Challenges to Cleaning Up Oil Spills in the Arctic

After the oil spill in the Gulf of Mexico, President Obama created the National Commission on the BP Deepwater Horizon Oil Spill and Offshore Drilling to investigate the causes of the offshore drilling disaster and to develop options to guard against, and cleanup, any oil spills associated with offshore drilling in the future. The Commission recently issued its final report and concluded that there are "serious concerns about Arctic oil-spill response, containment, and search and rescue."[1] In its report to President Obama, the Commission explained that when it comes to cleaning up an oil spill the Arctic creates "special challenges."

The Commission cautioned that oil-spill response methods used in other parts of the world cannot simply be transferred to the Arctic. The Commission urged the Bureau of Ocean Energy Management, Regulation and Enforcement (BOEMRE) to ensure that oil companies actually demonstrate that the proposed techniques and equipment can be deployed and will be effective when cleaning up oil in the Arctic.

The Commission also expressed concerns that current Coast Guard emergency response capabilities in the Arctic are very limited. The Coast Guard, for example, does not have sufficient ice-class vessels capable of responding to a spill under Arctic conditions: two of its three polar icebreakers have exceeded their service lives and are non-operational. The Commission explained that without a presence in the Arctic, it would be very difficult for the Coast Guard to conduct any emergency search and rescue operations in the region.

In light of these concerns, the Commission made three recommendations for action *before* the Department of the Interior decides whether drilling in a particular area is appropriate.

- Interior should ensure that oil companies have spill response plans that are adequate for each stage of development and that the underlying financial and technical capabilities have been effectively demonstrated in the Arctic.

- The Coast Guard and the oil companies operating in the Arctic should carefully delineate their respective responsibilities in the event of an accident, including search and rescue, and then must build and deploy the necessary capabilities.

- Congress should provide the resources to establish Coast Guard capabilities in the Arctic, based on the Coast Guard's review of current and projected gaps in its capacity.

Ultimately, the Commission warned that expanding oil and gas activities to the Arctic will require "the utmost care" and "the closest scrutiny, given the potential energy resources and the physical and environmental challenges of pursuing them safely."

The following pages briefly summarize some of the challenges of cleaning up oil in Arctic conditions.

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[1] National Commission on the BP Deepwater Horizon Oil Spill and Offshore Drilling, Deep Water The Gulf Oil Disaster and the Future of Offshore Drilling Report to the President (January 2011), *available at* http://www.oilspillcommission.gov/final-report.

Differences of Cleaning Up Oil in Icy Conditions

Cleaning up an oil spill in the ocean is difficult even under the best of circumstances. According to the National Academy of Sciences, "no current cleanup methods remove more than a small fraction of oil spilled in marine waters, especially in the presence of broken ice."

At the height of the Deepwater Horizon spill response, more than 6,500 response vessels worked on the cleanup efforts, with more than 3 million feet of containment booms and nearly 900 skimmers.[2] Despite these efforts, the estimates show that only 25 percent of the spilled oil was either recovered mechanically (directly at the wellhead (17 percent) and open-water skimming (3 percent)) or treated through burning (5 percent).[3]

Efforts to clean up an oil spill in the Arctic would be even less effective given the small number of vessels, boom and related response equipment Shell is proposing to use and the challenges of cleaning up oil in the Arctic. In the offshore, for example, Shell is proposing only one oil storage tanker; Shell has no back-up storage plan if this tanker breaks down or is damaged. With regard to nearshore cleanup, Shell only plans for three task forces with six work boats to protect the nearshore and shoreline environment in the Beaufort Sea in its "worst case discharge scenario." Arctic conditions further compromise Shell's ability to cleanup oil. According to Shell's spill response contractor, Alaska Clean Seas, the realistic maximum operating limits will be reduced by 80 percent effectiveness in October or near freeze-up.

Oil spilled into icy conditions also does not stay in one place; the oil moves with the ice. The oil can travel considerable distance either because it is trapped in ice or because it is carried by currents under the pack ice. A scenario developed in the mid-1980s for the Chukchi Sea estimated that spilled oil trapped in ice could move as much as 300 to 500 miles.

As the oil moves under ice floes or becomes encapsulated in surrounding ice it also becomes more difficult to locate the spilled oil. According to BOEMRE, the ability to detect and map oil trapped in, under, on, or around ice is critical to mounting an effective response in Arctic water.[4] Yet, BOEMRE admits it is difficult to detect spilled oil in icy conditions:

> "Spills in Broken Ice – It is not easy to detect and map spilled oil among drifting broken ice. New ice, oil and calm water make aerial observations difficult.
>
> Spills in and Under Ice – The detection and mapping of spilled oil encapsulated in and under ice is very difficult since the oil is hidden from view beneath a (generally) thick sheet of ice."[5]

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[2] Pew Environment Group, *Oil Spill Prevention and Response in the U.S. Arctic Ocean: Unexamined Risks, Unacceptable Consequences* 64 (2010) (Pew Report), *available at* http://www.pewtrusts.org/uploadedFiles/wwwpewtrustsorg/Reports/Protecting_ocean_life/PEW-1010_ARTIC_Report.pdf.

[3] Jane Lubchenco, et al., Deepwater Horizon Oil Budget: What Happened to the Oil? (Aug. 4, 2010) Figure 1, *available at* http://www.noaanews.noaa.gov/stories2010/PDFs/OilBudget_description_%2083final.pdf.

[4] U.S. Department of the Interior Minerals Management Service, Arctic Oil Spill Response Research and Development Program: A Decade of Achievement (2009) 11, *available at* http://www.boemre.gov/tarprojectcategories/PDFs/MMSArcticResearch.pdf (Decade of Achievement).

Mechanical Recovery – Booms and Skimmers

According to BOEMRE, using mechanical containment and recovery equipment like booms and skimmers in open water typically results in recovery of between "5 to 30 [percent]" of the spilled oil.[6]

In an environmental impact statement for the Beaufort Sea offshore leasing, BOEMRE explained that: "On average, spill-response efforts result in recovery of approximately 10-20 [percent] of the oil released to the ocean environment."[7]

In the *Exxon Valdez* spill response effort, the mechanical recovery rate was approximately 8 percent.[8]

In the *Deepwater Horizon* response effort, mechanical equipment only recovered 3 percent of the total amount of oil released.[9]

Mechanical recovery efforts are even less efficient when ice is present. Sea ice compromises the functionality of booms, skimmers and vessel operations and may limit or preclude the ability to operate certain kinds of vessels.[10]

In tests conducted in the Beaufort Sea during the spring and fall ice seasons in 2000, the maximum operation of the barge-based recovery system in sea ice conditions was zero to 1 percent in fall ice, 10 percent in spring ice without ice management, and 30 percent in spring ice with extensive ice management.[11]

BOEMRE admits that if mechanical efforts fail, it may be necessary to let the oil become incorporated into the ice and deal with it when the ice melts. This means a leaking well or unrecovered oil will be left uncontained all winter.

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[5] Decade of Achievement at 10.

[6] *Id*. at 15.

[7] Minerals Management Service, Alaska Outer Continental Shelf, Beaufort Sea Planning Area, Oil and Gas Lease Sales 186, 195, and 202, Final Environmental Impact Statement IV-17 (Feb. 2003), *available at* http://alaska.boemre.gov/ref/EIS%20EA/2003_001.pdf.

[8] D.A., Wolfe, , M.J. Hameedi, J.A. Galt, G. Watabayashi, J. Short, C. O'Clair, S. Rice, J. Michel, J.R. Payne, J. Braddock, S. Hanna, and D. Sale, The Fate of the Oil Spilled from the Exxon Valdez, 28 Env. Sci. & Tech. 13, 561A, 563A, 567A (concluding total recovery and/or disposal constituted only 14 percent) (1994).

[9] Jane Lubchenco, et al., Deepwater Horizon Oil Budget: What Happened to the Oil? (Aug. 4, 2010) Figure 1, *available at* http://www.noaanews.noaa.gov/stories2010/PDFs/OilBudget_description_%2083final.pdf.

[10] Pew Report at 75.

[11] *Id*. at 76.

Burning the Oil

Another spill response technique involves burning the oil from the surface of the water in a process called in-situ burning. Unlike mechanical recovery, burning does not remove the oil completely from the environment.[12] Oil also must be of a sufficient thickness or the oil will not ignite or maintain the burn. In cold temperatures, oil may burn more slowly or less completely. High winds can further compromise burning efficiency, while driving the smoky plume farther away from the burn site. Vessels must be able to tow and position booms to contain the oil to the desired thickness, and an ignition source must be safely deployed from a vessel or aircraft.[13] For these reasons, burning faces many of the same constraints as mechanical recovery.

Burning oil produces particulates, poly-cyclic aromatic hydrocarbons, volatile organic compounds, dioxins and dibenzofurans, carbonyls, carbon dioxide, carbon monoxide, sulfur dioxide, and other gases, which all have human health and ecosystem effects. [14]

Burning oil also produces potentially toxic burn residues. Floating burn residues may be ingested by birds, fish, and marine mammals and can adversely affect gills, feathers, fur, or baleen. Burn residues can sink to the ocean floor and threaten benthic species. [15]

Before the Deepwater Horizon oil spill, in-situ burning had not been widely used in actual spill response. As a result, our understanding of in-situ burning, especially in Arctic regions, is based primarily on experimental tests.[16]

Experimental studies are questionable predictors of burning in real-life conditions, because most studies involve pouring oil into a pre-staged containment area to the required thickness to allow the oil to burn. In an actual spill, responders have to boom and contain the oil quickly under emergency conditions.

When companies report burn efficiency rates, they are describing the percentage of the corralled oil that is burned – not the percentage of the total spill amount that is treated. For example, the burning operations during the Deepwater Horizon response included some highly efficient burns, yet burning was estimated to treat only 5 percent of the total spill amount.[17]

As with mechanical recovery, burning effectiveness is related to ice coverage. Both techniques are less effective in icy conditions. In fact, burn efficiencies in the presence of slush ice are lower than in open water and leave behind more residue.[18]

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[12] Pew Report at 77.
[13] Pew Report at 76-80.
[14] World Wildlife Fund, Not So Fast: Some Progress in Spill Response, but US Still Ill-Prepared for Arctic Offshore Development, A Review of U.S. Department of the Interior, Minerals Management Service's (MMS) "Arctic Oil Spill Response Research and Development Program – A Decade of Achievement" 11 (2009), *available at* http://www.worldwildlife.org/what/wherewework/arctic/WWFBinaryitem14712.pdf.
[15] *Id*.
[16] Pew Report at 79.
[17] *Id*.
[18] *Id*.

Chemical Dispersants

Dispersants are chemicals sprayed on oil slicks to break up the oil into smaller droplets in the water. Dispersants do not remove the oil from the water. They reduce the amount of surface oil that reaches and contaminates shoreline areas.[19]

During the Gulf of Mexico response, BP applied approximately 2 million gallons of chemical dispersants to break down the oil. Responders pumped almost 800,000 gallons underwater directly into the oil leaking from the well. Yet, chemical dispersants only treated 8 percent of the total spilled oil.[20]

Researchers at the National Marine Fisheries Service Auke Bay Laboratory in Juneau studied how Alaska North Slope crude oil disperses under a combination of sub-Arctic salinities and temperatures. The dispersants Shell proposes to use, Corexit 9500 and Corexit 9527, had an effectiveness of less than 40 percent for fresh oil and less than 10 percent for weathered oil. The researchers concluded that at the temperature and salinity most common in the estuaries and marine waters of Alaska, the effectiveness of dispersants was less than 10 percent.[21]

There is little understanding of the potential toxicities of applying dispersants especially in the Arctic. Chemically treated oil can be more toxic than untreated oil to some marine organisms. Researchers have also found that the oil residue left behind after a dispersant application may be more toxic than the untreated oil.[22]

In January 2011, the first peer reviewed study of dispersant application following the Deepwater Horizon found the subsea dispersants were not biodegrading as previously expected. The chemicals are staying in water. The long term effects of these dispersants on the marine environment is unknown. Shell has proposed using subsea dispersant application in the Arctic.

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[19] Pew Report at 80.
[20] Jane Lubchenco, et al., Deepwater Horizon Oil Budget: What Happened to the Oil? (Aug. 4, 2010) Figure 1, *available at* http://www.noaanews.noaa.gov/stories2010/PDFs/OilBudget_description_%2083final.pdf.
[21] Pew Report at 82.
[22] *Id*.