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National Commission on the BP Deepwater Horizon Oil Spill and Offshore Drilling

RESPONSE/CLEAN-UP TECHNOLOGY RESEARCH & DEVELOPMENT AND THE BP DEEPWATER HORIZON OIL SPILL

Staff Working Paper No. 7

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Of the many themes to arise in discussion of the Deepwater Horizon oil spill, one of the most pervasive has been that the spill response floundered because advances in clean-up technology had not kept pace with advances in exploration technology.[1] As this narrative goes, over the last two decades, industry pushed the frontier of deepwater drilling so far that commentators have "compared the drive into ever-deeper waters to deep space exploration."[2] Clean-up technology, on the other hand, "has progressed so little that the biggest advancement in the Gulf of Mexico disaster — at least in the public's mind — is an oil-water separator based on a 17-year-old patent and promoted by the movie star Kevin Costner."[3] Although, by many accounts, technology "advanced a decade in the four months" of the response to the spill,[4] existing response equipment was not up to the challenge of such a large spill. "I don't think any of us looks at this and says this is an acceptable response," Shell Oil President Marvin Odum said during the summer of 2010.[5]

Spill clean-up technology has made incremental improvements since 1990. For example, the University of California Santa Barbara has developed a skimmer with novel surface geometry and drum rotation that increases recovery for spills, particularly on broken ice.[6] Some other advances in skimming technology — such as high volume skimmers, portable skimmers, and shallow draft skimmers — were put to use during the spill response.[7] Today's boom can operate effectively in faster currents,[8] and dispersants are less toxic than they once were.[9] Information technology and how responders collect and use data — *e.g.*, remote sensing and

[1] Professor Tyler Priest of the University of Houston (a consultant to the Commission) has argued that this "theme" is not unique to offshore drilling or even the oil business in general but is "common to all technologically innovative societies." Tyler Priest, *The Ties That Bind MMS and Big Oil*, Politico (June 9, 2010).
[2] Jad Mouawad & Barry Meier, *Risk-Taking Rises to New Levels as Oil Rigs in Gulf Drill Deeper*, N.Y. Times (Aug. 30, 2010).
[3] Henry Fountain, *Advances in Oil Spill Cleanup Lag Since Valdez*, N.Y. Times (June 24, 2010).
[4] Interview by Commission Staff with Oil Company Executive.
[5] Steven Mufson, *Concerns About the Big Spill Might Already be Drying Up*, Wash. Post (Sept. 30, 2010).
[6] Victoria Broje & Arturo A. Keller, *Improved Mechanical Oil Spill Recovery Using an Optimized Geometry for the Skimmer Surface*, 40 Envtl. Sci. & Tech. 7914, 7914 (Oct. 26, 2006) ("The study showed that using the new surface pattern in the recovery unit can increase the skimmer oil recovery efficiency up to three times.").
[7] *See* E-mail from Dave Salt, Oil Spill Response Limited, to Commission Staff (Oct. 21, 2010) (on file with Commission staff).
[8] API, Recommendations of the Joint Industry Oil Spill Preparedness & Response Task Force V-9 (Sept. 3, 2010) [hereinafter API Report].
[9] R.R. Lessard & G. Demarco, *The Significance of Oil Spill Dispersants*, 6 Spill Sci. & Tech. Bull. 59, 62-63 (2000).

tracking techniques — have also improved.[10] Progress has, however, been modest. Neither boom design and construction,[11] nor the "principles behind skimming systems,"[12] nor the "basics of mechanical recovery systems," have significantly changed.[13]

This staff working paper discusses why a chasm between exploration technology and response technology has developed. Specifically, in the three sections below, this paper attempts to answer three basic questions:

(1) Does the private sector invest less than the socially optimal amount in response/clean-up technology?

(2) Do federal agencies lack adequate long-term funding to maintain response/clean-up preparedness?

(3) Can the federal government and industry create a set of incentives for private companies and government agencies that would optimize levels of investment in response/clean-up technology?

In addressing these questions, we have focused our analysis on response or clean-up technology — not to be confused with containment or well-control technology, which is the subject of separate work for the Commission.[14] We have also incorporated ideas discussed more fully in other work by the Commission and its staff. The response research and development ("R&D") funding gap is a multi-disciplinary problem: Its causes are disparate, and possible solutions are rooted in a number of different legal and policy contexts (for example, appropriations, insurance, and tax incentives).

What follows is the Commission staff's effort to summarize the state of private sector and federal government response R&D.[15] We believe the facts illustrate that neither industry nor government has dedicated appropriate resources to clean-up technology since the *Exxon Valdez* spill, and that the Deepwater Horizon spill response suffered as a result. With the proper combination of dedicated funding and creative incentives, however, Commission staff believes that the existing technology gap could begin to close.

[10] *See generally* API Report, Chapter II.
[11] *See id*. at V-3; *see also* Interview by Commission Staff with Louisiana Government Official.
[12] *See* API Report at V-5; *see also* Louisiana Government Official Interview.
[13] *See* API Report at v.
[14] On Wednesday, July 21, 2010, Exxon Mobil, Chevron, Shell, and ConocoPhillips announced the creation of the Marine Well Containment Company, a non-profit joint venture "to design, build and operate a rapid-response system to capture and contain" future oil spills in the Gulf of Mexico. Angel Gonzalez, *Oil Firms Plan Rapid-Response Force*, Wall St. J. (July 22, 2010).
[15] Certain states, including Alaska, California, Louisiana, and Texas, have funded oil spill R&D projects. Texas, in particular, has allocated approximately $1.25 million per year to oil spill R&D since 1992. *See* Telephone Interview by Commission Staff with Dr. Buzz Martin, Texas General Land Office (Dec. 30, 2010).

I. Private Sector Response R&D: Little to No Funding

According to news reports as well as experts interviewed by staff, the oil industry committed significant funds to clean-up technology R&D in the years immediately following the *Exxon Valdez* spill, but this commitment quickly waned.[16] Industry funding for response R&D fell off after the mid-1990s. Today, oil companies invest "little to no" money in oil spill response technology.[17]

The limited industry data available to Commission staff supports this narrative. As discussed in Part A below, information provided to the staff by five major oil companies suggests that — at least today — industry spends little to no money on in-house response R&D efforts. As discussed in Part B, industry does support independent Oil Spill Removal Organizations (OSROs), but these underfunded organizations similarly allocate little to no resources toward response R&D.

A. In-House R&D Funding

Because data on response R&D spending by the oil industry is not publicly available, the Commission staff requested historical (*i.e.*, since 1990) and current response R&D figures from ExxonMobil, Shell, ConocoPhillips, Chevron, and BP.[18] What follows is a summary of the responses we received:

- ExxonMobil: "ExxonMobil R&D investments impacting oil spill response containment and clean-up technology were about $60 million over the past 20 years (1990-2009)." ExxonMobil went on to cite its participation in "cooperative" research efforts "by a variety of government agencies, academic institutions, and industrial [sic] participants since 1989 to improve upon existing technologies and response options."[19]

- Shell: "Our estimate, based on input from Shell experts, is that Shell spends about an average of $5 million annually on spill research." Shell went on to cite its participation in, and funding for, OSROs like the Marine Spill Response Corporation (MSRC) and Alaska Clean Seas, trade associations like the American Petroleum Institute (API), and government/university partnerships like the Coastal Response Research Center.[20] Shell's

[16] *See, e.g.*, Fountain, *Advances in Oil Spill Cleanup Lag Since Valdez* ("And research money from oil companies has declined in the same period."); Telephone Interview by Commission Staff with Oil Industry Consultant ("Money dried up after *Exxon Valdez*.").
[17] Julie Schmit, *Despite Previous Spill, Oil Cleanup Research Falls Short*, USA Today (May 24, 2010) ("And oil companies have invested 'little to no' money on oil spill response technologies, concentrating instead on oil exploration and spill prevention, says Robert Peterson, a consultant to the oil and gas industry at Charles River Associates."). Robert Peterson (a consultant to BP) reiterated this same "little to no funding" language in an August 30, 2010 telephone interview with Commission staff.
[18] API did not respond to requests for cumulative industry response R&D funding figures. As for API's own funding for response R&D, reports suggest that "API doesn't have a budget for oil spill response research, but it puts on a spill response conference." Schmit, *Despite Previous Spill, Oil Cleanup Research Falls Short*.
[19] E-mail from Theresa M. Fariello, ExxonMobil, to Commission Staff (Sept. 21, 2010) (on file with Commission staff).
[20] E-mail from Sara Glenn, Shell, to Commission Staff (Sept. 10, 2010) (on file with Commission staff).

$5 million annual estimate includes its funding for OSROs, trade associations, and other organizations that conduct R&D.[21]

- ConocoPhillips: "Our expenditures on spill response technologies are not reported separately in our financial reports. However, in the Gulf of Mexico, we are a member company of Clean Gulf Associates and Marine Response Spill Corporation. We are also a member of the Ohmsett facility in New Jersey (National Oil Spill Response Research and Renewable Energy Test Facility), which provides full-scale oil spill response equipment testing, research and training. Our Alaska Business Unit has abundant spill response equipment through Alaska Clean Seas, and we recently participated in oil-under-ice method testing through a joint industry project at a cost of $1.2 million. Through our participation in industry groups such as API Emergency Preparedness & Response Committee, IPIEA Industry Technical Advisory Committee and Arctic Task Force, as well as our cooperatives, we continuously evaluate new technologies and equipment that maximize recovery and minimize waste creation during spill response."[22]

- Chevron: "In general, Chevron does not conduct independent research on spill response technologies specifically, but we do have a financial and manpower involvement in oil spill cooperatives or for profit response companies."[23]

- BP: "[T]he company does not separately account for various types of R&D spending. BP's worldwide R&D expenditures are spread across various business units and are embedded in operational budgets. Further, BP's amounts spent on R&D activities take many forms, including alliances with universities and participation in R&D consortia with industry partners."[24]

Based on these responses, it is difficult to pinpoint what resources, if any, these five major oil companies have allocated to in-house response R&D over the last two decades. ExxonMobil claims to have spent an average of $3 million annually on "oil spill response containment and clean-up technology," but this estimate lumps in containment technology spending with response R&D spending, and may include ExxonMobil's expenditures on OSROs and other outside entities, too. Shell estimated its annual "oil spill response" expenditures to be $5 million, but this line item includes Shell's expenditures on OSROs, trade associations, and other organizations. Responses from ConocoPhillips and Chevron confirm that those two companies spent no money on developing spill clean-up technology in-house, and BP's response does not indicate whether it spends any money on clean-up technology. Based on the available

[21] E-mail from Sara Glenn, Shell, to Commission Staff (Oct. 20, 2010) (on file with Commission staff).
[22] E-mail from Jim Ford, ConocoPhillips, to Commission Staff (Sept. 14, 2010) (on file with Commission staff).
[23] E-mail from Lisa Barry, Chevron, to Commission Staff (Sept. 3, 2010) (on file with Commission staff).
[24] E-mail from Daniel Squire, WilmerHale, to Commission Staff (Nov. 18, 2010) (on file with Commission staff). *See* John Flesher & Phuong Lee, *Little Spent on Spill Cleanup Technology*, Associated Press (June 26, 2010) ("[S]pokesman Robert Wine said BP does not research oil spill cleanup technology. Instead, he said BP supports oil spill response organizations, such as the nonprofit Marine Spill Response Corp.").

information, we believe it is fair to assume that industry spending on in-house response R&D has been, and is currently, minimal at best.[25]

B. Oil Spill Removal Organizations: R&D Not a Priority

Although ExxonMobil, Shell, ConocoPhillips, Chevron, and BP do not seem to have allocated significant (if any) resources to in-house response R&D, these companies have all cited their participation in, or funding for, OSROs and non-profit organizations as evidence of their commitment to response R&D.[26] We briefly describe below the three most prominent non-profit OSROs, including MSRC — the self-proclaimed "nation's largest oil spill recovery organization"[27] — as well as the largest for-profit OSRO. Our analysis shows that the OSROs all operate on a limited scale, and with a small amount of funding. Response R&D is not a priority for any of the OSROs.

i. Marine Spill Response Corporation

ExxonMobil, Shell, ConocoPhillips, Chevron, BP, and over 100 other oil companies are members of MSRC, a non-profit created by industry after the *Exxon Valdez* disaster to respond to oil spills, including catastrophic ones. MSRC is a subsidiary of the Marine Preservation Association (MPA).[28] By joining MPA, a company gains the right to enter into a service agreement with MSRC. A member company individually pays for MSRC's cleanup costs in the event of a spill for which the company is responsible. Member companies pay dues to MPA generally in proportion to the amount of oil received via marine transportation and produced in U.S. waters. MPA, in turn, funds MSRC, which today has about 400 employees and owns fifteen specialty ships, each 210 feet long with temporary storage for 4,000 barrels of recovered oil.[29]

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[25] Although it is difficult to find an appropriate metric to put industry in-house response R&D funding levels in the proper context, note that ConocoPhillips's total R&D expense in 2009 alone was $190 million, Chevron spent $603 million in 2009 on R&D, and ExxonMobil spent $1.05 billion. Chevron Corporation, Annual Report (Form 10-K), at 29 (Feb. 19, 2010); ConocoPhillips, Annual Report (Form 10-K), at 130 (Jan. 31, 2010); ExxonMobil Corporation, Annual Report (Form 10-K), at 41 (June 30, 2009).

[26] Section 4202 of the Oil Pollution Act of 1990 requires the preparation and submission of response plans by the owners or operators of certain oil-handling facilities and for all vessels defined as "tank vessels" under 46 U.S.C. § 2101. An owner or operator of such a facility or tank vessel is required to submit a response plan that, among other things, identifies and ensures by contract or other means the availability of private personnel and equipment necessary to remove, to the maximum extent practicable, a worst case discharge, and to mitigate or prevent a substantial threat of such a discharge. The Coast Guard created the voluntary OSRO classification program so that facility and tank vessel response plan holders could list OSROs in response plans in lieu of providing extensive detailed lists of response resources if "the organization has been classified by the Coast Guard and their capacity has been determined to equal or exceed the response capability needed by" the plan-holder. 33 C.F.R. § 154.1035(e)(3)(iii).

[27] Joe Stephens & Mary Pat Flaherty, *Oil Industry Cleanup Organization Swamped by BP Spill*, Wash. Post (June 29, 2010).

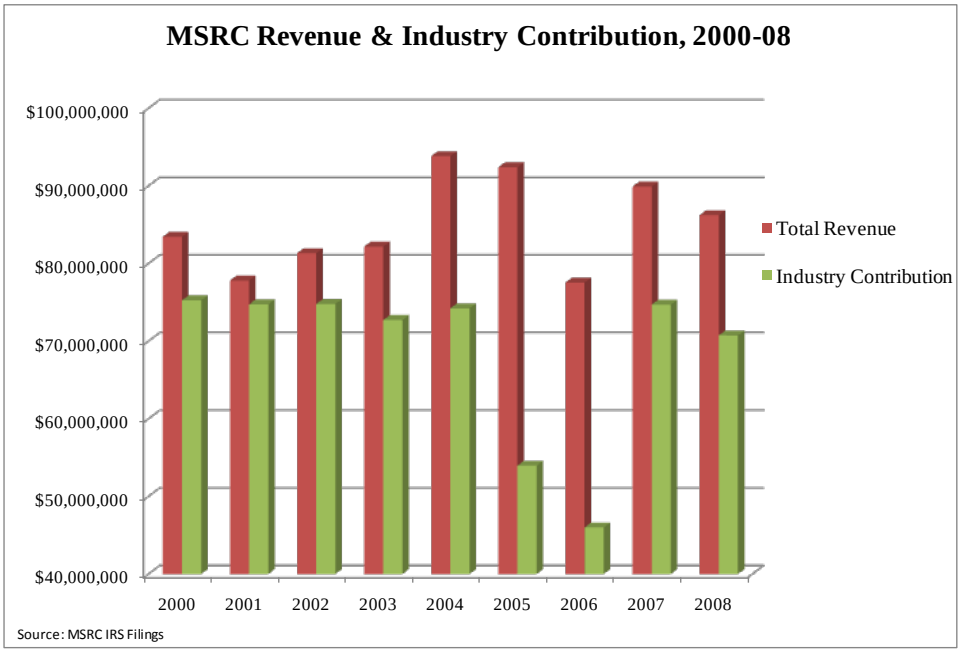
[28] "The structure was designed to shield oil companies from liability, in case MSRC was later found responsible for damages related to a skimming operation, according to official accounts at both organizations." *Id*.

[29] *Id*. In comments to the Commission staff following the original release of this paper, MPA stated that "MSRC also owns nineteen oil spill response barges with storage capacities between 12,000 and 68,000 barrels, sixty-eight shallow water barges, 600,000 feet of boom, over 240 skimming systems, six smaller self-propelled skimming vessels, seven mobile communication suites outfitted with the latest technology, has access to four contractually

The primary source of funding for MSRC has always been direct industry contributions.[30] ConocoPhillips's and Chevron's individual contributions to MSRC, for example, are approximately $13 million annually.[31] Each year, CEO Steve Benz requests a budget for MSRC from the board of MPA, which is largely composed of representatives from MPA's member companies. According to Mr. Benz, roughly 80% of MSRC's annual budget is derived from the five largest oil companies, 18% comes from medium-sized or independent companies, and vessel and pipeline owners and operators account for the final 2%.[32]

Upon its formation in 1990, MSRC obtained $30 to $35 million for a five-year R&D program, but "[a]t the end of its five-year program, MSRC eliminated its Research & Development program as its objectives had been achieved."[33] Today, as Mr. Benz told the Commission staff, MSRC has "no budget for research."[34]

Publicly available financial records show that, from 2000 to 2008 (the last date for which information is available), MSRC's "total revenue" (*i.e.*, direct member contributions plus revenue generated from spill response activities) held constant at roughly $80 to $90 million per year.[35]



dedicated aircraft for aerial dispersant application — two C-130s and two King Air BE-90s — and the largest stockpile of dispersant inventory in North America."

[30] *See* Marine Spill Response Corporation, Internal Revenue Service: Forms 990, 2000-08 [hereinafter MSRC Forms 990].

[31] E-mail from Jim Ford, ConocoPhillips, to Commission Staff (Oct. 8, 2010) (on file with Commission staff); E-mail from Rob Walker, Chevron, to Commission Staff (Sept. 7, 2010) (on file with Commission staff).

[32] Interview by Commission Staff with Steve Benz and Judith Roos, Marine Spill Response Corporation (Sept. 7, 2010) [hereinafter MSRC Interview].

[33] API Report at VIII-3.

[34] MSRC Interview; Schmit, *Despite Previous Spill, Oil Cleanup Research Falls Short* (quoting MSRC Marketing, Customer Services & Corporate Relations Manager Judith Roos).

[35] MSRC Forms 990.

During this same period, the "industry contributions" component of MSRC's total revenue averaged $70 to $75 million annually, or roughly 80% of MSRC's total revenue (except in 2005 and 2006).[36] According to Mr. Benz — who has been CEO since 1995 — MSRC's member companies (which comprise the MPA board) have never attempted to cut its funding. Mr. Benz told Commission staff, however, that he is always careful to propose a budget that will be "reasonable" to the industry[37] — that is, not to ask for too much.

Publicly available financial information confirms that the level of funding from industry is insufficient for MSRC to purchase cutting-edge equipment or grow its asset base. MSRC began operations in 1990 with capital equipment valued at approximately $325 million;[38] by 2008 its asset value had declined in a near straight line to $113 million.[39] The company has not made substantial investments in new spill response equipment. With aging ships, boom, and skimmers, MSRC would seem to require *significantly* increasing contributions from its membership base both to maintain its existing level of readiness and to innovate or grow.

According to Mr. Benz, MSRC performed well with the equipment it had during the spill response, collecting "well over half" of the oily water recovered offshore by all responders.[40] By most accounts, however, MSRC was ill-prepared to handle the scale of the Deepwater Horizon disaster. Much of the MSRC's equipment was not "up to the current challenge."[41] MSRC may have adequate resources to handle smaller spills, but it did not have the assets needed to respond to a Spill of National Significance.

In short, MSRC is underfunded. Its equipment is static; it has limited resources to purchase new equipment, and no resources to develop technologies. MSRC contributed to the spill response efforts, but it has not grown into the evergreen response organization it was designed to be. Industry has provided only the support necessary for MSRC to maintain its status quo, with no funds for research into or development of improved spill response technology.

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[36] *Id*. In comments to the Commission staff following the original release of this paper, MPA stated: "MPA as the funding entity collects member dues in excess of amounts provided to MSRC as a mechanism for setting aside reserve funds for the express purpose of reinvesting in new response equipment . . . . Thus, member contributions have in fact increased over time."

[37] MSRC Interview.

[38] *See* API Report at VIII-3.

[39] MSRC Forms 990. MSRC has undertaken one capital reinvestment program, and is in the midst of a second. In the early 2000s, the company spent $25 million on equipment updates. In 2009, it began a "comprehensive plan for capital investment" to spend another $25 million on updates over five years. *See* MSRC Interview.

[40] Stephens, *Oil Industry Cleanup Organization Swamped by BP Spill*. Note, however, that Plaquemines Parish, Louisiana President Billy Nungesser criticized MSRC's performance in the spill response in his testimony before the Commission on September 27, 2010: He complained that MSRC was "not prepared, had no boom, no equipment for this response. The stuff they brought to my parish sat on trailers for months."

[41] Stephens, *Oil Industry Cleanup Organization Swamped by BP Spill*.

ii. Clean Gulf Associates

The non-profit Clean Gulf Associates, founded in 1972, has 135 members — all operators in the Gulf of Mexico.[42] It provides boom, skimmers, and dispersant-related equipment in the event of a spill. Its scale is modest: Clean Gulf owns one high-volume open-sea skimmer, four fast response vessels, and nine portable skimming systems that were deployed on vessels of opportunity during the spill response.[43] A Clean Gulf affiliate also owns and operates a $6.5 million aircraft, used to spray dispersants during the response.[44] Initial membership fees can range from $5,000 to $50,000.[45] Basic annual dues start at only $12,800 and rise as high as $1.6 million (for BP) depending upon a member's production levels.[46]

Since 1997, Clean Gulf has partnered with MSRC. Under the terms of the agreement between the two OSROs, Clean Gulf owns equipment and MSRC stores, maintains, and operates this equipment in the event of a spill in the Gulf of Mexico.[47]

Clean Gulf's publicly available financials list assets of approximately $8 million (not including its recently purchased aircraft) as of the end of 2007.[48] Clean Gulf's director estimates that its assets have a market value of approximately $18 million.[49] Its 2010 budget was $5.2 million, and its 2011 budget has increased to $7.2 million, but these budgets only include $100,000 for "new technology" and no allotment for R&D.[50]

iii. Alaska Clean Seas

Alaska Clean Seas, which operates out of Prudhoe Bay, Alaska, is a non-profit formed in 1979 for the purpose of maintaining spill response equipment for ten companies operating in Alaska, which include Alyeska Pipeline Service Company, Anadarko, BP, Brooks Range Petroleum Corporation, ConocoPhillips, Eni Petroleum, ExxonMobil, FEX LP, Pioneer Natural Resources, and Shell.[51] Its scale is significantly more modest than MSRC: It has 78 employees (including contractors), its initiation fee for oil producers is $500,000, and its annual dues are

[42] Telephone Interview by Commission Staff with Frank Paskewich, Clean Gulf Associates (Oct. 15, 2010). Note that BP, Shell, and Marathon Oil did not become members of Clean Gulf Associates until September 2010. *Id*.
[43] *Id*.
[44] *Id*.; *see also* Jen DeGregorio, *Clean Gulf Acquires New $6.5 Million Aircraft*, Times-Picayune (July 20, 2009).
[45] *See* Clean Gulf Associates, http://www.cleangulfassoc.com; Clean Gulf Associates 2010 Annual Report, *available at* http://www.cleangulfassoc.com/PDFs/2010_Chairmans_Report.pdf.
[46] Paskewich Interview.
[47] *See, e.g.*, Clean Gulf Associates 2010 Annual Report.
[48] Clean Gulf Associates, Internal Revenue Service: Form 990 (2007), *available at* http://nccsdataweb.urban.org/orgs/profile/721058176?popup=1#forms.
[49] Paskewich Interview.
[50] *Id*.
[51] Alaska Clean Seas 2010 Yearbook at 8, *available at* http://www.alaskacleanseas.org/adobefiles/2010%20Yearbook_web.pdf. Chevron resigned from Alaska Clean Seas in 2009. *See id*. at 4.

$50,000.[52] According to publicly available information, Alaska Clean Seas has an asset base of $7.3 million dollars.[53]

Alaska Clean Seas' promotional materials discuss its R&D efforts at length. According to its 2010 yearbook:

> Alaska Clean Seas has maintained an active oil spill Research and Development (R&D) program since the early 1980's and acts as a facilitator for much of the research and development related to spill response in arctic conditions. The R&D program focuses on specific areas such as oil spill recovery techniques in, on, and under ice and during various broken ice conditions. Other areas of research include viscous oil pumping, methods to detect and track oil under ice, and alternative response options.[54]

The OSRO's 2010 yearbook also makes clear that only "an average of $200,000 annually was spent on advancing arctic spill response through R&D" during the past decade.[55] Unlike MSRC and Clean Gulf Associates, Alaska Clean Seas does have a small amount of dedicated funding for response R&D.

iv. National Response Corporation

In contrast to MSRC, Clean Gulf Associates, and Alaska Clean Seas, National Response Corporation is a *for-profit* OSRO. The company, founded in 1992, is a subsidiary of the publicly-traded Seacor International, a diversified offshore oil and gas, industrial aviation, and marine transportation company.

Specific information on National Response Corporation's revenues, assets, and client companies is not publicly available. News reports suggest that the National Response Corporation dedicated "eight ships it owns . . . and more than 100 other vessels" to the Deepwater Horizon spill response.[56] Steve Candito, the President of the National Response Corporation, told Commission staff that the "spill response would have been a hell of a lot worse without NRC."[57]

Like MSRC, National Response Corporation has no R&D budget. According to Mr. Candito, the company is "a service provider, not a manufacturer."[58] National Response Corporation is "not in the business of building skimmers."[59]

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[52] *Id*. at 8.
[53] Alaska Clean Seas, Internal Revenue Service: Form 990 (2008), *available at* http://nccsdataweb.urban.org/PubApps/showVals.php?close=1&ft=bmf&ein=920163046.
[54] *See* Alaska Clean Seas 2010 Yearbook at 25.
[55] *Id*.
[56] Stephens, *Oil Industry Cleanup Organization Swamped by BP Spill*.
[57] Telephone Interview by Commission Staff with Steve Candito, President of NRC, and Paul Robinson, General Counsel, Seacor International (Nov. 11, 2010).
[58] *Id*.
[59] *Id*.

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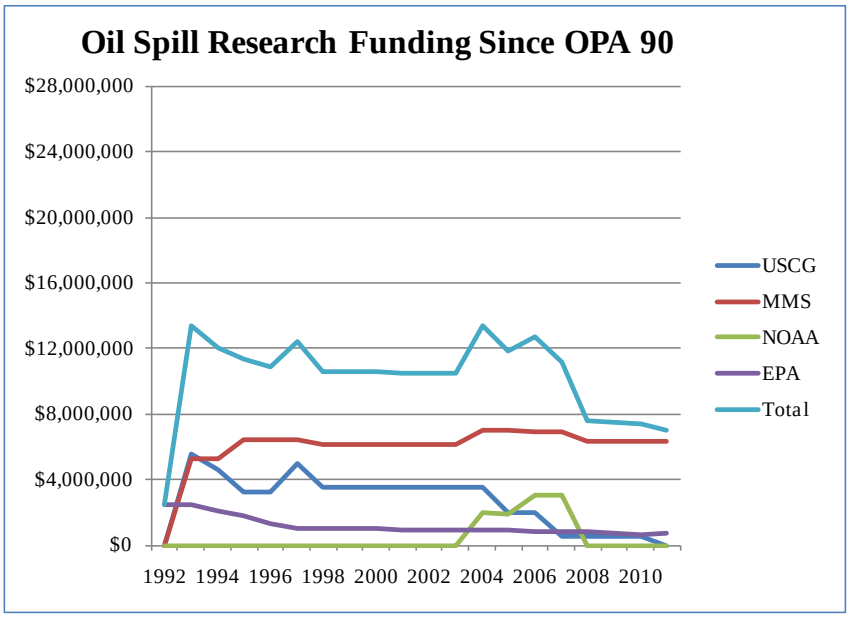
In short, although the Commission staff's data set on response R&D spending by major oil companies and OSROs is incomplete, the evidence available suggests that the oil and gas industry allocates little to no money to response R&D. Of the five major oil companies surveyed, one indicated it does not separately account for response R&D, two answered that they allocate no funds directly toward in-house R&D efforts, and two provided answers suggesting their in-house response R&D funding is — at best — minimal. The companies cited participation in OSROs as evidence of their commitment to response R&D, but the four most prominent OSROs also allocate few dollars to developing clean-up technology. Thus, the Commission staff can comfortably conclude that public reports appear to be true: The oil industry has not invested in response R&D.

II. Federal Agency Response R&D Funding: Authorized But Not Appropriated

The Oil Pollution Act of 1990 establishes an Interagency Coordinating Committee on Oil Pollution Research to "coordinate a comprehensive program of oil pollution research, technology development, and demonstration among the Federal agencies, in cooperation and coordination with industry, universities, research institutions, State governments, and other nations, as appropriate, and . . . foster cost-effective research mechanisms, including the joint funding of research."[60] The Committee is chaired by the Coast Guard and includes representatives from fourteen federal agencies.[61] The Committee produced the first Oil Pollution Research and Technology Plan in 1992, and a second plan in 1997.[62] There has been no update of the research plan since 1997.[63]

The Oil Pollution Act authorizes up to $22 million in annual funding for the Interagency Committee's "comprehensive program of oil pollution research" and an additional $6 million annually for a Regional Research Program. The Act also specifies that this funding is "subject to appropriations."[64] As the following chart illustrates, not even half of the authorized $28 million has been appropriated in any single year since the passage of the Oil Pollution Act.

[60] Oil Pollution Act of 1990 § 7001(a)(2), 33 U.S.C. § 2761(a)(2).
[61] *Id*.
[62] The Interagency Committee's 1997 plan reported that ''most of the information and technology gaps of 1990 remain,'' due to a failure to appropriate sufficient funds for oil pollution technology programs. Interagency Coordinating Committee on Oil Pollution Research, Oil Pollution Research and Technology Plan (1997).
[63] On September 16, 2010, a public meeting was held in Washington, D.C. "to hear comments on the priorities of oil pollution research, including projects related to the Deepwater Horizon incident and the Arctic environment . . . . Public comment will then be used to augment the revision of the 1997 Oil Pollution Research and Technology Plan." 75 Fed. Reg. 51473; *see also* Transcript, Interagency Coordinating Committee On Oil Pollution Research Meeting (Sept. 16, 2010).
[64] Oil Pollution Act of 1990 § 7001(f), 33 U.S.C. § 2761(f).



Congress enacted the Oil Pollution Act in August of 1990, and in October of the same year, the Omnibus Budget Reconciliation Act of 1990.[65] Although Congress always intended the Oil Pollution Act's oil spill research funding provision to be subject to the appropriations process,[66] it also intended that research appropriation to come out of the Oil Spill Liability Trust Fund,[67] not out of the general treasury — so that oil spill research funding would be essentially "assured money."[68] The Budget Reconciliation Act, however, applied budget caps to all agencies and all agency funding.[69] Oil spill research was then forced to compete with other priorities within each agency for budget dollars, even though the research funds were from the Oil Spill Liability Trust Fund, and not the general treasury.[70]

In part because the Budget Reconciliation Act forced a change in how oil spill research would be funded, contrary to the original intent of the Oil Pollution Act, Congress has never appropriated anywhere near the authorized amount for spill research funding. Total oil spill research appropriations for the Coast Guard, the Minerals Management Services (MMS, now BOEMRE), the National Oceanic and Atmospheric Administration (NOAA), and the Environmental Protection Administration (EPA) — the four agencies that have received the vast majority of Oil Pollution Act-authorized R&D funding — have averaged only roughly $10 million per year since 1992, and have never exceeded $14 million per year.[71]

The oil spill research efforts of Coast Guard, MMS/BOEMRE, NOAA, and EPA are briefly outlined below.

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[65] Telephone Interview by Commission Staff with Dan Sheehan, Independent Consultant (Oct. 14, 2010).
[66] *See* H.R. Conf. Rep. 101-653, at 12-14 (1990), *reprinted in* 1990 U.S.C.C.A.N. 779, 790-92; E-mail from William Holt, U.S. Coast Guard (ret.), to Commission Staff (Oct. 20, 2010) (on file with Commission staff).
[67] *See* H.R. Conf. Rep. 101-653.
[68] Telephone Interview by Commission Staff with Dan Sheehan, Independent Consultant (Oct. 22, 2010).
[69] *Id*.
[70] *Id*.
[71] *See infra* Appendix A.

A. Coast Guard Oil Spill Research

The Coast Guard conducts oil spill research through its Research and Development Center in Groton, Connecticut. Coast Guard's budget for oil spill research was $5.6 million in 1993, held constant at $3.5 million from 1998 through 2004, but fell to $500,000 in 2007 and has stayed at $500,000 for 2008, 2009, and 2010.[72] The limited Coast Guard R&D budget has been allocated to four main areas: spill response planning and management, spill detection and surveillance, vessel salvage and on-board containment, and spilled oil clean-up and countermeasures.

B. MMS/BOEMRE Oil Spill Research

The MMS budget for oil spill research has held steady at $6.3 million for the last four years.[73] MMS's Oil Spill Response Research Program focuses on improving technologies used for detection, containment, and clean-up of oil spills that may occur on the Outer Continental Shelf. More than 40% of MMS's R&D projects "are Joint Industry Projects, where MMS partners with other stakeholders to maximize research dollars."[74]

MMS also operates OHMSETT, the National Oil Spill Response Test Tank Facility in Leonardo, New Jersey. Under the Oil Pollution Act, the agencies "represented on the Interagency Committee shall ensure the long-term use and operation of the Oil and Hazardous Materials Simulated Environmental Test Tank (OHMSETT) Research Center in New Jersey for oil pollution technology testing and evaluations."[75] The Committee delegated this responsibility to MMS.[76] MMS has described the OHMSETT facility as follows:

> Ohmsett is the only facility in the world where full-sized oil spill response equipment can be tested and training of first responders can be conducted with a variety of oils in a simulated marine environment under controlled conditions. The primary feature of Ohmsett is a large outdoor, above ground concrete test tank which measures 667 feet long (the approximate length of two football fields) by 65 feet wide, by 11 feet deep. It is filled with 2.6 million gallons of crystal clear salt water. Ohmsett is also the premier training site for spill response personnel from State and Federal Government agencies, private industry and foreign countries. This includes the U.S. Coast Guard Strike Team personnel. MMS now manages Ohmsett as part of its mandated requirements to ensure that the best and safest technologies are used in offshore oil and gas operations. On July

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[72] *Id*.
[73] *Id*.
[74] *A New Direction for Federal Oil Spill Research and Development: Hearing Before the Subcomm. on Energy & Env't of the H. Comm. on Sci. & Tech.*, 111th Cong. 65 (June 4, 2009) (Statement of Minerals Management Service, Department of the Interior), *available at* http://edocs.dlis.state.fl.us/fldocs/oilspill/federal/49820.pdf [hereinafter MMS Statement].
[75] Oil Pollution Act of 1990 § 7001(c)(7), 33 U.S.C. § 2761(c)(7).
[76] *See* MMS Statement.

22, 2009, Ohmsett celebrated its 17th anniversary under MMS management and to date 24 countries have made use of the facility.[77]

MMS's annual funding dedicated to OHMSETT has increased modestly over time — from $1.0 million annually during the 1992 to 1998 period, to $1.5 million from 1999 to 2002, to $3.3 million in 2006, falling to $2.7 million for the last three years.[78] Senator Robert Menendez of New Jersey has alleged that OHMSETT is underfunded.[79]

C. NOAA Oil Spill Research

Although the Oil Pollution Act does grant NOAA the authority to carry out oil spill response R&D, NOAA does not currently have a funded oil spill R&D program.[80] From 2004 to 2008, the base appropriation for its Office of Response and Restoration, whose responsibilities include developing scientific tools to support oil spill preparedness and response, steadily declined to approximately 30% below the amount budgeted by the President in 2008.[81] From 2004 to 2007, an earmark from Senator Judd Gregg of New Hampshire allocated $2 to $3 million per year to an oil spill response partnership involving NOAA and the Coastal Response Research Center at the University of New Hampshire.[82] NOAA has not funded spill response R&D since 2007.[83]

D. EPA Oil Spill Research

EPA's oil spill response R&D budget was $2.5 million in 1992 and 1993, but has averaged less than $1 million annually for the last decade. [84] Because EPA is the lead federal response agency for spills in the inland waters, its limited research addresses mitigation, fate and effects, and spill flow characteristics, and is conducted through the Office of Research and Development's National Risk Management Research Laboratory. The program's objective is to provide environmental managers with the "tools, models, and methods needed to mitigate the effects of oil and biofuel spills on ecosystems."[85]

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[77] *Id*.
[78] E-mail from Ken Lane, Department of Interior, to Commission Staff (Oct. 19, 2010) (on file with Commission staff); E-mail from Raya Bakalov, Department of Interior, to Commission Staff (Oct. 28, 2010) (on file with Commission staff). Note that from 2003 to 2007, "capital improvements were made and additional funds were appropriated." *Id*.
[79] *See* Letter from Senator Robert Menendez to Secretary of the Interior Ken Salazar (June 21, 2010), *available at* http://menendez.senate.gov/imo/media/doc/20100621ltr_OHMSETT.pdf.
[80] E-mail from Margaret Spring, NOAA, to Commission Staff (Nov. 16, 2010) (on file with Commission staff); *infra* Appendix A.
[81] Spring E-mail.
[82] Interview by Commission Staff with NOAA Officials (Nov. 18, 2010); Press Release, Sen. Gregg Announces $20.2 Million for a Variety of Granite State Ocean, Fisheries Research (July 13, 2006) (on file with Commission staff); *infra* Appendix A.
[83] Spring E-mail. Note that NOAA's Office of Response and Restoration received its full budget requests of $17.3 million and $19.1 million in 2009 and 2010 respectively. Neither budget included oil spill research funding. *Id*.
[84] *See infra* Appendix A.
[85] *A New Direction for Federal Oil Spill Research and Development: Hearing Before the Subcomm. on Energy & Env't of the H. Comm. on Sci. & Tech.*, 111th Cong. 5 (June 4, 2009) (Statement of Environmental Protection Agency), *available at* http://edocs.dlis.state.fl.us/fldocs/oilspill/federal/49820.pdf.

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Oil spill research provided for in the Oil Pollution Act has never been appropriated to even half the authorized levels. Indeed, NOAA — which played a major role in the Deepwater Horizon response — currently receives no funding for oil spill research. The Commission may wish to consider recommending that the Oil Pollution Act be amended to ensure that federal agency oil spill R&D efforts are fully funded to levels authorized by the Act, as intended by Congress. Oil Pollution Act spill research funding, including funding for OHMSETT, could become a mandatory appropriation, rather than one subject to the normal appropriations process.[86] Such a legislative change would be complicated: A mandatory appropriation would qualify as direct spending, meaning it would be "scored" and thus require a corresponding budget offset under pay-go rules.[87] Nevertheless, the Commission may determine that a mandatory appropriation is worth these additional complications.

III. Incentives for Response R&D

As discussed in Section I and Section II, both industry and the federal government have underfunded response R&D. Closing this funding gap for federal agencies would involve appropriating more money for R&D in the budgeting process and potentially considering a mandatory appropriation to ensure that funding continues after the political salience of the disaster has begun to diminish. The Administration has already taken steps in this direction: On September 13, 2010, President Obama added $9 million (on top of the $6 million already requested) to his 2011 budget request for "oil spill research."[88] The $9 million is intended to "be used to address key research gaps brought to light by the Deepwater Horizon oil spill in the Gulf of Mexico and the associated spill containment and response efforts."[89] As the President wrote in requesting the additional $9 million, "[d]eep oil and gas spill containment capabilities need to be improved, along with the understanding of how best to respond to deep oil and gas spills."[90]

Closing the response R&D funding gap for industry is decidedly more complex. Industry has not invested significant resources in response R&D because it lacks the incentive to do so. Federal regulations and market forces have conspired to create disincentives for oil companies to invest significant resources in response R&D. The following section discusses some of these regulations and market forces, and suggests a few new incentives that could be implemented to encourage private sector investment in response R&D.

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[86] Telephone Interview by Commission Staff with Sandy Davis, Congressional Budget Office (Oct. 14, 2010).
[87] *Id*.
[88] Letter from President Barack Obama to House Speaker Nancy Pelosi (Sept. 13, 2010), *available at* http://www.whitehouse.gov/sites/default/files/omb/assets/budget_amendments/amendment_09_13_10.pdf.
[89] *Id*.
[90] *Id*. The $9 million budget increase for 2011 would be added to BOEMRE's oil spill research budget, but would be "coordinated with other Federal agencies and non-Federal partners." *Id*. $9 million "would be fully offset by proposed reductions to other accounts within the Department of the Interior." *Id*.

A. Market Forces and Countervailing Incentives

The single largest disincentive to response R&D seems to be the market itself — more specifically, that there is not much of one. A few for-profit spill response companies, such as National Response Corporation, do exist. For the most part, however, the market for equipment to clean up spills on the scale of the Deepwater Horizon spill is tiny. Only cost-insensitive and independently wealthy entrepreneurs can afford to sink money into spill response companies that may be a decade or two away from generating revenue, and then only for a limited period of time. To be prepared for a catastrophic spill, companies must invest in technology that may not be used, and may not generate revenue, for many years.

This section discusses three possible ideas for stimulating the response R&D market. This list of ideas is not meant to be exhaustive.[91] In truth, the response R&D market needs "belts and suspenders" — multiple stimuli to grow the market necessary to support development of technology capable of responding to the next catastrophic spill. None of the ideas discussed in this section is likely to be sufficient on its own.

i. Revised Insurance Requirements

To stimulate response R&D, the Commission may wish to consider revising the current insurance requirements for offshore facilities. The Oil Pollution Act of 1990 mandates demonstration of financial responsibility but limits an offshore facility's liability for economic and natural resources damages to $75 million per incident. MMS/BOEMRE Oil Spill Financial Responsibility (OSFR) guidelines require leaseholders of rigs in the Outer Continental Shelf to demonstrate a minimum financial responsibility of $35 million per 35,000 barrels of "worst case oil-spill discharge," up to a maximum of $150 million.[92] Operators can demonstrate financial responsibility with surety bonds, guarantees, letters of credit, third-party insurance, and — in the case of certain major oil companies, including BP — self insurance.

Potential revisions to the offshore drilling insurance regime — including (1) increased OSFR requirements, (2) increased liability requirements, and (3) independent third-party monitoring requirements for companies that self-insure — are explored in other Commission work. In the context of this analysis of response R&D, it is important to highlight that such regulatory changes could be an effective way to stimulate the development of clean-up technology.

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[91] Professor Jody Freeman of Harvard Law School, for example, has advocated allowing companies "that go beyond the legal minimum requirements, pay for backup safety systems and provide superior worker training for spill response" to receive drilling permits more quickly or reductions in their royalty payment requirements. *See* Jody Freeman, *The Good Driller Award*, N.Y. Times (June 30, 2010). Similarly, regulations rewarding drillers that proactively invest in superior spill clean-up technology, or clean-up technology R&D, with "carrots" such as quicker drilling permits or reductions in royalty payments could stimulate the existing market for clean-up technology. *Id*. As another example, the Commission staff has heard that one government agency, in its review of the Deepwater Horizon spill response, is considering whether to recommend reform of the entire OSRO certification process. If for-profit and non-profit spill response companies were required to invest in clean-up technology and related R&D in order to receive the Coast Guard's official OSRO certification, this, too, could serve as powerful clean-up technology market stimulus.

[92] *See* 30 C.F.R. § 253.13.

By monetizing risk in the form of periodic premiums, insurance companies make it easier for firms to understand and justify measures to reduce risk. A firm that self-insures may have difficulty determining expected liabilities and justifying precautionary measures to accounting officers based on internal calculations of expected liabilities. On the other hand, a firm presented with a periodic premium, and options for higher or lower premiums based on loss experience or undertaking particular safety measures, may find it easier to justify improved safety measures. If liabilities are borne by insurance carriers, carriers will also have a strong incentive to promote new safety techniques and methods by encouraging other institutions (including insured firms) to engage in such research. They may also require certification by non-profit organizations or agencies devoted to identifying best practices. And they may provide a vehicle for developing or improving collective response mechanisms, such as the Marine Well Containment Company or MSRC.[93]

More robust OSFR and liability requirements, coupled with independent monitoring requirements for companies that self-insure, could force insurers or third parties to oversee precautions that drillers take to prevent spills and reduce spill impacts (which, for the most part, they do not currently do[94]). Adding this layer of private oversight to offshore drilling could, in turn, encourage the development of new technologies to mitigate these risks. In this way, changes to the offshore drilling insurance requirements could stimulate response R&D.

One key caveat: Numerous industry sources have told Commission staff that the offshore energy insurance market currently has a finite amount of liability insurance capacity — somewhere in the range of $1.25 billion to $1.5 billion per company.[95] Similarly, working capacity for OSFR insurance certification is currently no more than $200 million per company.[96] In the current market, any revisions to the insurance regime would likely be short-circuited by these market capacity limits.

In reaction to the Deepwater Horizon spill, major insurance and reinsurance firms have increased premiums charged to firms engaged in exploration and production activities by as much as 50%.[97] Perhaps seeing these rising rates as a business opportunity, on September 12, 2010, Munich Re announced a new "concept for offshore oil drilling" whereby it proposes to write project-specific (as opposed to company-specific, which is the current model) liability policies of $10 to $20 billion. Under this plan, a consortium of insurers or reinsurers, including Munich Re, will provide liability insurance on a project-by-project basis. The plan cannot work without scale — *i.e.*, participation by all or most offshore rigs in the Gulf. Munich Re appears to believe that legislative changes to the offshore insurance requirements could yield the scale

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[93] *See supra* note 14.
[94] Telephone Interview by Commission Staff with Offshore Energy Insurance Brokers (Sept. 10, 2010); Telephone Interview by Commission Staff with Dr. Robert Hartwig, Insurance Information Institute (Sept. 3, 2010).
[95] Rawle O. King, Cong. Research Serv., R41320, Deepwater Horizon Oil Spill Disaster: Risk, Recovery, and Insurance Implications (July 12, 2010); *see also* Offshore Energy Insurance Brokers Interview.
[96] King, Deepwater Horizon Oil Spill Disaster: Risk, Recovery, and Insurance Implications.
[97] *See Liability and Financial Responsibility for Oil Spills Under the Oil Pollution Act of 1990 and Related Statutes: Hearing Before the H. Comm. on Transp. & Infrastructure*, 111th Cong. (June 9, 2010) (Testimony of Dr. Robert Hartwig, Insurance Information Institute), *available at* http://transportation.house.gov/Media/file/Full%20Committee/20100609/Hartwig%20Testimony.pdf.

necessary for its product to succeed.[98] However, there seems to be considerable skepticism from the insurance industry about whether the Munich Re plan — specifically, its stated aim of creating $10 to $20 billion in capacity — is viable.[99]

ii. A Technology Incubator

The establishment of a clean-up technology "incubator" could function as a much-needed stimulus for response R&D. A possible model is In-Q-Tel, the non-profit venture capital vehicle affiliated with the Central Intelligence Agency. A brief history of In-Q-Tel posted on the company's website notes that, "by the late 1990s, the pace of commercial IT innovation was outstripping the ability of government agencies — including the CIA — to access and incorporate."[100] Because of this technology gap, "[i]n 1998, CIA identified technology as a top strategic priority, and set out a radical plan to create a new venture that would help increase the Agency's access to private sector innovation . . . . IQT was tasked with building a bridge between the Agency and a new set of technology innovators."[101] There are parallels with the clean-up technology deficit discussed in this paper: A "radical plan"[102] to incentivize offshore drillers and OSROs to access innovation is needed. Although In-Q-Tel is designed to "bridge" government and "technology innovators,"[103] a new incubator modeled on In-Q-Tel could act as valuable bridge between industry and spill technology innovators.

In-Q-Tel seems to have been a success,[104] and may provide a viable model for a spill technology incubator. There is, however, a crucial distinction between intel-tech and spill-tech: The market for intelligence-oriented technology is much larger, and more developed, than the market for oil spill response technology. Dozens if not hundreds of government agencies provide end-users for any technology developed by companies seeded by In-Q-Tel. Even if an incubator were funded to encourage the development of response technology, few entrepreneurs would be interested in tapping into these funds unless the market for the technology grows. Thus, a spill technology venture capital fund would succeed only in concert with other market stimuli.

A spill clean-up technology incubator could be funded by Congress (like In-Q-Tel) or by BP. On May 24, 2010, BP pledged $500 million over a ten-year period to create the Gulf of Mexico Research Initiative.[105] Among the stated goals of this Initiative is "to develop improved spill mitigation and oil detection, characterization and remediation technologies."[106] BP has promised that these funds will be administered by an independent advisory council, and that all

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[98] *See* Munich Re, Catastrophe Cover for Offshore Oil Drilling (Sept. 12, 2010) (on file with Commission staff); Telephone Interview by Commission Staff with Munich Re Executives (Sept. 17, 2010).
[99] *See* Interview by Commission Staff with Insurance Industry Executive.
[100] In-Q-Tel History, www.iqt.org/about-iqt/history.html.
[101] *Id*.
[102] *Id*.
[103] *Id*.
[104] Terence O'Hara , *In-Q-Tel, CIA's Venture Arm, Invests in Secrets*, Wash. Post (Aug. 15, 2005).
[105] Jake Sherman, *BP Offers $500 Million to Study Oil Spill Impact*, Politico (May 24, 2010).
[106] Letter from David C. Nagel, Executive Vice President BP America, to U.S. Representatives Lois Capps & Lynn C. Woolsey (Sept. 23, 2010) (on-file with Commission staff).

grants will be funded through a request-for-proposals process.[107] Although the limited information available suggests that the Initiative will be geared toward funding research by scientists at academic institutions, the Commission may wish to consider recommending that a portion of BP's $500 million grant, if not a separate BP grant, be dedicated to seeding a spill technology venture capital fund loosely modeled after In-Q-Tel.

iii. R&D Tax Credit

A third potential incentive to consider is a spill clean-up technology R&D tax credit. On September 4, 2010, President Obama asked Congress to increase and permanently extend an across-the-board research credit that has existed for businesses, in some form, since 1981.[108] In December 2010, Congress enacted a temporary R&D tax credit as part of the bill extending Bush-era tax cuts.[109] The Commission may also wish to recommend Congress pass a response R&D tax credit specific to the oil industry. Any proposal would have to establish that the credit would *not* apply to research on and development of technology related to drilling but only to spill clean-up R&D. The credit could benefit a wide spectrum of companies, from majors such as ExxonMobil and ConocoPhillips to small entrepreneurs. Although there would undoubtedly be opposition to extending a new tax credit to major oil companies that are already profitable, the long-term benefits of the incentive may significantly outweigh the long-term costs.

B. Regulatory Disincentives

Public reports and interviews by Commission staff have pinpointed a few specific federal regulations that may create disincentives for response R&D investment by industry and OSROs — in particular, two regulations relating to mechanical recovery equipment, and one relating to open-water oil testing requirements.

Before examining these specific regulations, however, it is worth briefly considering whether two overarching regulatory concepts — (1) a performance-based "safety case" approach and (2) a progress "road map" created and overseen by an independent advisory board — could incentivize response R&D. Although both of these approaches are discussed in more detail in other work by the Commission and its staff, the Commission may wish to consider whether these approaches could, in addition to providing benefits analyzed in this other work, encourage response R&D.

First, the "safety case": The prescriptive approach of the federal regulatory structure relating to oil spills (*e.g.*, prescribing daily recovery capacities for equipment and allowable percentages of oil in oiled-water discharge) may serve as a fundamental disincentive for response R&D. Under the current regime, companies are incentivized to meet certain set laws and regulations — no less and no more — instead of general performance or function standards. At

[107] *Id*.
[108] Jackie Calmes, *Obama to Pitch Permanent Research Tax Credit*, N.Y. Times (Sept. 4, 2010).
[109] Ryan J. Donmoyer & Peter Cohn, *Congress Passes $858 Billion Tax-Cut Extension, Sends to Obama for Signing*, Bloomberg (Dec. 17, 2010).

least by some accounts, the prescriptive model "encourage[s] a passive attitude."[110] Companies have no incentive to develop better technology or more creative approaches to spill response as long as their current technology clears the bar set by existing regulation. The regulator is the guarantor of compliance.

A performance-based "safety case" approach could encourage innovation by giving companies the freedom to determine what solutions they will pursue to meet general performance requirements. Because the companies, not the regulators, are the guarantors of performance, they have the incentive to continually innovate to meet high-level standards in more efficient and effective ways. The British "safety case" system, for example, "puts the burden — and ultimate legal and financial responsibility — on oil and gas companies to figure out the myriad ways something could go wrong on a drilling rig or production platform, then show regulators the practices and *technologies* that would be used to avoid or deal with the problems."[111]

Like Great Britain, Norway has adopted a "safety case" approach to offshore drilling regulation in which government sets performance standards to be achieved and leaves compliance to operators.[112] By all accounts, Norway has been able to develop much more robust spill clean-up technology.[113] In his testimony before the Commission on September 28, 2010, Doug Suttles of BP emphasized that clean-up technology developed in Norway proved to be a great asset in the spill response,[114] and press reports confirm Mr. Suttles's claim that U.S. responders put Norwegian technology to use in the Gulf of Mexico.[115] Although there is no conclusive link, Norway's technological success may be due, at least in part, to that country's "safety case" approach.[116]

As an alternative to the more generalized "safety case" performance-based model, the Commission may wish to consider recommending formation of an independent advisory board, staffed with experts from industry and government, to create a detailed "road map" for how clean-up technology should develop over the ensuing years and decades to keep pace with exploration technology, as well as to monitor the industry's adherence to the board's guidelines. Professor Jody Freeman of Harvard Law School has analyzed the independent advisory board concept in detail for the Commission in her memo entitled *Structural Options for Improving MMS/BOEM Decision Making on Offshore Drilling*. While her analysis considers the advisory board as a monitor of drilling safety, her advisory board concept could be modified to add clean-

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[110] Petroleum Safety Authority of Norway, *From Prescription to Performance in Petroleum Supervision* (Mar. 3, 2010), http://www.ptil.no/news/from-prescription-to-performance-in-petroleum-supervision-article6696-79.html.
[111] Neela Banerjee, *U.S. Looks to British Model to Improve Offshore Drilling Safety*, L.A. Times (Oct. 24, 2010) (emphasis added).
[112] *Id*.
[113] A number of Norwegian organizations have made a commitment to new technology development, including the Norwegian Oil Spill Control Association, a non-profit cooperative of industry, research institutions, and government, and the Norwegian Clean Seas Association for Operating Companies, which maintains a technology development program that solicits and selects technology proposals to research.
[114] *See also* Interview by Commission Staff with Oil Company Executive ("[T]he best of the best is in Norway.").
[115] Patrick McLoughlin, *Norwegian Environment Minister Praises BP's Gulf Spill Response*, Platts Commodity News (Aug. 17, 2010).
[116] *See* Petroleum Safety Authority of Norway, *From Prescription to Performance in Petroleum Supervision*.

up technology development to its list of responsibilities. The Interagency Coordinating Committee created under the Oil Pollution Act (discussed above) was designed with similar goals in mind, but has not served as an effective response R&D planner and monitor. A new advisory board would need to incorporate key structural features (*e.g.*, an independent staff and budget, a tailored charter, and reporting lines to an agency head and Congress) to guarantee independence and authority that the Interagency Coordinating Committee does not possess. Useful models for such a board include the Nuclear Waste Technical Review Board, the Clean Air Science Advisory Committee, and the independent National Transportation Safety Board.

The Department of the Interior's recently announced plan to set up an Ocean Energy Safety Institute "that would research and develop technologies to prevent, contact and clean up future offshore oil spills"[117] could serve many of the same functions as the kind of independent advisory board Professor Freeman has proposed. According to information provided by the Department to the Commission, one of the Institute's primary responsibilities will be to create a "road map" for technology development that will lead to sound and safe offshore drilling operations.[118] The Institute will include representatives from industry and academia as well as the Department of the Interior, the Department of Energy, and Coast Guard — but, noticeably, not the EPA.[119] The limited details available suggests that the Institute will report to the Secretary of the Interior but does not indicate whether it will incorporate structural features designed to ensure independence, such as a dedicated staff and budget, and a tailored charter.[120]

Although three existing regulations are discussed in the following section, the Commission may wish to consider whether the best way to incentivize response R&D is in the context of a new overarching approach to regulation of offshore drilling — such as a performance-based "safety case" or a progress "road map" approach — rather than by tweaking the specifics of existing regulations.

i. Effective Daily Recovery Capacity Regulations

Coast Guard guidelines create minimum Effective Daily Recovery Capacity (EDRC) requirements for all oil recovery equipment listed in response plans that companies propose to use to recover discharges.[121] MMS/BOEMRE regulations contain a similar EDRC requirement.[122]

Both Coast Guard and MMS/BOEMRE regulations detail specific formulas for calculating EDRC. Specifics aside,[123] both the Coast Guard and the MMS/BOEMRE formulas

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[117] Stephen Power, *Salazar Pitches Drilling Safety Institute*, Wall St. J. (Oct. 21, 2010); *see also* Juliet Eilperin & Steven Mufson, *Interior Considers First Deepwater Drilling Permits Since BP Spill*, Wash. Post (Oct. 22, 2010); Press Release, Department of the Interior, Salazar Proposes Ocean Energy Safety Institute (Nov. 2, 2010), *available at* http://www.doi.gov/news/pressreleases/Salazar-Proposes-Ocean-Energy-Safety-Institute.cfm.
[118] Non-Public Document from the Department of the Interior.
[119] *Id*.
[120] *Id*.
[121] 33 C.F.R. § 154, Appendix C.
[122] *See* 30 C.F.R. § 254.44.
[123] Coast Guard regulations allow for two methods of calculating EDRC for oil recovery devices. *See* 33 C.F.R. § 154, Appendix C (EDRC Formula in Section 6.2.1: throughput rate (*i.e.*, pump rate) x 24 x efficiency rate of 20%;

are flawed in one sense: Neither takes adequate account of the *efficiency* with which response equipment recovers oil. The regulations allow companies to measure response equipment by liquid, not oil, pumping ability. There is no regulatory incentive for companies to list on their mandated response plans — and thus invest in, or encourage OSRO investment in — more efficient oil recovery equipment. Companies need only show that they have access to equipment with the minimum liquid pumping capacity mandated by the EDRC regulations. Big, simple pumps clear this low regulatory hurdle. Oil recovery rates are usually overstated because the formulas to do not accurately reflect how much oil, as opposed to liquid, equipment actually pumps.[124]

According to MSRC CEO Steve Benz, this loophole has hampered the development of spill clean-up technology. EDRC regulations disincentivize oil companies from developing their own more efficient oil recovery devices or providing additional funding to MSRC for research on and development of its own more efficient equipment. The metric by which the vessels are measured to satisfy the regulations is simply how much liquid they can take up, not how much oil they can recover.[125]

Whether Mr. Benz's explanation is a legitimate rationale or an excuse for MSRC's own lack of R&D, it does seem that for-profit companies such as National Response Corporation have emerged as competitors to the non-profit MSRC in part because they take advantage of this regulatory gap to provide companies with a less expensive alternative to MSRC.[126] National Response Corporation's equipment is less efficient than MSRC's equipment, yet still EDRC-compliant.[127] With cheaper equipment, National Response Corporation can offer lower fees than MSRC.[128] Independent and smaller companies, including Marathon Oil and Anadarko Petroleum Company, have opted for the less costly National Response Corporation, and are not members of MSRC.[129]

EDRC Formula in Section 6.3.1: average oil recovery rate x hours per day usable). MMS/BOEMRE regulations allow for only one method of calculating EDRC, which is largely similar to the Section 6.2.1 method in the Coast Guard regulations. *See* 30 C.F.R. § 254.44(a).

[124] *See* API Report at V-9; E-mail from William Holt, U.S. Coast Guard (ret.), to Commission Staff (Oct. 13, 2010) (on file with Commission staff).

[125] *See* MSRC Interview; *see also* API Report at V-9.

[126] MSRC Interview; Candito & Robinson Interview.

[127] *See* MSRC Interview; Candito & Robinson Interview; Stephens, *Oil Industry Cleanup Swamped by BP Spill* ("When MSRC was formed, the oil companies envisioned it as uniquely poised to clean up catastrophic spills. But over time, a competing approach arose. Seacor Holdings, based in Fort Lauderdale, saw a business opportunity in the post-Valdez cleanup standards. It formed the for-profit National Response Corp., and set out to provide many of the same services as MSRC at lower prices. While MSRC had a dedicated fleet, NRC retrofitted a handful of ships and contracted with commercial shippers for access to their fleets in an emergency. Before long, some MSRC customers were moving to NRC. MSRC cut costs, including research into better ways to recover spilled oil. 'That was much to the detriment of the organization,' said David McLain, a former MSRC consultant.").

[128] MSRC Interview; Candito & Robinson Interview (noting that National Response Corporation offers lower fees than MSRC because it is "more innovative," "more cost-effective," and can "do things more efficiently as a for-profit").

[129] *See* MSRC Interview.

Commission staff believes that the EDRC requirements should be revised to include a reliable, dynamic efficiency measure.[130] The simple mathematical EDRC formulas should be changed to accurately reflect oil, not liquid, pumping ability. As is, the regulations and the manner in which they are applied do not encourage companies to include the most efficient oil spill recovery equipment in response plans. Revised EDRC requirements could serve to incentivize companies and OSROs to invest in response R&D, with the goal of developing more efficient skimmers and other recovery equipment.

ii. EPA Open-Water Testing Permit Process

The EPA's open-water oil testing permit process is a second area of regulation that may have a chilling effect on certain types of spill response research and thus warrant revision. Section 311(b)(3)(B) of the Clean Water Act permits the discharge of oil "in quantities and at times and locations or under such circumstances and conditions as the President may, by regulation, determine not to be harmful."[131] Using this statutory authority, EPA has issued an oil discharge permit regulation, which provides that the Administrator may permit the discharge of oil "in connection with research, demonstration projects, or studies relating to the prevention, control, or abatement of oil pollution."[132]

Although it is technically possible to obtain an EPA permit to spill on the open ocean,[133] Senator Mary Landrieu of Louisiana, among others, has complained about the fact that a permit has not been granted "for at least 20 years."[134] The EPA, however, maintains that the lack of open-water testing is due to a lack of initiative by industry.[135] According to the EPA official in charge of the open-water testing permit process, the agency is amenable to granting open-water testing permits and, indeed, did grant a permit to the only applicant to have completed the application process (in the mid 1990s).[136] That does not, however, satisfactorily explain why U.S. companies and institutions have tested clean-up technologies with oil on open water in Canada and Norway, countries that do allow for controlled oil spills.[137] Presumably, if the problem were solely a lack of industry initiative, U.S. companies would not journey abroad to test technologies in open-water spills.

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[130] The Coast Guard EDRC guidelines also require that "[a]ll equipment identified in a response plan must be designed to operate in the conditions expected in the facility's geographic area," 33 C.F.R. § 154, Appendix C, but the Coast Guard's EDRC calculation does not explicitly mandate a numerical adjustment for different environments. That is, Coast Guard EDRC regulations do not take into account that a single piece of equipment could have one EDRC capacity in the Gulf of Mexico and another in the Arctic. The Commission may also wish to examine this aspect of the Coast Guard EDRC regulation.

[131] 33 U.S.C. § 1321(b)(3)(B).

[132] 40 C.F.R. § 110.5.

[133] *See* EPA, Application for EPA Permits to Discharge Oil for Research Purposes, Interim Guidelines (Mar. 29, 2010).

[134] *Sen. Mary Landrieu Says U.S. Doesn't Allow Open-Water Oil Spill Practice*, Politifact.com (June 28, 2010), http://www.politifact.com/truth-o-meter/statements/2010/jun/28/mary-landrieu/sen-mary-landrieu-says-us-doesnt-allow-open-water-/.

[135] Telephone Interview by Commission Staff with Nick Nichols, EPA (Oct. 14, 2010).

[136] *See id*.

[137] *See, e.g.*, Dickens Associates Ltd., Sintef, University Centre at Svalbard, Boise State University, 2006 Svalbard Experimental Spill to Study Spill Detection and Oil Behavior in Ice: Summary Field Report (Apr. 12, 2006), *available at* http://www.boemre.gov/tarprojects/569/SummaryFieldReport.pdf (detailing team of U.S. and international scientists, including scientists from Boise State University, conducting oil-on-ice study in Norway).

Perhaps because it is too cumbersome or burdensome,[138] the EPA's permitting process has resulted in a *de facto* ban on intentional open-water spills for testing purposes in the U.S.[139] Separate from the question of whether this ban hurts the quality of response R&D, it could disincentivize R&D. To promote the development of new clean-up technologies, the Commission may wish to consider recommending that the EPA revise its procedures to encourage applications for open-water testing permits and to streamline the permitting process.

Open-water testing would, of course, risk environmental impacts, but the OHMSETT facility in New Jersey, where every test of oil on water inside the U.S. is currently conducted, cannot replicate all open-water testing conditions. The Commission should balance the costs and benefits of using OHMSETT against the costs and benefits of open-water testing. For example, one source told the Commission staff that OHMSETT is "pretty expensive," especially for small entrepreneurs who could potentially play an important role in developing clean-up technology.[140] The Department of the Interior has insisted that OHMSETT's fees are, in fact, "a very small fraction of the cost to conduct open water tests,"[141] but this cost comparison likely assumes that open-water oil testing can only be done outside of the U.S., which gives rise to additional expense.

OHMSETT may also have a "full agenda,"[142] which could create meaningful time-to-market delays for entrepreneurs. For example, a representative from a major oil company told Commission staff that the facility has been reserved for all of August and September 2011 for an oil spill technology competition.[143] In response to an inquiry about OHMSETT's capacity, the Department of the Interior passed on the following information to Commission staff:

> Although the Ohmsett facility has a use rate of over 80%, it has been able to accommodate all clients that give sufficient notice of their testing requirements and pay for the test or training at least 30 days in advance. This lead time is necessary to deposit the funds into a reimbursable account and to have a contracting officer approve a task order. BOEMRE is looking at the possibility of having the contractor collect and disburse the client's funds. This would eliminate the need for a task order proposal and the subsequent review.[144]

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[138] The EPA's *Application for EPA Permits to Discharge Oil for Research Purposes, Interim Guidelines* is twenty pages long and requires applicants to submit information on Test Justification, Site Justification, Assessment of Environmental Effects, Assessment of Non-Environmental Effects, Regulatory Compliance, Public Participation, a Safety Plan, and Peer Review.

[139] *See Deluge of Oil Highlights Research and Technology Needs for Effective Cleanup of Oil Spills: Hearing Before the Subcomm. on Energy & Env't of the H. Comm. on Sci. & Tech.*, 111th Cong. (June 9, 2010) (Testimony of Dr. Nancy Kinner), *available at* http://science.house.gov/publications/hearings_markups_details.aspx?newsid=2854.

[140] *See* Nichols Interview.

[141] Lane E-mail.

[142] *See id*.

[143] Interview by Commission Staff with Oil Company Executive (referencing the Wendy Schmidt Oil Cleanup X Challenge, www.iprizecleanoceans.org).

[144] Lane E-mail.

Even if OHMSETT's capacity is not an issue, the requirements of 30 day advance notice for payment and testing, along with "a task order proposal and subsequent review," are hurdles that could potentially deter small entrepreneurs.

In short, the Commission should keep OHMSETT's strengths and weaknesses in mind in assessing whether the EPA's apparently *de facto* open-water testing ban serves as a response R&D disincentive worthy of revision.[145]

iii. EPA Regulations on Discharge of Oiled Water

EPA discharge regulations require all equipment (including oil spill response equipment) capable of sucking up oiled water to return 99.9985% oil-free water to the ocean.[146] Public reports have cited this regulation as an impediment to the development of oil-water separation technology.[147] Kevin Costner pointed to the EPA's fifteen-parts-per-million requirement as a significant obstacle in his company's extended struggle to bring its centrifugal force oil-water separator to market.[148] According to one report, "although his [Mr. Costner's] machines are effective, the water they discharge is still more contaminated than environmental regulations allow. He could not get spill-response companies interested in his machines . . . without a federal stamp of approval."[149] Similarly, owners of the Taiwanese *A Whale* pointed to this requirement as having delayed that vessel's participation in the spill response.[150]

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[145] A paper describing "lessons learned" from the Coast Guard's 2002 Spill of National Significance exercise recommends changes to "agencies policies and regulations prohibit[ing] the controlled spilling of oil in the environment to test response technologies." Commander Michael Drieu et al., *Lessons Learned from 2002 Spill of National Significance (SONS) Exercise Gulf of Mexico*, 2003 International Oil Spill Conference (Undated), *available at* http://www.iosc.org/papers/IOSC%202003%20a470.pdf.

[146] Section 311 of the Clean Water Act, as amended by the Oil Pollution Act of 1990 (codified at 33 U.S.C. § 1321), prohibits the discharge of harmful quantities of oil into U.S. waters (including discharges that may affect natural resources in the U.S. Exclusive Economic Zone — which extends 200 miles offshore), and mandates that the President define, by regulation, what he deems to be discharges of harmful quantities of oil. 33 U.S.C. § 1321(b)(3) and (4). Pursuant to this mandate, the EPA defines harmful quantities of oil as those that "(a) [v]iolate applicable water quality standards; or (b) [c]ause a film or sheen upon or discoloration of the surface of the water . . . ." 40 C.F.R. § 110.3. In turn, Coast Guard regulations prohibit discharge of water with an oil concentration of greater than fifteen parts per million (*see* 33 C.F.R. § 151.10) — which is generally recognized to be the minimum amount of oil that creates a sheen. This Coast Guard regulation is in accord with the International Convention for Prevention of Pollution from Ships (the MARPOL protocol). *See* MARPOL 73/78 Annex I, implemented in the United States by the Act to Prevent Pollution from Ships, 33 U.S.C. §§ 1901 *et seq*. Thus, while the Coast Guard regulation (33 C.F.R. § 151.10) defines the amount of oil that creates a sheen, the EPA regulation is the one that prohibits the discharge of water with that amount of oil under the Clean Water Act.

[147] *See e.g.*, Opinion: Paul H. Rubin, *Why is the Gulf Cleanup so Slow?*, Wall St. J. (July 2, 2010).

[148] *See Deluge of Oil Highlights Research and Technology Needs for Effective Cleanup of Oil Spills: Hearing Before the Subcomm. on Energy & Env't of the H. Comm. on Sci. & Tech.*, 111th Cong. (June 9, 2010) (Testimony of Kevin Costner), *available at* http://gop.science.house.gov/Media/hearings/energy10/jun9/Costner.pdf; Fountain, *Advances in Oil Spill Cleanup Lag Since Valdez*.

[149] Fountain, *Advances in Oil Spill Cleanup Lag Since Valdez*.

[150] Telephone Interview by Commission Staff with Scott Segal & Kevin Ewing, Bracewell & Giuliani (Oct. 14, 2010); Paul H. Rubin, *Why is the Gulf Cleanup so Slow?*; Patrik Jonsson, *A Whale to the Rescue: Can Super-Skimmer Turn Tide of Gulf Oil Spill?*, Christian Sci. Monitor (July 2, 2010).

The fifteen-parts-per-million regulation is grounded in international precedent,[151] and the Federal On-Scene Coordinator has the authority to waive the requirement during a spill.[152] Indeed, the On-Scene Coordinator did waive the requirement for Mr. Costner's technology and the *A Whale* during the Deepwater Horizon response. However, the Commission should consider whether the regulation should be revised with respect to testing of equipment that is not part of an actual spill response. If clean-up technology companies could more easily obtain an EPA "stamp of approval" to test decanting equipment that did not discharge 99.9985% oil-free water, this might break down another potential barrier to the development of new technology.

IV. Conclusion

The facts show that industry and the federal government underfunded response R&D, and, as a result, clean-up technology used during the Deepwater Horizon spill was dated and inadequate. But did this resource gap actually hinder the response? Would the Gulf of Mexico, Louisiana's marshes, and beaches in Alabama and Mississippi be cleaner today if industry and government had dedicated significant and sustained funding to response R&D since 1990?

Certain commentators and industry representatives have argued in public reports and to the Commission staff that more response R&D dollars would not have made much of a difference. According to this argument, R&D dollars are more efficiently directed toward prevention as well as containment technology that serves to prevent spills from occurring, rather than toward response technology that removes oil from water *after* a spill has occurred. According to a top executive at one of the major oil companies, "response is only a three to five percent solution."[153] Once a spill has occurred and oil is in the water, there is only so much technology can do. As one Coast Guard Admiral involved in the spill response told the Commission staff, "boom is not a panacea . . . . [The] [b]est way to capture the oil was always at the source."[154] Following this logic, available R&D dollars should be dedicated to prevention and containment because, as one member of the spill-response community put it, "you need to prevent the fire in the first place."[155]

The Commission staff believes that there are a number of flaws in this position. To summarize a few:

- Data shows that response was much more than a "three to five percent solution" for this spill. The government's Oil Budget Calculator released on November 23, 2010 indicates that burning, skimming, and chemical dispersion addressed a total of 24% (1.2 million

[151] *See supra* note 146.
[152] 40 C.F.R. § 122.3(d). The EPA's *Application for EPA Permits to Discharge Oil for Research Purposes, Interim Guidelines* "encourages the use of accidental spills (also known as 'spills of opportunity') for field testing. An average of more than 65 accidental oil spills greater than 40,000 gallons occur each year, some of which may be suitable tests of new spill response technologies. The Agency suggests that potential applicants for 40 CFR 110.5 permits work with the appropriate Regional Response Team (RRT) to explore the possibility of conducting research on accidental spills instead of intentional spills."
[153] Interview by Commission Staff with Oil Company Executive.
[154] Interview by Commission Staff with Coast Guard Admiral.
[155] Stephens, *Oil Industry Cleanup Organization Swamped by BP Spill*.

barrels) of the oil released from the wellhead.[156] Given the size of the disaster, additional investment in response R&D could well have paid a dramatic dividend in terms of oil recovered and protection of the environment (by, *e.g.*, skimmers and boom).

- An exclusive focus on prevention and containment is not an in-depth defense. Although there can be little doubt that "prevent[ing] the fire in the first place" is the top priority, suggesting that companies should invest in containment *instead of* response precludes a valuable redundancy. Given the profits generated by the oil and gas industry, industry and government can support *both* response and containment R&D.

- Commentary on the efficiency of response R&D spending is speculative. As discussed, neither industry nor the federal government has made significant investments in response R&D. The technology used in response to the Deepwater Horizon spill was largely the same technology deployed to clean up after *Exxon Valdez*. Thus, any argument about the limited potential of response technology is not based on experience. We simply do not know what kind of spill response solutions could result from a sizeable commitment by industry and government to response R&D.

- Promising response technologies were developed during the spill. With agencies, industry, and entrepreneurs intent on developing response technologies for the first time in twenty years, promising technologies were developed during the Deepwater Horizon spill response period. For example, the subsea application of dispersants, which had never before been attempted in an oil spill, appears to have been a qualified success. Robert Craft, the Mayor of Gulf Shores, Alabama, developed a beach cleaning machine that effectively scooped up tarballs and oil from beaches. BP ordered at least twenty of these machines.[157] One Coast Guard officer told Commission staff that certain response technology ideas submitted during the spill response will undergo testing at the Coast Guard's R&D facility in Connecticut.[158] And the list goes on. BP and the Coast Guard are reported to have received hundreds of clean-up technology business plans, and the Commission staff has received many business plans itself. The spill caused the once miniscule market for response technology to expand, albeit temporarily, and with this expansion came new technological developments.

The Commission staff believes that a multi-pronged approach to R&D spending is more desirable than focusing R&D resources solely on prevention and containment. The impacts of the Deepwater Horizon spill would have been mitigated by better clean-up technology. The federal government and industry must take the steps necessary to increase research funding and incentivize development so the *Exxon Valdez*-era skimmers and boom used in the Deepwater Horizon spill are replaced by more effective technology in the response to any subsequent Spill of National Significance. As the report for President Nixon's 1969 Panel on Oil Spills put it:

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[156] Federal Interagency Solutions Group, Oil Budget Calculator Science and Engineering Team, Oil Budget Calculator, Deepwater Horizon, Technical Documentation 39-40 (Nov. 2010), *available at* http://www.restorethegulf.gov/sites/default/files/documents/pdf/OilBudgetCalc_Full_HQ-Print_111110.pdf.
[157] Ryan Dezember, *BP Agrees to Buy Tractor-Pulled Beach-Cleaning Rigs for Gulf Shores*, Mobile Press-Register (June 8, 2010).
[158] Interview by Commission Staff with Coast Guard Captain.

"Adequate public funds must be provided, and these funds must be commensurate with the job that is to be done. Placing a man on the moon is a job which could not have been funded in the tens of millions of dollars. Although the development of a technology for handling oil spills in the open ocean is not the same order of magnitude as developing a technology to place a man on the moon or to build a nuclear energy system, the principle is the same."[159]

Suggestions for the Commission's Consideration:

- Public reports are correct: There is indeed a response R&D funding gap. Industry has committed little to no funding to in-house response R&D. Key OSROs are underfunded, and dedicate few if any resources to response R&D.

- The Commission may wish to recommend that language in the Oil Pollution Act be revised to guarantee the full oil spill research authorization provided for in the Act, as originally intended by Congress. The Commission may also wish to recommend an amendment to guarantee sustained and additional funding for OHMSETT.

- To stimulate the spill clean-up technology market and incentivize related R&D, the Commission may wish to recommend revisions to offshore drilling liability and insurance requirements; funding an incubator venture capital fund to invest in clean-up technology; and/or a spill technology R&D tax credit.

- To incentivize response R&D, the Commission may wish to recommend that Effective Daily Recovery Capacity regulations be revised to give companies the incentive to list and employ the most efficient recovery equipment.

- As additional response R&D incentives, the Commission may wish to recommend that the EPA streamline its permitting process for open-water testing and loosen its oiled-water discharge requirement for technology testing purposes.

[159] Office of Sci. & Tech., Exec. Office of the President, First Report of the President's Panel on Oil Spills, The Oil Spill Problem (1969), *reproduced at* the Richard Nixon Presidential Library (on file with Commission staff).

Appendix A

AGENCY OIL SPILL RESEARCH FUNDING																				
$ in millions																				
	1992	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
USCG	0.0	5.6	4.6	3.2	3.2	5.0	3.5	3.5	3.5	3.5	3.5	3.5	3.5	2.0	2.0	0.5	0.5	0.5	0.5	N/A
MMS	0.0	5.3	5.3	6.4	6.4	6.4	6.1	6.1	6.1	6.1	6.1	6.1	7.0	7.0	6.9	6.9	6.3	6.3	6.3	6.3
NOAA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	1.9	3.0	3.0	0.0	0.0	0.0	0.0
EPA	2.5	2.5	2.1	1.8	1.3	1.0	1.0	1.0	1.0	0.9	0.9	0.9	0.9	0.9	0.8	0.8	0.8	0.7	0.6	0.7
Total	**2.5**	**13.4**	**12.0**	**11.4**	**10.9**	**12.4**	**10.6**	**10.6**	**10.6**	**10.5**	**10.5**	**10.5**	**13.4**	**11.8**	**12.7**	**11.2**	**7.6**	**7.5**	**7.4**	**7.0**
Source: Congressional Research Service estimates; data provided to Commission staff by agencies.																				