes 300–307 and accompanying text (discussion of optimal net environmental benefit).

[309] *Infra* notes 311–314 and accompanying text.

[310] *Supra* notes 259–269 and accompanying text.

[311] *See SMART*, NOAA Office of Response and Restoration, http://response.restoration.noaa.gov/oil-and-chemical-spills/oil-spills/resources/smart.html (last updated Dec. 31, 2013), *available at* http://perma.cc/FV8L-ABJ5.

[312] U.S. Coast Guard ISPR Team, *supra* note 4, at 40.

[313] The EPA and Coast Guard authorized the use of subsurface dispersants after testing for toxicity and effectiveness, though there was little scientific information to perform these tests. *Questions and Answers on Dispersants*, *supra* note 44.

[314] U.S. Coast Guard ISPR Team, *supra* note 4, at 45.

ix. *The United States Lacks a Sufficient Testing Regime for Dispersants*

In the United States, the testing regime for the safety of dispersants seems to fall far short of the standards represented by Article 194 of UNCLOS.[315] As described above, dispersants are listed on the NCP Product Schedule with minimal testing and are then pre-authorized in RCPs via Dispersant Use Plans without testing specific types of dispersants in combination with particular oil types and unique ecological conditions of a given area.[316] The effectiveness and overall environmental impact of dispersants has proven to fluctuate considerably by the application rate of the dispersant, type of oil, weather condition, water depth, water temperature, local species, and other variables.[317] The discrepancy in results between Nalco's tests of Corexit that were submitted to the EPA (using No. 2 fuel oil and testing only for toxicity and effectiveness) and the EPA's tests of Corexit on Louisiana sweet crude (performed after the Deepwater Horizon oil spill) highlights how unreliable generic toxicity and effectiveness tests are.[318] For this reason, the National Research Council stated "there is no strong correlation between laboratory and field tests."[319]

Corexit, like other dispersants, has proven to have a variable effect in different conditions and on different species, though only a limited amount of data is available.[320] One study showed that the toxicity of Corexit decreases with temperature, and that some fish and young animals are more sensitive to the toxicity of Corexit than mollusks and adults, respectively.[321] And ASTM International, a leader in establishing scientific and technical standards, asserts that the effectiveness[322] of a

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[315] *Infra* notes 316–319 and accompanying text.

[316] *Supra* notes 87–99, 137–145 and accompanying text.

[317] *See generally* Alaska Dep't of Envtl. Conserv., Dispersant Application (2006), *available at* http://www.dec.state.ak.us/spar/perp/star/23dispersants.pdf and http://perma.cc/G5GG-5JGH (discussing impacts of different application techniques and environmental conditions).

[318] *See supra* notes 157–165, 174–179 and accompanying text.

[319] Region IV Reg'l Response Team, *supra* note 45, at 115.

[320] Nat'l Comm'n on the BP Deepwater Horizon Oil Spill and Offshore Drilling, *supra* note 151, at 20.

[321] George-Ares & Clark, *supra* note 37, at 1007.

[322] Effectiveness is a measure of how much oil is dispersed during a certain period of time. *See* George A. Sorial, Laboratory Testing to Determine Dispersion Predictability of the Baffled Flask Test (BFT) and Swirling Flask Test (SFT) 3 (2006), *available at* http://www.bsee.gov/Research-and-Training/Technology-Assessment-and-Research/tarprojects/500-599/513AA.aspx and http://perma.cc/7C9K-62HT ("Dispersant effectiveness is a measure of the amount of oil that has been dispersed into the water column compared to the amount that remains on the surface.").

dispersant "varies with oil type, sea energy, oil conditions, salinity, and many other factors."[323]

Dispersants also have vast unknown effects on the marine environment that do not seem to have been sufficiently considered in approving Corexit in the NCP Produce Schedule and pre-approving its use in the relevant RCPs.[324] For example, although previous testing of Corexit showed it to be biodegradable, many scientists were surprised that some ingredients of Corexit have persisted in the Gulf of Mexico.[325] Some research indicates that Corexit did not biodegrade properly because of colder temperatures.[326] Many experts agree that the widespread use of Corexit, especially thousands of feet underwater at the Macondo wellhead, constitutes a massive toxicological experiment for which there is very little determinative science.[327]

Despite all of the unknowns concerning the environmental impacts of dispersants when used in unique conditions, Subpart J requires a minimal amount of testing for a dispersant to be listed in the NCP Product Schedule.[328] First, a dispersant need only achieve a modest effectiveness of 45 percent,[329] which is a comparatively low threshold when compared to 84.80 and 100 percent effectiveness, attributed to Saf-Ron Gold and Dispersit, respectively (when used in conjunction with a particular type of oil).[330] Second, although a dispersant must be tested for toxicity, there is no toxicity threshold that a dispersant is required to meet.[331] And even if there were, Subpart J's toxicity results are unreliable because toxicity is tested only on two species—the Menidia and the Mysidopsis.[332] Furthermore, there were gaps in the data and

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[323] *ASTM F2059—06(2012)e1,* ASTM Int'l, http://www.astm.org/Standards/F2059.htm (last visited Jan. 1, 2014), *available at* http://perma.cc/R8GE-TNN7.

[324] *See, e.g.*, U.S. Gov't Accountability Office, *supra* note 78, at 17–18 (summary of comments from experts).

[325] Janet Raloff, *Dispersants Persisted After BP Spill*, Sci. News (Jan. 27, 2011), http://www.sciencenews.org/view/generic/id/69192/title/Dispersants_persisted_after_BP_spill, *available at* http://www.readcube.com/articles/10.1002/scin.5591790506 and http://www.perma.cc/0oU7xSepuyV.

[326] *See, e.g.*, Schrope, *supra* note 80.

[327] *See* Avery Fellow, *Officials, Experts Voice Concerns on Dispersants*, Courthouse News Serv. (Aug. 4, 2010), http://www.courthousenews.com/2010/08/04/29325.htm, *available at* http://www.perma.cc/0eFk4sBWKjz.

[328] *See, e.g.*, U.S. Gov't Accountability Office, *supra* note 78, at 10.

[329] *See* 40 C.F.R. § 300.920(a) (2013).

[330] *National Contingency Plan Product Schedule Toxicity and Effectiveness Summaries*, *supra* note 158.

[331] *See* 40 C.F.R. § 300.915(a)(8).

[332] *See supra* notes 160–164 and accompanying text.

incorrect procedures for the minimal testing required of Corexit,[333] which, per the requirements of Subpart J, is tested by the industry without independent oversight.[334] Overall, the existing lax standards for testing dispersants do not meet the standards established by UNCLOS Article 194 to take "all measures . . . necessary" to prevent, reduce, and control pollution of the marine environment.[335]

On the other hand, because a dispersant is not actually "approved" for use once listed in Subpart J, some might argue that the United States abided by the terms of Article 194.[336] A dispersant must either be pre-authorized for use by an RRT or an AC before an FOSC may unilaterally approve it, otherwise the FOSC must first seek approval from the EPA and other stakeholders.[337] Furthermore, RRTs and ACs may require additional testing before pre-authorizing dispersants for unilateral authorization by an FOSC.[338] The reality, however, is that the NCP Product Schedule has been treated as though all of the dispersants were pre-authorized for use without further testing, as Senator Whitehouse of Rhode Island has argued.[339] Indeed, every dispersant listed in the NCP Product Schedule was pre-authorized for use in Federal Region IV and Federal Region VI, where the Deepwater Horizon oil spill occurred, and these dispersants do not appear to have undergone further testing specific to that region.[340]

In summary, the United States currently requires only minimum testing of dispersants that cause "pollution of the marine environment," while also complacently allowing a culture of dispersant pre-authorization without additional testing that is specific to unique marine environments.[341] Therefore, the United States did not use all means necessary to ensure that dispersants are only used in circumstances that result in a net environmental benefit, and that the particular dispersant used is

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[333] Biello, *supra* note 56.

[334] *See supra* notes 93–96 and accompanying text.

[335] *See supra* notes 315–334 and accompanying text.

[336] For example, the NCP Product Schedule states, "This listing does NOT mean that EPA approves, recommends, licenses, certifies, or authorizes the use of [Product Name] on an oil discharge." Envtl. Prot. Agency, *supra* note 90.

[337] *See supra* notes 124–125, 134 and accompanying text.

[338] *See* U.S. Coast Guard ISPR Team, *supra* note 4, at 40.

[339] *See* Tilove, *supra* note 42.

[340] Other federal regions are outside the scope of this Article but could be a topic for future research. *See supra* notes 137–145 and accompanying text.

[341] *See* U.S. Coast Guard ISPR Team, *supra* note 4, at 40; *see also* U.S. Gov't Accountability Office, *supra* note 78, at 10 (describing the standard tests for inclusion of a dispersant on the Product Schedule).

the *optimal* dispersant for a particular marine environment, which falls short of the standards stated in Article 194 of UNCLOS.[342]

x. *Recommendations for the United States's Observance of UNCLOS*

First, the United States should require that dispersants be tested in the particular marine environments for which they are pre-authorized.[343] Even a division of Exxon Mobil conceded that dispersants should be assessed using actual conditions specific to the region of pre-approval, as opposed to relying on generic data.[344] Similarly, the U.S. Coast Guard's ISPR Final Report on the Deepwater Horizon oil spill suggests that Subpart J should require chronic testing, indigenous species testing, or testing of specific oil types with specific dispersants in specific water bodies.[345] The Coast Guard's recommendation is logically sound, but dispersants should also be tested at all depths of the ocean and on a wide enough variety of species to create reliable data on how a dispersant will affect any given species.[346]

Dispersants should also be required to undergo intensive testing in conditions specific to a given Federal Region if the dispersant is to be pre-authorized for use there. Assuming that research on the environmental effects of dispersants will receive a boost after the Deepwater Horizon oil spill, this could be achieved by requiring RRTs to be updated annually or biannually to reflect new science on the use of dispersants.[347] This will also help ensure that that the optimal dispersant policy is achieved in any given year.

Given the significant unknown environmental impacts of dispersants, the United States should also aggressively research the long-term effects of dispersants, both for surface and subsurface applications. This includes synthesizing information on chemical dispersants, which is currently scattered and too technical for policymakers to assess the science

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[342] *Supra* notes 315–341 and accompanying text.

[343] *See infra* notes 344–352 and accompanying text.

[344] George-Ares & Clark, *supra* note 37, at 1007.

[345] U.S. Coast Guard ISPR Team, *supra* note 4, at 41.

[346] *See, e.g.*, Nat'l Comm'n on the BP Deepwater Horizon Oil Spill and Offshore Drilling, *Dispersant Use During the BP Deepwater Horizon Oil Spill*, Encyc. of Earth (Nov. 14, 2010), http://www.eoearth.org/view/article/160620/, *available at* http://perma.cc/09WcdHmKqSG (describing the need for studies about subsurface use of dispersants and the limited scope of dispersant testing on only two species).

[347] This recommendation was included in the Coast Guard's ISPR Final Report. *See* U.S. Coast Guard ISPR Team, *supra* note 4, at 44 ("RRTs need to continually review and update dispersant policies for their area of responsibility (AOR) to ensure they can make informed decisions regarding the pre-authorized use of dispersants.").

fully.[348] If the United States wants to collaborate internationally to collect data on the effects of dispersants, then the Intergovernmental Panel on Climate Change, which collects, analyzes, and synthesis data on climate change, would be a prime model, albeit on a much smaller scale.[349] An international panel on dispersants would also help the United States abide by Article 204 of UNCLOS, which requires States to "observe, measure, evaluate and analyze, by recognized scientific methods, the risks or effects of pollution of the marine environment."[350]

Although allocating government funds for environmental programs is often politically challenging in the United States,[351] the Oil Spill Liability Trust Fund (OSLTF) has already taxed the petroleum industry billions of dollars for a wide variety of uses, including research and development.[352] The OSLTF should increase taxes on the petroleum industry specifically to pay for research on the short-term and long-term environmental effects of dispersants, unless the petroleum industry shows a good faith effort to conduct the research itself.

3. Article 195—Duty Not to Transfer Damage or Hazards or Transform One Type of Pollution into Another

Article 195 of UNCLOS imposes two obligations upon States in "taking measures to prevent, reduce and control pollution of the marine environment": a duty not to "transfer, directly or indirectly, damage or hazards from one area to another," and a duty not to "transform one type of pollution into another."[353] During the Deepwater Horizon oil spill, the United States probably fell short of observing Article 195 of

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[348] *Id.* at 40.

[349] *See Organization*, Intergovernmental Panel on Climate Change, http://www.ipcc.ch/organization/organization.shtml#.UnydCpTF1TQ (last visited Nov. 7, 2013), *available at* http://perma.cc/0b8us5DuKcd (describing the basic functions of the IPCC). A May 2012 report from the U.S. Government Accountability Office stated that "[a]ccording to federal officials, experts, and specialists we spoke with, federal agencies and researchers face resource, scientific, and communication challenges in their attempts to enhance knowledge on chemical dispersant use and its effects." U.S. Gov't Accountability Office, *supra* note 78, at 39.

[350] United Nations Convention on the Law of the Sea, *supra* note 215, art. 204.

[351] *See, e.g.*, Andrew Taylor, *House GOP to Slash Environmental, Arts Funding*, Associated Press (July 22, 2013), http://www.bigstory.ap.org/article/house-gop-slash-environmental-arts-funding, *available at* http://perma.cc/0ohfGcKn3zW (describing a proposal from House Republicans to reduce the EPA budget by one-third, among other cuts).

[352] *"The Restore Act" (H.R. 3096): Relationship to the OSLTF and OPA '90: Hearing Before the House Committee on Transportation and Infrastructure*, 112th Cong. (2011) (testimony of Craig A. Bennett, director of National Pollution Funds Center, that "[t]he current OSLTF balance is approximately $2.3 billion").

[353] *See* United Nations Convention on the Law of the Sea, *supra* note 215, art. 195.

UNCLOS because the U.S. government's authorization of the use of dispersants (1) transferred damage from the ocean surface and shorelines to the water column and deep sea environment, and (2) transformed an oil slick, which is one type of pollution, into a physically distinct oil plume or cloud.[354] Some commentators might interpret Article 195 of UNCLOS in light of Article 192 of UNCLOS, such that the terms of Article 195 would not be breached if the pollution is "transferred" or "transformed" in order to protect and preserve the marine environment, but this section will not focus on such an argument.[355]

i. *"Transfer"*

This subsection addresses the duty under Article 195 of UNCLOS not to "transfer, directly or indirectly, damage or hazards from one area to another" and concludes that the United States probably failed to observe the provision.[356] The ordinary meaning of "transfer" provides strong evidence that the United States did not meet the standards imposed by Article 195.[357] Although the terms "transfer," "damage or hazards," and "transform" are not defined in UNCLOS and do not appear to have been discussed in the record of UNCLOS negotiations,[358] "transfer" within the scope of Article 195 has often been interpreted to imply "physical movement from place to place, including the transfer of alien species."[359] Likewise, Webster's Third International Dictionary defines "transfer" as "to carry or take from one person or place to another."[360]

Based on the ordinary meaning of the term "transfer," the United States likely transferred oil—which is a "damage or hazard" under the plain meaning of those words because dispersants are toxic and have at least some destructive effect on wildlife and marine ecosystems[361]—

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[354] *Infra* notes 355–379 and accompanying text.

[355] *See, e.g.*, *supra* notes 226–230 and accompanying text (discussion of net environmental benefit).

[356] *Infra* notes 358–370 and accompanying text.

[357] *Infra* notes 358–360 and accompanying text.

[358] Center for Oceans Law and Policy, *supra* note 240, at 72.

[359] *Id.*

[360] Webster's Third New International Dictionary 343 (3d ed. 1993). According to Article 31 of the Vienna Convention, which is customary international law, "a treaty shall be interpreted in good faith in accordance with the ordinary meaning." *See* Vienna Convention, *supra* note 226, art. 31. Therefore, dictionaries can be the first place for international scholars to turn when interpreting specific words.

[361] *See supra* notes 353–360 and accompanying text.

from one place to another.[362] Specifically, the use of dispersants "transferred" oil from the surface of the ocean to the subsurface water column.[363] In fact, a major motivation for using dispersants is to shift damage away from surface species, shorelines, and wetlands, where there are many sensitive ecosystems and endangered species.[364] Therefore, transferring oil into the water column is not a mere side effect of the use of dispersants, but rather is one of the primary purposes of dispersants.[365]

Furthermore, under UNCLOS the water column is probably considered a different "area" than the ocean surface and shoreline.[366] The ordinary meaning of "area" is "a section, portion, or part."[367] The water column is likely a different "area" from the water surface because both are distinct zones of the ocean with different marine species, temperatures, habitats, and other features.[368] Even if the water column is not a different "area" than the ocean surface, the water column is certainly a different area than the shore—where a larger amount of oil would have ended up without the use of dispersants.[369] Based on the plain meaning of these words, the United States's authorization of the use of dispersants, by allowing the "transfer" of "damage or hazards" from "one area to another," did not meet the standards of Article 194 of UNCLOS.[370]

ii. *"Transform"*

Article 195 of UNCLOS imposes a duty to enact and enforce laws and regulations to restrict the transformation of one type of pollution

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[362] The use of dispersants led to the transfer of oil from the ocean surface and shorelines to the water column. Nat'l Comm'n on the BP Deepwater Horizon Oil Spill and Offshore Drilling, *supra* note 151, at 143.

[363] *See supra* notes 29–31 and accompanying text.

[364] *See supra* notes 46–50 and accompanying text.

[365] Eur. Mar. Safety Agency, Manual on the Applicability of Oil Spill Dispersants 22 (2009), *available at* http://www.emsa.europa.eu/operations/marine-pollution/87-marine-pollution/719-manual-on-the-applicability-of-oil-spill-dispersants.html and http://perma.cc/0y9yToAWxeN.

[366] *See infra* notes 367–369 and accompanying text.

[367] *Area*, Dictionary.com, http://dictionary.reference.com/browse/area (last visited Jan. 2, 2013), *available at* http://www.perma.cc/0KuLyeXYHNE.

[368] For example, barnacles, limpets, coral, crabs, and lobsters dwell on the bottom of the ocean, whereas kelp and seabirds are on or near the surface of the ocean. *See, e.g.*, David D. Kemp, Exploring Environmental Issues: An Integrated Approach 121 (2004).

[369] Nat'l Comm'n on the BP Deepwater Horizon Oil Spill and Offshore Drilling, *supra* note 151, at 17.

[370] *Supra* notes 356–369 and accompanying text.

into another, but the United States likely did not meet the standards imposed by Article 195.[371] Although UNCLOS does not specifically define "transform," a dictionary can provide the ordinary meaning of the word.[372] Webster's Third New International Dictionary defines "transform" as "to change the outward form or appearance."[373] Likewise, specifically in the context of UNCLOS, "transform" has previously been interpreted to refer to a change in the quality or the nature of the pollution.[374]

Considering the ordinary meaning of "transform," using dispersants probably violates Article 195's prohibition not to "transform one type of pollution into another."[375] The use of dispersants transforms oil from an oil slick into oil droplets, which results in a change of the oil's "outward form or appearance," or quality and nature.[376] An oil slick is a mass of floating oil, primarily on the surface of the water, but dispersed oil droplets are akin to a cloud of small milky particles.[377] These droplets are different in size, buoyancy, and mass and can include the added properties of dispersants.[378] Therefore, based on the ordinary meaning of "transform," the use of dispersants to transform an oil slick into a cloud of oil droplets does not meet the standards of UNCLOS Article 195.[379]

iii. *Scope of Article 195*

The legislative history of UNCLOS offers further support that dispersants used to mitigate the effects of ocean pollution fall within the scope of Article 195.[380] Currently, Article 195 imposes a duty on a State to take "measures to prevent, reduce, and control pollution of the marine environment . . . ."[381] The drafting history of UNCLOS shows that

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[371] *Infra* notes 372–378 and accompanying text.

[372] *See* Vienna Convention, *supra* note 226, art. 31.

[373] *Transform*, Webster's Third New International Dictionary, http://www.merriam-websterunabridged.com (last visited Jan. 4, 2014) (search for "transform" from search box on main page).

[374] Center for Oceans Law and Policy, *supra* note 240, at 72. This interpretation is similar to the Webster's dictionary definition.

[375] *Supra* notes 376–378 and accompanying text.

[376] Nat'l Comm'n on the BP Deepwater Horizon Oil Spill and Offshore Drilling, *supra* note 3, at 143.

[377] *See supra* notes 29–31 and accompanying text.

[378] *See supra* notes 28–31 and accompanying text.

[379] *See infra* notes 372–378 and accompanying text.

[380] The preparatory work of a treaty may serve as a tool of interpretation for ambiguous language. *See* Vienna Convention, *supra* note 226, art. 31.

[381] United Nations Convention on the Law of the Sea, *supra* note 215, art. 195.

the scope of Article 195 was expanded from only including measures to "prevent" pollution to measures to "prevent and control pollution," then finally measures to "prevent, reduce, and control pollution."[382] The previous language notably does not require taking measures to "reduce" pollution of the marine environment, which is now included in Article 195.[383] The change in language shows that the drafters of UNCLOS intended the scope of Article 195 to include mechanisms that were meant to reduce pollution. The primary purpose of dispersants in response to oil spills is to reduce pollution.[384] Therefore, the use of dispersants likely falls within the scope of Article 195 of UNCLOS.

iv. *Recommendations for Observance of UNCLOS*

The United States, by failing to enact and enforce sufficient laws and regulations, has permitted the use of dispersants to "transfer" damage or hazards from one area of the ocean to another and "transform" one type of pollution into another.[385] The terms of Article 195 seem to require that pollution not be transferred or transformed in an attempt "reduce" pollution of the marine environment.[386] Furthermore, the fact that the Deepwater Horizon oil spill occurred in the Gulf of Mexico, and not in international waters, does not mean that the United States can ignore UNCLOS, because Part XII of UNCLOS is not limited to international waters.[387] Therefore, abiding by Article 195 of UN-

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[382] *See* Center for Oceans Law and Policy, *supra* note 240, at 71.

[383] *Id.*

[384] *See, e.g.*, Nat'l Acad. of Sci., Oil Spill Dispersants: Efficacy and Effects 1 (2010), *available at* http://dels.nas.edu/resources/static-assets/materials-based-on-reports/special-products/oil_spill_dispersants_key_findings_final.pdf.

[385] *Supra* notes 386–389 and accompanying text.

[386] *See supra* notes 353–354 and accompanying text.

[387] *See* Van Dyke, *supra* note 7, at 3 ("The 'marine environment' is a purposively comprehensive concept covering all aspects of the ocean world—the water itself, its resources, the air above, and the seabed below—and it covers all jurisdictional zones—internal waters, territorial seas, contiguous zones, exclusive economic zones (EEZs), continental shelves, archipelagic waters, and the high seas."). Further support exists in the wording of UNCLOS, which states that "pollution of the marine environment" includes estuaries, which, being where a river or stream meets the ocean, is by necessity within a state's internal or territorial waters. *See* United Nations Convention on the Law of the Sea, *supra* note 215, art. 1(4); *Estuaries*, Nat'l Ocean and Atmospheric Admin, http://oceanservice.noaa.gov/education/kits/estuaries/estuaries01_whatis.html (last visited Nov. 16, 2013), *available at* http://perma.cc/QC5C-MLH6. Similar support exists in UNCLOS Article 194(3), which lists "land-based activities" as a potential source of pollution from which a state has an obligation to prevent damage. *See* United Nations Convention on the Law of the Sea, *supra* note 215, art. 194(3).

CLOS could require the United States to make the use of dispersants illegal if the effect of such chemicals continues to be merely transferring pollution into the water column in the form of an oil plume.[388] In such a scenario, the United States would need to continue development of alternate oil spill cleanup methods, such as in-situ burning and mechanical recovery of oil.

Another argument is that oil spill dispersants should be used even if they transfer or transform the pollution if a net environmental benefit would result. If this argument prevails, the United States should establish a regulatory review process that only allows the use of dispersants when such a net environmental benefit can be proven by the highest scientific standards. More generally, at the very least the United States should continue to study the effects of oil plumes.[389]

IV. Looking Ahead: Using Genetically Engineered Microorganisms to Clean Up Spills

Hopefully the Deepwater Horizon oil spill will not repeat itself, but a significant chance exists that another massive oil spill will pollute America's waters in the future. Such a scenario would once again raise difficult questions regarding proper methods for oil spill cleanup. One potential method is to use genetically engineered microorganisms (GEMs) that are custom-designed to clean up oil spills, either in the form of biosurfactants or oil-eating microorganisms.[390]

Scientists have already developed GEMs to use during oil spills.[391] Although none of these organisms have been used yet in the marine

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[388] If customary international law indeed has the status of federal law and is enforceable in courts, Congress would be prudent to pass specific laws that codify the customary international law reflected in UNCLOS in a way that bolsters environmental protection regarding dispersant use under the NCP. *See* William S. Dodge, *Customary International Law and the Question of Legitimacy*, 120 Harv. L. Rev. F. 19, 20 (2007) (arguing that the Supreme Court endorsed the view that customary international law is enforceable by the courts without executive or congressional endorsement). Current opinion is that U.S. laws that are contrary to customary international law are controlling. *See* Michael John Garcia, Congressional Research Service, International Law and Agreements: Their Effect upon U.S. Law 7 (Mar. 1, 2013), *available at* http://www.fas.org/sgp/crs/misc/RL32528.pdf and http://perma.cc/0oUQ5WkbCPE. Nevertheless, courts have long held that the U.S. Constitution does not authorize the federal government to violate customary international law. *See* Michael P. Socarras, *International Law and the Constitution*, 4 Fed. Courts L. Rev. 185, 240–41 (2011).

[389] *See* Nat'l Comm'n on the BP Deepwater Horizon Oil Spill and Offshore Drilling, *supra* note 3, at 271; *supra* note 81 and accompanying text.

[390] *Infra* notes 403–409 and accompanying text.

[391] The first patent for a living organism, granted in 1981, was for a microorganism—the bacterium Pseudomonas—bioengineered to break down crude oil more effectively. In

environment, this technology might come under consideration for future use.[392] This part first discusses the risks of releasing GEMs, including the potential for a global catastrophe.[393] This part then explores whether the United States's laws meet the standards established by UNCLOS as that treaty pertains to the release of GEMs into the marine environment.[394]

A. *Introduction to Genetic Engineering*

Genetic engineering is the engineering of living organisms to create new characteristics.[395] Essentially, biotechnologists are able to select useful bits of genetic code from two or more organisms and synthesize them into a new organism with certain desired traits.[396] Genetic engineering traditionally uses "recombinant DNA" techniques by stitching together existing strands of DNA to create new organisms.[397] More recently, scientists have made great strides in the field of synthetic biology—the engineering of organisms with DNA that is chemically synthesized (or "printed") from a computer—which allows greater flexibility to customize the traits of genetically engineered microorganisms.[398]

Diamond v. Chakrabarty, 447 U.S. 303 (1980), the Supreme Court upheld the patentability of a human-made microorganism by a 5–4 decision. The Court indicated that there is no constitutional prohibition on patenting life, and that an organism can be patented if it falls within the statutory requirements. *See id.* at 309–10.

[392] One of the only known field releases of a bioengineered organism was a strain *pseudomonas fluorescens*, released into a contained soil environment. *See* Gary S. Sayler & Steven Ripp, *Field Applications of Genetically Engineered Microorganisms for Bioremediation Processes*, 11 Current Opinion in Biotechnology 286, 286 (2000).

[393] *Infra* notes 395–417 and accompanying text.

[394] *Infra* notes 418–438 and accompanying text.

[395] *USAID Fact Sheet Outlines Agricultural Biotechnology Basics*, IIP Digital, U.S. State Dep't (June 17, 2004), http://iipdigital.usembassy.gov/st/english/article/2004/06/20040617104427akllennoccm0.6702539.html#axzz2kaOKUNWf, *available at* http://perma.cc/0c1UzHEic7m.

[396] *What Is Synthetic Biology?*, Synthetic Biology Project, http://www.synbioproject.org/topics/synbio101/definition (last visited Oct. 22, 2013), *available at* http://www.perma.cc/0fMVuVJ9v6i.

[397] Sarah Morgan et al., Biomanufacturing: A State of the Technology Review 15 (2003), *available at* http://www.che.ncsu.edu/academics/concentrations/documents/Biomanufacturing-AStateofTechRev.pdf and http://www.perma.cc/0W9NKqU3QyZ.

[398] *See First Self-Replicating Synthetic Bacterial Cell*, J. Craig Venter Institute, http://www.jcvi.org/cms/research/projects/first-self-replicating-synthetic-bacterial-cell/faq#q3 (last visited Oct. 22, 2013), *available at* http://www.perma.cc/0hWiFxFoFFu.

Extreme forms of synthetic biology can involve the creation of life essentially from scratch.[399]

The technology behind genetic engineering is rapidly advancing.[400] Traditionally, genetic engineering is perhaps best known for altering the genetic makeup of crops to increase drought resilience, add more nutrients, bolster pest resistance, or create other beneficial attributes.[401] Genetic engineering can also be used to create new viruses, disease-curing microorganisms, animals with novel biological makeups, and, as discussed below, microorganisms to clean up oil spills.[402]

B. *GEMs and Oil Spills*

GEMs could be used to clean up oil spills in two ways—as biosurfactants (Corexit is a chemical, rather than biological, surfactant) or as a method of bioremediation.[403] First, a dispersant made of biosurfactants uses biological microorganisms rather than an oil-based formula to disperse oil sheens into droplets that microorganisms can consume more easily.[404] Currently, biosurfactants are generally not as cost-effective as oil-based surfactants, though some scientists assert that a bioengineered surfactant would be able to do a superior job of dispersing oil spills—and without the toxicity that is inherent to an oil-based formula.[405]

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[399] Denise Caruso, *Synthetic Biology: An Overview and Recommendations for Anticipating and Addressing Emerging Risk*, Sci. Progress (Nov. 12, 2008), http://www.scienceprogress.org/2008/11/synthetic-biology, *available at* http://perma.cc/0J74R9ytDAf.

[400] *See, e.g.*, Jabar Zaman Khan Khattak et al., *Recent Advances in Genetic Engineering: A Review*, 4(1) Current Res. J. of Biological Sci. 82, 82–89 (2012), *available at* http://maxwellsci.com/print/crjbs/v4-82-89.pdf and http://perma.cc/0rG3J7sn55u.

[401] John N. Shaw, *Should We Care About Genetically Modified Foods?*, Food Safety News (Feb. 1, 2010), http://www.foodsafetynews.com/2010/02/should-we-care-about-genetically-modified-foods/#.Un-wF43VKix, *available at* http://perma.cc/0QXxDECU18R.

[402] *See, e.g.*, Khattak et al., *supra* note 400, at 82–89.

[403] Palashpriya Das et al., *Genetic Regulations of the Biosynthesis of Microbial Surfactants: An Overview*, 25 Biotechnology & Genetic Engineering Rev. 165, 165–66 (2008), *available at* http://www.nottingham.ac.uk/ncmh/BGER/pdf/volume_25/08-Das.pdf and http://perma.cc/075n5GMdx8X (describing genetically engineered surfactants); Nilanjana Das & Preethy Chandran, *Microbial Degradation of Petroleum Hydrocarbon Contaminants: An Overview*, Biotechnology Res. Int'l (2011), http://www.hindawi.com/journals/btri/2011/941810, *available at* http://perma.cc/0PnufeizBZ1 (describing genetically modified bacteria for bioremediation use).

[404] J. Liu& C. Vipulanandan, Oil Spill Remediation by Using UH-Biosurfactant 1 (2010), *available at* http://hurricane.egr.uh.edu/sites/hurricane.egr.uh.edu/files/files/jia.pdf and http://perma.cc/0HoYoF6us4f.

[405] Paul Voosen, *Scientists Brew 'Green' Dispersants in Gulf Spill's Wake,* N.Y. Times (Apr. 20, 2011), http://www.nytimes.com/gwire/2011/04/20/20greenwire-scientists-brew-green- dispersants-in-gulf-spil-37018.html?pagewanted=all, *available at* http://perma.cc/0ZvHDx2mxmq.

Second, a GEM could be used in bioremediation efforts during an oil spill.[406] Bioremediation is defined as the "use of microorganisms to accelerate the degradation of oil or other environmental contaminants."[407] Natural communities of microorganisms already consume oil and eventually release carbon dioxide and water.[408] Scientists would seek to improve these biodegrading abilities through genetic engineering.[409] The costs and difficulties associated with cleaning toxic waste sites make bioremediation a potentially attractive technology.[410] Currently, GEMs are no more superior at breaking down oil than their natural counterparts, but progress in genetic engineering technologies and an increased understanding of how microorganisms consume pollution will likely drive advancement in this field.[411]

C. *GEMs and the Deepwater Horizon Oil Spill*

GEMs became a significant topic of conversation during the Deepwater Horizon oil spill.[412] Some people speculated that British Petroleum (BP) might have even secretly deployed GEMs to help clean up the spill.[413] Such people have cited mysterious rashes and other skin conditions, and dubbed the resulting human and environmental health

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[406] Christine Dümmer & David J. Bjornstad, Joint Institute for Energy and Environment, Regulatory Policy Toward Organisms Produced Through Biotechnology: Evolution of the Framework and Relevance for DOE's Bioremediation Program 1 (2004), *available at* http://isse.utk.edu/pdf/jieepubs/2003-04bio.pdf and http://perma.cc/07VpGNmrdx7.

[407] U.S. Congress Office of Technology Assessment, Bioremediation for Marine Oil Spills 1 (1991), *available at* http://govinfo.library.unt.edu/ota/Ota_2/DATA/1991/9109.PDF and http://perma.cc/8HH6-5DXL.

[408] *Microbes & Oil Spills FAQ,* Am. Acad. of Microbiology 1 (2011), *available at* http://www.dfo-mpo.gc.ca/science/publications/microbes/pdf/microbes-eng.pdf and http://perma.cc/9D6V-C9M7.

[409] Shweta Kulshreshtha, *Genetically Engineered Microorganisms: A Problem Solving Approach for Bioremediation*, 4(4) J. Bioremediation & Biodegradation 1, 1–2 (2013), *available at* http://www.omicsonline.org/genetically-engineered-microorganisms-a-problem-solving-approach-for-bioremediation-2155-6199.1000e133.pdf and http://perma.cc/0A1HMFkk5hh.

[410] *See* A.A. Snow et al., *Genetically Engineered Organisms and the Environment: Current Status and Recommendations,* 15(2) Ecological Applications 377, 385 (2005).

[411] *See, e.g.*, Derek R. Lovley, *Cleaning Up with Genomics: Applying Molecular Biology to Bioremediation,* 1 Nature Rev. 35, 35–44 (2003), *available at* https://geobacter.org/publication-files/ Lovley35.pdf and http://www.perma.cc/0zzRbe7qNdJ.

[412] *Infra* notes 413–415 and accompanying text.

[413] *See generally* Michael Edward, *The Perfect Genetic Storm—Synthetic DNA and the Gulf Blue Plague,* Gulf Blue Plague (Jan. 11, 2011), http://worldvisionportal.org/wordpress/index.php/2011/01/the-perfect-genetic-storm and http://www.perma.cc/0x4FfTTTsQG.

effects as the "Blue Plague."[414] Even major environmentalists showed some concern: A consortium of 154 environmental groups requested information from the EPA that lists, *inter alia,* "any natural and/or bio-engineered bacteria . . . used in response to the BP spill."[415] No substantial evidence was ever established to prove that BP used GEMs, though, and until shown otherwise, a safe assumption is that BP did not use GEMs. Still, during the Deepwater Horizon oil spill, a Columbia University chemical engineer delivered a presentation to the U.S. government on GEMs in the context of oil spill cleanup,[416] and the National Science Foundation has since provided money to develop a genetically engineered dispersant called "FA-Glu."[417]

D. *Potential Danger of GEMs*

This section presents a brief overview of the potential short-term and long-term risks to human and environmental health presented by the release of GEMs into the marine environment, including the risk of a global catastrophe.[418] A global catastrophic risk (GCR) is a risk that has a potential to significantly harm humans on a global scale, regardless of probability.[419] Examples of GCRs include emerging technologies such as biological engineering, artificial intelligence, advanced nanotechnologies, climate change, financial collapse, government failure, natural and artificial diseases outbreak, and nuclear war.[420] While many GCRs have an extremely low probability of occurrence,[421] the consequences of a global catastrophe would be so severe that humanity should take great caution not to let such a catastrophe occur. Some

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[414] *See id.*

[415] *Louisiana Senate Panel OKs Ban on Gulf Oil Spill Dispersants,* Associated Press (May 31, 2011), http://www.nola.com/news/gulf-oil-spill/index.ssf/2011/05/louisiana_senate_panel_oks_ban.html, *available at* http://www.perma.cc/06uU2sKwz7g; Deborah Dupre, *154 Groups Demand Aid for Gulf BP-Gov't Oil Disaster Health Crisis,* Hum. Rts. Exam'r (May 25, 2011), http://www.examiner.com/article/154-groups-demand-aid-for-gulf-bp-gov-t-oil-disaster-health-crisis.

[416] Voosen, *supra* note 405.

[417] *See id.*

[418] *Infra* notes 419–438 and accompanying text.

[419] Seth D. Baum et al., *Double Catastrophe: Intermittent Stratospheric Geoengineering Induced by Societal Collapse,* 33(1) Env't Systems and Decisions 168, 168–70 (2013), *available at* http://sethbaum.com/ac/2013_DoubleCatastrophe.pdf and http://perma.cc/9HSA-XB42.

[420] *See Research,* Global Catastrophic Risk Inst., http://gcrinstitute.org/research (last visited Jan. 3, 2014).

[421] *See generally* Toby Ord et al., *Probing the Improbable: Methodological Challenges for Risks with Low Probabilities and High Stakes,* 13(2) J. of Risk Res. 191 (2010), *available at* http://www.amirrorclear.net/academic/papers/risk.pdf and http://perma.cc/9TFC-HB4R (commenting on low-probability, high-stakes risk analysis).

forms of biotechnology, such as genetically engineered viruses, currently present a GCR.[422]

In the short term, some commentators argue that a "highly modified" GEM probably would not survive in the marine environment at all, though a microorganism that is merely tweaked could have a better chance at survival.[423] Other commentators argue that genetic engineering could increase a microorganism's competitive advantage, and that the microorganism could then spread across vast distances by sea current,[424] for example, which could disrupt the ecosystem. Some existing microorganisms also present health risks; for example, *dinoflagellate* has spread across the globe and caused paralytic shellfish poisoning, an ailment that can cause death in extreme cases.[425] GEMs could have similar or worse effects.[426] Despite these risks, there does not appear to be evidence that GEMs in the ocean environment pose a GCR to humanity in the short term.

The long-term risks from GEMs are potentially much greater.[427] One potential negative effect is that a GEM could outcompete its natural counterparts,[428] which could have a long-term cascading effect on the ecosystem. This risk is compounded by the fact that if a GEM can survive in the marine environment, the GEM might become impossible

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[422] Seth Baum & Grant Wilson, *The Ethics of Global Catastrophic Risk from Dual-Use Bioengineering*, Ethics in Biology, Engineering and Med. (forthcoming) (manuscript at 6), *available at* http://sethbaum.com/ac/fc_BioengineeringGCR.pdf and http://perma.cc/0ihem8RPJT4.

[423] *See* Michele S. Garfinkel et al., *Synthetic Biology*, *in* From Birth to Death and Bench to Clinic: The Hastings Center Bioethics Briefing Book for Journalists, Policymakers, and Campaigns 163–67 (2008), *available at* http://www.thehastingscenter.org/uploadedFiles/Publications/Briefing_Book/synthetic%20biology%20chapter.pdf and http://perma.cc/JQ9F-BKJS.

[424] Raymond A. Zilinskas & Peter J. Balint, Genetically Engineered Marine Organisms: Environmental and Economic Risks 117 (1998).

[425] Sabitiyu Abosede Lawal, Ballast Water Management Convention, 2004: Towards Combating Unintentional Transfer of Harmful Aquatic Organisms and Pathogens 33–35 (Aug. 2011) (Master of Laws thesis, Dalhousie University), *available at* http://goo.gl/2EircP and http://perma.cc/C85G-YDNV.

[426] *See, e.g.*, Gary Marchant, *Modified Rules for Modified Bugs: Balancing Safety and Efficiency in the Regulation of Deliberate Release of Genetically Engineered Microorganisms*, 1 Harv. J. of L. & Tech. 163, 207 (1988).

[427] *Infra* notes 428–438 and accompanying text.

[428] Mae-Wan Ho & Ricarda A. Steinbrecher, *Fatal Flaws in Food Safety Assessment: Critique of the Joint FAO/WHO Biotechnology and Food Safety Report, Part 7.4*, Physicians and Scientists for Responsible Application of Sci. and Tech., http://www.psrast.org/fao96.htm (last visited Jan. 3, 2014), *available at* http://perma.cc/LL6W-G5H9 ("Individual strains of genetically engineered microorganisms . . . can survive and out-compete wild-type strains.").

to eradicate.[429] Studies have shown that the ability of genetically engineered bacteria to survive in marine environments is at least equivalent to many naturally occurring species.[430] A GEM could also transfer "nonessential but highly selectable traits" such as "antibiotic resistance, pathogenicity, and enzymes to metabolize new resources" to a natural microorganism via horizontal gene transfer.[431] Such a process could have harmful effects on the marine environment and could be pathogenic to humans or marine organisms,[432] though not much is known regarding the extent to which synthetic genomes can be transferred.

So-called "biological containment" methods exist, including kill-switches and engineering organisms so that they can't transfer genes,[433] but such biological containment methods are not effective in every single bacterium out of billions.[434] While layering several such safeguards on top of one another could provide additional protection, such a method is not a guaranteed mode of safety.[435] Overall, the long-term effects of releasing a GEM into the marine environment are extremely difficult to gauge.[436] Because some commentators argue that there is a potential for a catastrophic effect on the marine environment,[437] which could also have harmful effects on humanity, great caution should be used before releasing a GEM into the marine environment.[438]

E. *UNCLOS and GEMs*

GEMs used during oil spills present a threat of significant environmental harm,[439] so determining the obligations that UNCLOS could

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[429] *See* Marchant, *supra* note 426, at 193 n.192.

[430] Zilinskas & Balint, *supra* note 424, at 119.

[431] Snow et. al, *supra* note 410, at 390.

[432] Zilinskas & Balint, *supra* note 424, at 119.

[433] Gerd H.G. Moe-Behrens et al., *Preparing Synthetic Biology for the World*, 4 Frontiers in Microbiology 1, 1–10 (2013), *available at* http://europepmc.org/articles/PMC3554958 and http://perma.cc/0DKYx2XJv1Z.

[434] Zilinskas & Balint, *supra* note 424, at 117–18.

[435] *Id.*

[436] Garfinkel, *supra* note 423, at 163–67.

[437] Sheldon Krimsky, *Risk Assessment of Genetically Engineered Microorganisms: From Genetic Reductionism to Ecological Modeling*, *in* Coping with Deliberate Release: The Limits of Risk Assessment 36–37 (Ad Van Dommelen ed., 1996), *available at* http://www.tufts.edu/~skrimsky/PDF/Risk%20Assessment%20GEMs.PDF and http://perma.cc/6LH6-JWKL.

[438] *See, e.g.*, Jonathan B. Tucker & Raymond A. Zilinskas, *The Promise and Perils of Synthetic Biology*, New Atlantis, Spring 2006, at 34, *available at* http://www.thenewatlantis.com/docLib/TNA12-TuckerZilinskas.pdf and http://perma.cc/YMM7-EEYG ("Given these uncertainties, it would be prudent to adopt the 'precautionary principle' and treat synthetic microorganisms as dangerous until proven harmless.").

[439] *See supra* notes 418–438 and accompanying text.

impose upon the United States as customary international law is prudent, even if this biotechnology is nowhere close to being used in the field. As discussed below, the primary obligation arising from UNCLOS for the release of GEMs into the marine environment comes from Article 196, which, in pertinent part, regulates the introduction of "alien or new" species.[440] Applying Article 194 to GEMs probably does not add any additional insights beyond the dispersant framework discussed above.[441] Therefore, the United States regulatory scheme that applies to GEMs should meet the basic obligations arising from Article 196.

1. Article 196 of UNCLOS

Article 196 of UNCLOS establishes a duty of States to take "all measures necessary to prevent, reduce and control pollution of the marine environment resulting from . . . the intentional or accidental introduction of species, alien or new, to a particular part of the marine environment, which may cause significant and harmful changes thereto."[442]

i. *"Alien" Species*

Although UNCLOS does not define the term "alien," this word's ordinary meaning[443] is "a species occurring outside its normal distribution" or "any species that enters an ecosystem beyond its historic range."[444] Therefore, a GEM is "alien" if it is a modified version of an organism that is outside of its natural range in the area in question.[445] On the other hand, a GEM that is a slightly modified version of a microorganism *within* its historic range might not be "alien."[446]

ii. *"New" Species*

Under UNCLOS, a "new" species probably includes a GEM.[447] Although UNCLOS does not define "new," Webster's Third New International Dictionary defines "new" as "being other than the former or old: having freshly come into a relation (as use, connection, or func-

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[440] *See* United Nations Convention on the Law of the Sea, *supra* note 215, art. 196(1).

[441] *See id.* art. 194.

[442] *See id.* art. 196.

[443] *See* Vienna Convention, *supra* note 226, art. 31.

[444] *See* Peter Ehlers et al., Marine Issues: From a Scientific, Political and Legal Perspective 246 (2002).

[445] *See id.*

[446] *See id.*

[447] *See infra* notes 448–454 and accompanying text.

tion),"[448] whereas the Concise Oxford English Dictionary defines "new" as "not existing before, made, introduced or discovered recently."[449] In the context of species, these definitions imply that a "new" species is one that has never existed before, which would include a species created through genetic engineering techniques.[450] On the other hand, this interpretation is still slightly ambiguous because a species that is merely genetically tweaked may have "existed before," albeit in a slightly different form.[451]

More evidence of the meaning of "new" organisms can be found by looking at the drafting history of UNCLOS.[452] A representative from Norway who introduced a proposal that was the basis of Article 196 explained that the Article covered "the introduction of living organisms not previously existing in the seas or by the transfer of a form of marine life to an area where the implications of its existence were unknown."[453] Under this explanation, a GEM would likely be considered to have never previously existed in the seas, though this notion is ambiguous as applied to organisms with slight genetic alterations.[454]

iii. *"All Measures Necessary"*

First, the modifier "all" means that a State must take *every* possible measure, "both technical and legal," to achieve the purpose of Article 196.[455] Second, use of the strict term "necessary" rather than a looser term such as "appropriate" (which is used elsewhere in UNCLOS) indicates that the measures to be taken to protect the environment from

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[448] *New*, Webster's Third New International Dictionary, http://www.merriam-websterunabridged.com (last visited Jan. 4, 2014) (search for "new" from search box on main page).

[449] Oxford American Dictionary & Thesaurus 868 (2nd ed. 2009).

[450] *See id.*; *New*, *supra* note 448.

[451] Recombinant DNA techniques may cause mutagenesis ("changes in specific locations or regions of a gene to produce a new gene product"), alter a gene's expression, select new gene locations or regions, or make other changes. *See* U.N. Food and Agric. Org., Biosafety Resources Book 4 (2011), *available at* http://www.fao.org/docrep/014/i1905e/i1905e.pdf and http://perma.cc/0VH9DYAnEyT. Synthetic microorganisms are less likely to have "existed before" because they are synthesized essentially from scratch. *See* Charles W. Schmidt, *Synthetic Biology: Environmental Health Implications of a New Field*, 118(3) Envtl. Health Persp. 118, 120 (2010), *available at* http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2854787 and http://perma.cc/0prttG4gEdu.

[452] If a treaty's terms appear ambiguous, the treaty's preparatory work may serve as a supplementary means of interpretation. *See* Vienna Convention, *supra* note 226, art. 32.

[453] Center for Oceans Law and Policy, *supra* note 240, at 76.

[454] *See id.*

[455] *See, e.g.*, Meng Qing-nan, Land Based Marine Pollution: International Law Development 115 (1987) (providing an analysis of Article 7 of the Abidjan Convention).

alien or new species should not be influenced or diluted by non-environmental concerns (such as money or convenience).[456] Nonetheless, the phrase "all measures necessary" is inherently open to multiple interpretations, and UNCLOS does not elaborate upon what this provision means in practice, which makes Article 196 difficult to enforce.[457]

iv. *"Prevent, Reduce, or Control"*

The phrase "prevent, reduce, or control" is somewhat ambiguous but seems to indicate that failing to prevent the introduction of an alien or new species into the marine environment is not a per se violation of Article 196, so long as sufficient preventative measures are taken.[458] Because Article 196 applies to measures taken to prevent the spread of invasive species from ballast water, this looser language also concedes that stopping the spread of all alien or new organisms is nearly impossible.[459]

v. *"May"*

The term "may" ("control pollution . . . resulting from . . . species, alien or new . . . which *may* cause significant and harmful changes") "emphasizes the need to take action where a material risk is indicated."[460] In other words, deliberate action must be taken to protect the marine environment from *possible* but unproven risks from alien or new species.

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[456] A treaty should be interpreted according to its ordinary meaning in context. *See* Vienna Convention, *supra* note 226, art. 31.

[457] *See* Suzanne Bostrom, *Halting the Hitchhikers: Challenges and Opportunities for Controlling Ballast Water Discharges and Aquatic Invasive Species,* 39 Envtl. L. 867, 880–81 (2009).

[458] *See* United Nations Convention on the Law of the Sea, *supra* note 215, art. 196.

[459] *Id.* For a description of the challenges of preventing the spread of invasive species from ballast water, see Christopher F. Deacutis and Richard C. Ribb, Narragansett Bay Estuary Program, Ballast Water and Introduced Species: Management Options for Narragansett Bay and Rhode Island 1 (2002), *available at* http://www.nbep.org/publications/other/ballast/BallWaterIntroSpeciesRpt.pdf and http://perma.cc/0ainNK1LeEi. "The scientific consensus is that current ballast water exchange protocols, while a helpful preventative measure, are not a completely effective method of reducing the risk of introduced species." *Id.*

[460] Meinhard Doelle et al., *Invasive Seaweeds: Global and Regional Law and Policy Reponses, in* Seaweed Invasions: A Synthesis of Ecological, Economic and Legal Imperatives 120 (Craig R. Johnson ed., 2008).

vi. *"Significant and Harmful"*

Finally, a violation of Article 196 constitutes actual or potential changes of the marine environment that are "significant and harmful."[461] The phrase "significant and harmful" is inherently subjective, and UNCLOS does not define these terms. Nonetheless, "harmful" changes to the environment can be understood to be those that cause environmental health hazards, impair biological diversity, and cause other types of environmental degradation.[462] Furthermore, "significant" changes to the environment include changes that meet a minimum threshold of severity and are more than "negligible," "appreciable," or "nominal."[463]

2. U.S. Law and Regulations Pertaining to the Release of GEMs into the Marine Environment

The United States regulates GEMs under the Coordinated Framework for Regulation of Biotechnology ("Coordinated Framework").[464] The Coordinated Framework divides regulatory duties regarding genetic engineering among various agencies based on their traditional duties, with each agency promulgating new biotechnology regulations.[465] The EPA covers bioengineered microbial pesticides and microorganisms, the U.S. Department of Agriculture's Animal and Plant Health Inspection Service (APHIS) covers plant pests, and the U.S. Food and Drug Administration (FDA) covers food products.[466] Because releasing a GEM into the marine environment seems generally unrelated to food

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[461] *See* United Nations Convention on the Law of the Sea, *supra* note 215, art. 196(1).

[462] *See, e.g.*, International Convention for the Control and Management of Ships' Ballast Water and Sediments art. 1(8), adopted Feb. 13, 2004 (not yet in force) (defining "Harmful Aquatic Organisms and Pathogens" as entities that "may create hazards to the environment, human health, property or resources, impair biological diversity or interfere with other legitimate uses of such areas"), *available at* http://goo.gl/Je5GHm and http://perma.cc/0AcK2qVnLt9.

[463] *See* Karen Hulme, War Torn Environment: Interpreting the Legal Threshold 36 (2004).

[464] Sheldon Krimsky & Roger Paul Wrubel, Biotechnology and the Environment 249 (1996).

[465] *See Biotechnology*, U.S. Dep't of Agric., http://www.aphis.usda.gov/biotechnology/framework_roles.shtml (last visited Nov. 10, 2013), *available at* http://perma.cc/0a4VEYZTQTb.

[466] Presidential Comm'n on the Study of Bioethical Issues, New Directions: The Ethics of Synthetic Biology and Emerging Technologies 97–100 (2010), *available at* http://bioethics.gov/sites/default/files/PCSBI-Synthetic-Biology-Report-12.16.10.pdf and http://perma.cc/08b7ERMSS3E.

products, this subsection discusses only certain EPA and APHIS regulations and omits FDA regulations.[467]

i. *Toxic Substances Control Act*

The Toxic Substances Control Act regulates certain chemical substances and/or mixtures by means of reporting, record keeping, testing, and permitting requirements.[468] Per the Coordinated Framework, in 1997 the EPA promulgated a regulation that interpreted the phrase "chemical substances" to apply to "new chemical substances" and "biotechnology products."[469] While some substances such as foods, drugs, and pesticides are excluded from TSCA, GEMs to be used in an oil spill fall within the statute's scope.[470] Therefore, TSCA imposes various requirements upon an actor who wishes to release a GEM into the marine environment.[471]

Foremost, TSCA requires manufacturers of chemical substances for commercial purposes—including substances used for the breakdown of pollutants—to submit their products for EPA review via a microbial commercial activity notice.[472] The EPA then conducts a risk assessment.[473] A GEM can receive pre-market approval unless the EPA finds within ninety days that there is an unreasonable risk of adverse effects on human health or the environment.[474] Otherwise, the EPA takes the necessary actions to regulate any unreasonable risks.[475]

TSCA does not define "unreasonable risk," but based on the statute's legislative history, the EPA's risk assessment determines whether a substance presents an unreasonable risk to human health or the environment by weighing the probability, magnitude, and severity of harm

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[467] *Supra* notes 464–466 and accompanying text.

[468] 15 U.S.C. § 2601 (2006 & Supp. 2010).

[469] 62 C.F.R. § 17910 (1997).

[470] *See* 15 U.S.C. § 2602(2)(B) (2012).

[471] *See, e.g.*, Presidential Comm'n on the Study of Bioethical Issues, *supra* note 466, at 92–94.

[472] 40 C.F.R. § 725.105 (1997).

[473] *Making a Finding on Unreasonableness of Risk*, Envtl. Prot. Agency, http://www.epa.gov/oppt/newchems/pubs/unrerisk.htm (last updated Apr. 3, 2013), *available at* http://perma.cc/0a78whFEhLh ("In considering risk, EPA considers factors including environmental effects, distribution, and fate of the chemical substance in the environment, disposal methods, waste water treatment, use of protective equipment and engineering controls, use patterns, and market potential of the chemical substance.").

[474] *See* Richard A. Denison, *Ten Essential Elements in TSCA Reform*, 39 Envtl. L. Rep. 10020, 10020–21 (2009), *available at* http://www.edf.org/sites/default/files/9279_Denison_10_Elements_TSCA_Reform_0.pdf and http://perma.cc/0k3PtxUMiPD.

[475] *See id.* at 10024.

to humans and the environment against the substance's societal benefits.[476] Such social benefits include economic considerations and the availability of alternatives.[477] If the EPA determines there is an "unreasonable risk" to human health or the environment, then the agency may take regulatory risk management actions to eliminate the unreasonable risk, which could include varying levels of restrictions or a total ban.[478]

There are several elements of TSCA that fall below the standards of Article 196 of UNCLOS.[479] One major problem is that TSCA places the burden on the EPA to prove that a substance poses an unreasonable risk of adverse effects on the environment.[480] The EPA must also show that the actions it takes under TSCA are the least burdensome option, which, according to the EPA, makes the EPA less likely to ban or restrict substances under TSCA.[481] To abide by UNCLOS, TSCA should require the proponent of a GEM to prove its long-term and short-term safety, both to the environment and human health. Likewise, proponents of releasing a GEM into the marine environment should have to address potential worst-case scenarios, including the possibility of a global catastrophe.

Article 196 of UNCLOS requires a State to sufficiently protect the marine environment from GEMs that "*may* cause significant and harmful changes."[482] As discussed above, GEMs released into the marine environment pose significant ecological risks, as well as some danger to humans, and therefore almost certainly *may* cause significant and harmful changes to the marine environment.[483] Therefore, for TSCA to comply with UNCLOS, the statute might need to prohibit the release of GEMs into the marine environment until they have been proven safe.

Another problem is the discretionary nature of TSCA. On one hand, if the EPA definitively finds that there is an unreasonable risk of

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[476] *Making a Finding on Unreasonableness of Risk, supra* note 473.

[477] U.S. General Accounting Office, Toxic Substances Control Act—Legislative Changes Could Make the Act More Effective 20–21 (1994), *available at* http://archive.gao.gov/t2pbat2/152799.pdf and http://www.perma.cc/0KU7gnELzhG.

[478] *See* 15 U.S.C. § 2605(a)(1)–(2) (2006); *see also* Corrosion Proof Fittings v. Envtl Prot. Agency, 947 F.2d 1201, 1215 (5th Cir. 1991) (describing the duty of the EPA to pick the least burdensome measure to eliminate an "unreasonable risk").

[479] *Infra* notes 480–492 and accompanying text.

[480] One researcher called this burden an "impossibly high" standard and argued that the EPA must prove a chemical's environmental risks "beyond all reasonable doubt." *See* Denison, *supra* note 474, at 10020–21.

[481] *Id.*

[482] United Nations Convention on the Law of the Sea, *supra* note 215, art. 196(1).

[483] *Supra* notes 418–438 and accompanying text.

harm to human health or the environment, then it *must* take regulatory measures to address these concerns.[484] If, however there is insufficient information for the EPA to conduct a reasoned health and environmental impact evaluation, which in turn *could* result in an "unreasonable risk of harm," then the EPA "may" prohibit or limit the manufacture, processing, distribution in commerce, use, or disposal of the substance.[485] In other words, EPA action is discretionary for unproven risks.[486] Article 196 of UNCLOS requires a state to protect the marine environment from GEMs that "*may* cause significant and harmful changes,"[487] which would seem to *require* the EPA to prohibit or limit a substance with unproven, but possible, risks of significant and harmful changes to the marine environment.

One final problem is that TSCA allows for the consideration of non-environmental factors when determining whether an unreasonable risk to human health or the environment exists.[488] For example, the EPA could determine that the societal benefits of releasing a bioengineered microorganism into the marine environment outweigh the probability and magnitude of harm to human health and the environment *despite* there being a risk of "significant and harmful changes" to the marine environment.[489] This is noncompliant with UNCLOS, which requires "all measures *necessary*" (rather than appropriate or socially beneficial) to protect the environment from alien or new species.[490] To comply with Article 196, TSCA probably should require at least a checklist of detailed, stringent, and mandatory regulatory environmental guidelines to direct decision-making,[491] in addition to specific rules about how to "evaluate or reduce" risks arising from GEMs,[492] without consideration of societal benefits such as economic considerations and availability of alternatives.

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[484] *See* 15 U.S.C. § 2605(a) (2006).

[485] *Id.* § 2604(e)(1).

[486] *Id.*

[487] United Nations Convention on the Law of the Sea, *supra* note 215, art. 196(1).

[488] *See Corrosion Proof Fittings*, 947 F.2d at 1215 (describing the EPA's required consideration of environmental, economic, and social impacts of its actions under TSCA).

[489] *See* Denison, *supra* note 474, at 10021–22.

[490] *See* United Nations Convention on the Law of the Sea, *supra* note 215, art. 196(1).

[491] *See* U.S. General Accounting Office, *supra* note 477, at 15–21.

[492] Mary Jane Angelo, *Regulating Evolution for Sale: An Evolutionary Biology Model for Regulating the Unnatural Selection of Genetically Modified Organisms,* 42 Wake Forest L. Rev. 93, 131 (2007) (noting that the EPA has yet to promulgate regulations to evaluate or reduce risks from intergenic microorganisms).

ii. *Plant Protection Act Regulations*

Under the Plant Protection Act, APHIS in the U.S. Department of Agriculture[493] regulates the introduction of genetically engineered organisms—plants, insects, and microorganisms—that are "plant pests or are believed to be plant pests."[494] APHIS established the Biotechnology Regulatory Services program in 2002 to focus on its biotechnology regulatory functions.[495] In turn, "introduction" includes the "importation, interstate movement, and release into the environment" of a genetically engineered organism.[496] A person who seeks to introduce what is, or is believed to be, a plant pest typically must apply for a permit from APHIS.[497]

GEMs released into the marine environment to clean up an oil spill would fall under the scope of APHIS regulations if they pose a risk to plant health, in which case they would require an APHIS permit.[498] To obtain an APHIS permit, applicants must send a detailed application to the Biotechnology Permits unit of Biotechnology, Biologics, and Environmental Protection, which reviews data about the actual and potential dangers of the organism to plants, explores potential alternatives, and discusses the need for the bioengineered organism.[499] If APHIS concludes that there is a significant impact on the environment, then it must take the procedural step of preparing an environmental impact statement.[500] Finally, when APHIS grants a permit, it may include safety conditions to reduce the risk of harm to plant health.[501]

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[493] 7 C.F.R. § 340.0 (2013).

[494] *Id.* § 340.1.

[495] *History of APHIS*, Animal and Plant Health Inspection Service, http://www.aphis.usda.gov/about_aphis (last visited Oct. 22, 2013), *available at* http://www.perma.cc/02KLKBPHA6R.

[496] *See Biotechnology*, Animal and Plant Health Inspection Service, http://www.aphis.usda.gov/biotechnology (last visited Nov. 16, 2013), *available at* http://www.perma.cc/0zTK7fQMFun.

[497] *See* 7 C.F.R § 340.0.

[498] *See Biotechnology* , *supra* note 496. Although "notifications" are a streamlined version of the APHIS permit, they are available to bioengineered plants, not microorganisms. U.S. Dep't of Agric., USDA-APHIS Biotechnology Regulatory Services User Guide: Notification 4–5 (2010), *available at* http://www.aphis.usda.gov/biotechnology/downloads/notification_guidance_0810.pdf and http://perma.cc/KM9E-CHHW.

[499] *See generally Regulation of Genetically Engineered Organisms and Products*, Biotechnology Information Series (Jan. 1995), http://www.biotech.iastate.edu/biotech_info_series/bio11.html, *available at* http://www.perma.cc/0wXwtva4hWX.

[500] *See* 42 U.S.C. § 4332(2)(c) (2006); *see also* Pew Initiative on Food and Biotechnology, Issues in the Regulation of Genetically Engineered Plants and Animals 33 (2004), *available at* http://goo.gl/kta076 and http://www.perma.cc/0cMGJb6RQwx

One problem with using APHIS to regulate GEMs is that the scope of APHIS is limited to agriculture, with a goal of curbing the spread of plant pests.[502] As a general rule, under the Coordinated Framework, APHIS generally regulates genetically engineered plants, while the EPA regulates GEMs, pesticides, and other life forms.[503] One critique of the Coordinated Framework is that APHIS, pursuant to the Farmland Protection Policy Act, is directed merely to "assess and manage plant pests" (organisms that harm plants)[504] rather than also consider larger risks to human health or the environment, regardless of the consequences for plants. Therefore, APHIS could potentially approve the release of a GEM into the environment if APHIS does not perceive an actual or potential plant pest—even if the GEM poses major risks to human and environmental health, such as virulence.[505] This situation appears to contradict UNCLOS Article 196's mandate to sufficiently protect the marine environment from a GEM that *may* cause significant and harmful changes.[506] One potential improvement would be to expand the scope of "plant pest" to include organisms that not only pose risks to plant health but also to human and environmental health.

Another problem is that the general standard that APHIS uses to determine whether a GEM is a "plant pest" is whether the "donor, recipient, vector, or vector agent" involved in genetic engineering is itself a plant pest.[507] APHIS can regulate genetically engineered organisms if it has "reason to believe" the organisms are a plant pest, regardless of whether the organism contains plant pest genetics.[508] But APHIS needs a "reasonable basis" for believing the organism to be a plant pest, and "[i]t is unclear how difficult it would be for APHIS to meet this standard."[509] In practice, APHIS has found that many genetically engineered

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(describing the duty of APHIS to conduct an EIS for major federal actions significantly affecting the quality of the human environment).

[501] U.S. Dep't of Agric., APHIS and Biotechnology 8 (2012), *available at* http://www.aphis.usda.gov/publications/biotechnology/content/printable_version/BRS_Bro_FApdf and http://perma.cc/6VJV-Z8W3.

[502] *See Biotechnology*, *supra* note 496 ("APHIS regulates certain [genetically engineered] organisms that may pose a risk to plant or animal health . . . . APHIS participates in programs that use biotechnology to . . . control plant and animal pests.").

[503] Pew Initiative on Food and Biotechnology, *supra* note 500, at 9.

[504] *Id*. at 49–50.

[505] *See* Karen Goldman Herman, *Issues in the Regulation of Bioengineered Food*, 7 High Tech. L.J. 107, 126–27 (1992).

[506] *See* United Nations Convention on the Law of the Sea, *supra* note 215, art. 196.

[507] 7 C.F.R. § 340.1 (2013); *see also* Pew Initiative on Food and Biotechnology, *supra* note 500, at 49.

[508] 7 C.F.R. § 340.1.

[509] Pew Initiative on Food and Biotechnology, *supra* note 500, at 49.

plants are *not* "plant pests."[510] To take "all measures necessary" to protect the marine environment from significant and harmful changes from alien species, APHIS should include *all* GEMs as "plant pests" rather than just those that have plant pest DNA. Furthermore, considering the unknown but potentially massive risks posed by the release of GEMs into the marine environment, including the irreversibility of releasing such organisms, APHIS permit applicants should have to demonstrate that the microorganisms will *not* cause significant and harmful changes to the environment nor will they cause a global catastrophe.[511]

iii. *National Institute of Health Guidelines for Research Involving Recombinant DNA Molecules*

The National Institute of Health Guidelines for Research Involving Recombinant DNA Molecules ("NIH Guidelines") specify practices for constructing and handling recombinant deoxyribonucleic acid (DNA) molecules and organisms, and viruses containing recombinant DNA molecules.[512] Although the NIH Guidelines are important to consider for researchers working with recombinant DNA, they are outside the scope of the analysis in this Article for several reasons. First, the NIH Guidelines only apply to recombinant DNA research that receives NIH funding, whereas abiding by Article 196 of UNCLOS would require measures that apply to all actors handling GEMs.[513] Furthermore, the NIH Guidelines apply to the research stage of genetic engineering, whereas this analysis is focused on the later field release stage.

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[510] *Id.*

[511] Zilinskas & Balint, *supra* note 424, at 117 (discussing how genetically engineered marine microorganisms are likely to escape test sites). A needed improvement is to expand the scope of "plant pest" to include any organisms that not only pose risks to plant health, but risks to human and environmental health as well. The Plant Protection Act now contains a broader definition for "noxious weed" that includes plant or plant products that "directly or indirectly injure or cause damage to . . . the public health [or] the environment . . . ." *See* 7 U.S.C. § 7702 (2006). Updating the scope of "plant pest" is likewise feasible. *See id.*

[512] Office of Biotechnology Activities; Recombinant DNA Research: Action Under the NIH Guidelines for Research Involving Recombinant DNA Molecules (NIH Guidelines), 76 Fed. Reg. 62,816, § 1-A (Oct. 11, 2011).

[513] *See NIH Guidelines for Research Involving Recombinant DNA Molecules: Summary of Experiments Covered,* U. of Florida Envtl. Health and Safety, http://www.ehs.ufl.edu/programs/bio/ibc/nih_guide (June 13, 2012), *available at* http://www.perma.cc/0V96xKo48N2.

3. Conclusion of UNCLOS and GEMs Under Article 196

With genetic engineering techniques becoming increasingly sophisticated, and with oil and gas development expanding into the Arctic and other regions, development of bioengineered organisms that serve as both dispersants and as oil-eating bacteria will continue.[514] To comply with Article 196 of UNCLOS as customary international law, U.S. laws and regulations should be modernized in acknowledgment of the reality that GEMs pose unknown and potentially dangerous effects on the marine environment and human health.[515]

Furthermore, lawmakers should consider clarifying the duties of the various agencies involved in the Coordinated Framework so that the agencies do not have overlapping responsibilities.[516] In the alternative, lawmakers should consider creating a new legal regime crafted specifically for GEMs. Finally, the United States should take additional actions to bolster biosafety and biosecurity pertaining to GEMs to ensure that GEMs do not enter the environment outside of the regulatory requirements of the Coordinated Framework. Such measures could include "genetic features" to minimize chances of an undesired proliferation of GEMs, increased environmental risk assessment, ensuring there is adequate research on risks before a large-scale release, train professionals to minimize risk, and other measures.[517]

One major factor driving the development of GEMs is the large influx of research and development money.[518] For example, biologist Craig Venter struck a $300 million deal with Exxon Mobil to develop bioengineered algae that digests carbon dioxide and creates oil.[519] BP similarly contracted Venter's Synthetic Genomics to develop a GEM designed to recover more hydrocarbon from well sites.[520] The value of this deal, however, had not been disclosed on Synthetic Genomics's

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[514] Eur. Mar. Safety Agency, *supra* note 365, at 20 (describing expanding oil exploration in the Arctic); *see also infra* notes 518–524 and accompanying text (investments in genetically engineered microorganisms).

[515] *See supra* notes 419–513 and accompanying text.

[516] *See* Pew Initiative on Food and Biotechnology, *supra* note 500, at 10.

[517] Snow et al., *supra* note 410.

[518] See *infra* notes 519–524 and accompanying text.

[519] David Biello, *Can Algae Feed the World and Fuel the Planet? A Q&A with Craig Venter,* Sci. Am. (Nov. 15, 2011), http://www.scientificamerican.com/article.cfm?id=can-algae-feed-the-world-and-fuel-the-planet, *available at* http://www.perma.cc/09MDjEibBDH.

[520] *Hydrocarbon Recovery & Conversion,* Synthetic Genomics, http://www.syntheticgenomics. com/what/hydrocarbonrecovery.html (last visited Nov. 10, 2013), *available at* http://www.perma.cc/0x65JazUDxc.

website as of late 2013.[521] Although much of the influx in money has gone toward bioengineered algae research, gas and oil companies face massive financial consequences from environmental disasters.[522] BP, for example, reached a deal to settle a class action lawsuit by businesses and individuals affected by the Deepwater Horizon oil spill for $7.8 billion, in addition to criminal penalties.[523] Therefore, a strong financial incentive exists to develop GEMs that can effectively clean up oil spills.[524] Because market pressure will likely exist to continue the development of these microorganisms, their risks should be considered now rather than later.

Conclusion

By authorizing the broad use of dispersants in the Deepwater Horizon oil spill, the United States likely did not meet the standards represented in Article 194 and Article 195 of the United Nations Convention on the Law of the Sea (UNCLOS). Regarding Article 194, the United States failed to take "all measures . . . necessary" using the "best practical means" to prevent, reduce, and control "pollution of the marine environment . . . ." Fulfilling the obligation of Article 194 relative to dispersants is possible only if the authorization of such chemicals results in a net environmental benefit, and if the dispersants are the optimal dispersants available. Furthermore, in "taking measures to prevent, reduce and control pollution of the marine environment," the United States fell short of Article 195 because it transferred "damage or hazards from one area into another" and transformed "one type of pollution into another" through its use of dispersants. This Article recommends that the United States take certain measures to update the National Contingency Plan, considering the known and unknown environmental risks posed by dispersants.

Additionally, looking ahead to the potential use of genetically engineered microorganisms in the ocean environment to clean up oil

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[521] *Id.*

[522] For example, BP set aside $42 billion to cover potential costs for the Deepwater Horizon oil spill, and BP stated that it spent $25 billion as of July 2013. Murrey Jacobson, *By the Numbers: The Oil Spill and BP's Legal Troubles*, PBS News Hour (July 9, 2013), http://www.pbs.org/newshour/rundown/2013/07/gulf-oil-spill-by-the-numbers.html, *available at*http://perma.cc/0pukvAvFUXk.

[523] *Judge OKs Settlement in BP Class-Action Suit,* CNN (Dec. 22, 2012), http://www.cnn.com/2012/12/22/us/bp-spill-settlement/index.html, *available at* http://www.perma.cc/0EK4URxYhox.

[524] *See id.*

spills, this Article concludes that the U.S. government has not taken sufficient measures to meet the standards presented in UNCLOS Article 196, which requires States to "take all measures necessary to prevent, reduce and control . . . the intentional or accidental introduction of species, alien or new . . . which may cause significant and harmful changes [to the marine environment]." This Article recommends that the United States update the Coordinated Framework to reduce broad agency discretion and economic considerations regarding the EPA, and a focus on plant health regarding the Department of Agriculture's Animal and Plant Health Inspection Service.

Why did the United States authorize British Petroleum to use a dispersant with unknown effects that could damage the ocean for decades? Perhaps because oil slicks drift upon the ocean surface and onto public beaches and wetlands in clear view, but dispersed oil plumes creep around the depths of the ocean, where they are difficult to locate and monitor. Whatever the underlying purpose for authorizing the use of more than 1.7 million gallons of Corexit in the Gulf of Mexico, the laws and regulations that authorize the use of dispersants should be reformed with environmental protection in mind.

Likewise, the stakes are increasing dramatically as the United States develops new, potentially dangerous technologies such as bioengineered biosurfactants and bacteria designed to consume oil more efficiently. These technologies have unknown consequences and could wreak havoc on the environment and, perhaps in the long-term, even cause a global catastrophe. The United States must soon come to terms with the vast risks presented by its massive fossil fuel dependence and the methods used to clean up associated environmental disasters.