



Icebound. Alaska's outer continental shelf is the oil and gas industry's next frontier.

ENERGY

Despite Data Gaps, U.S. Moves Closer to Drilling in Arctic Ocean

Last week, the Department of the Interior (DOI) conditionally approved Shell Oil Co.'s plans to begin drilling four exploratory wells in the Arctic Ocean in 2012—a key step toward opening the Alaskan Outer Continental Shelf (OCS), one of the world's most pristine and inhospitable marine environments, to oil and gas development. In granting its approval, the DOI's Bureau of Ocean Energy Management, Regulation and Enforcement claimed it had found no evidence that Shell's proposed action would result in significant environmental harm.

Yet a 279-page report published just 2 months ago by the U.S. Geological Survey (USGS) reveals major uncertainties in the science needed to support oil and gas activities in the region. Prepared at the request of DOI Secretary Kenneth Salazar, the report takes no position on the advisability of granting oil companies access to the OCS. But its findings make clear that much about the way oil and gas activities might affect local ecology remains unknown, and it raises questions about whether oil companies can respond adequately to a major spill in the region.

So why did DOI give Shell the go-ahead? By limiting its assessment to Shell's short-term exploration plans, DOI didn't consider risks from long-term development, argues Robert Spies, president of Applied Marine Sciences, a consulting firm in Livermore, California, who was the federal government's chief scientist on the *Exxon Valdez* oil spill. "Risks from any one well might be insignificant," he says. "But cumulative

risks over the long haul might not be."

An estimated 27 billion barrels of oil and 130 trillion cubic feet of natural gas—nearly a quarter of remaining U.S. domestic reserves—lie buried offshore under the OCS. Since Shell began laying the groundwork for its current exploration plan in 2006, environmentalists and the oil industry have clashed repeatedly over when and how those resources might be extracted safely—a debate that has intensified in the wake of BP's recent disaster in the Gulf of Mexico, which eroded public confidence in the ability of oil companies to respond to a subsea blowout.

Compared with the Gulf of Mexico, the OCS poses daunting challenges for the oil industry. Heavy storms, sea ice, and fog make for difficult working conditions, and a late-fall or winter blowout could trigger a worst-case scenario: oil gushing for months under ice, much of it inaccessible to recovery



efforts. Given the region's isolation, disaster response would by necessity be mounted from great distances.

Even so, political and economic pressures to drill in the OCS are growing rapidly, especially with onshore yields from Alaska's Prudhoe Bay falling two-thirds from their peak in 1991, says Curtis Smith, a spokesperson with Shell Oil Co. in Anchorage. With nearly \$4 billion invested in offshore leases and research, Shell leads the charge toward the OCS, although it has faced repeated lawsuits and other barriers aimed at keeping it out. With DOI's approval, Shell's prospects for 2012 now look promising, although the company still needs air permits from the Environmental Protection Agency and approval for its marine mammals protection plan from the National Oceanic and Atmospheric Administration (NOAA).

Shell's current plan calls for drilling 10 exploratory wells in the region over 2 years: six at sites up to 240 kilometers offshore in the Chukchi Sea west of Barrow (Alaska's northernmost settlement) and four closer to land in the adjoining Beaufort Sea, to the east. DOI's approval pertains only to exploration plans for the Beaufort Sea; plans for Chukchi are held up by legal challenges. Smith says that exploration in the Beaufort Sea—performed to confirm the predicted size of an oil reservoir—poses little risk, as it will be done in summer and early fall, before the seas freeze over in October.

In their June report, USGS scientists considered the potential impacts of both near-term exploration and long-term development, when pumping the oil and moving it ashore via tankers and subsea pipelines would continue year-round, likely for decades. They identified data gaps in many key areas—including potential effects of climate change on drilling operations and how chemical dispersants work in ice-filled seas. Even when data exist, they may not always be available, says Brenda Pierce, a USGS program coordinator who co-authored the new report. "A lot of it isn't integrated in ways that make it as useful as it could be," she says.

Jacqueline Grebmeier, an arctic specialist at the University of Maryland's Center for Environmental Science in Solomons, agrees. OCS researchers have garnered "reams of physical and biological data," she says, but much of the information has not been digitized and remains buried in paper reports. They include studies by DOI's Outer Continental Shelf Environmental Assessment Program, which was launched in 1975 but wrapped up in the 1980s after falling oil prices doused companies' interest in costly

drilling off the Alaskan coast.

After a lull of nearly 2 decades, OCS research has picked up again, and today a range of industry, government, and academic projects are under way. But most of that work is “stove-piped,” Grebmeier says: run by specialists who rarely collaborate. “No one’s ever looked at the OCS from a system-wide perspective,” she says. “And the OCS is undergoing tremendous changes, so we need representatives from different fields gathered around the table talking to each other.”

One area that would benefit from such an approach, researchers agree, is beefing up measurements of ocean currents, crucial information for forecasting how an oil spill would spread should one occur. The data shortage is particularly acute for winter, says Grebmeier, who was not involved in the USGS report. Scientists can study the Chukchi and Beaufort seas during warmer seasons, she says. But because ice-breaking vessels are in short supply, winter data come chiefly from a few dozen scattered remote-sensing buoys.

Oceanographers have a reasonable understanding of circulation patterns during the ice-free season, says Tom Weingartner, a physical oceanographer at the University of Alaska, Fairbanks. What’s missing, he says, are data that resolve how competing forces influence currents. For instance, while prevailing currents move north in the Chukchi, prevailing winds push the sea’s surface waters south, Weingartner says. “And if the winds are really strong, subsurface and surface waters will move in opposite directions.” Meanwhile, near-shore currents in the Beaufort Sea move at barely a tenth of a knot, trapped under a wide stretch of so-called land-fast ice that extends for up to 64 kilometers offshore. “But we don’t understand how circulation patterns in the Beaufort change as you move across the shelf from land out to the deep ocean,” Weingartner says. And when ocean currents interact with ice, Grebmeier says, the results become wildly unpredictable.

The USGS report hammers home the need for more information about sea ice. Scientists don’t fully understand how ice affects oil weathering in the ocean, or how it might influence oil spill recovery, or how climate change might affect sea-ice cover over time.

The long-term questions are especially troubling to ecologists who’ve watched retreating sea ice in the OCS imperil some species of wildlife there. Walruses, for example, ordinarily rest and rear their young on ice floes over shallow waters, eating clams and other foods found on the sea floor. Recently, however, summer sea-ice has been retreating beyond the continental shelf toward deep



Vulnerable. Walruses (*left*), seabirds, and bowhead whales (*top*) that sustain subsistence hunting in Alaska face uncertain risks from oil and gas activities.

company plans to shut down its activities during approved subsistence hunts, limited to 40 animals a year. “And we’ve got an aggressive research program looking at bowhead migrations,” he says. “We’re also trying to understand the movements and behavior of all marine mammals around our operations.”

Experts differ on how much data is needed to make informed decisions, the USGS report acknowledges. Shell’s Macrander says the company knows enough to proceed safely with exploration during the open-water season and that it will continue to collect data—for instance, about how ocean dynamics in winter could affect the company’s development activities. Other scientists, including Alan Springer, a research professor at the University of Alaska, Fairbanks, insist there’s already sufficient evidence to conclude that offshore development in the OCS should never be allowed. And Henry Huntington, science director with the Pew Environment Group’s Arctic Program in Eagle River, Alaska, argues that scientific uncertainties suggest the need to slow down.

“At the very least, the DOI should come up with a plan for how it intends to address USGS’s recommendations,” Huntington says. “We need to know how we’re going to move from uncertainty to a better understanding of the ecosystem and how it might be affected by oil and gas development. I’m not talking about an endless process of study, but simply a sound, comprehensive, strategic plan for getting the information decision-makers need.”

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offshore waters. Now walruses are beaching themselves on Alaska’s coastline, in herds that can number up to 100,000.

Stanley Senner, director of conservation science at the Ocean Conservancy in Anchorage, worries that because scientists can’t predict the location of any future ice “refuges” that might persist in a warmer climate, oil companies run the risk of drilling near increasingly scarce walrus habitat. Another concern is that beached walruses might stampede toward water when spooked, trampling juveniles in the way. It’s not clear what drives the animals to stampede; perhaps noise, or maybe visual or even vibrational cues, says USGS ecologist Chadwick Jay.

An entire chapter of the USGS report is devoted to how industrial noise might threaten marine mammals. Scientists worry especially that it might divert bowhead whales from their traditional migrations, putting them beyond reach of Native Alaskans who’ve hunted the animals in sealskin boats for more than 2000 years. As the shyest of cetaceans, bowheads will travel up to 30 kilometers to avoid noises they don’t like. “Some of the proposed drill sites lie right in the middle of their migratory corridors,” says J. Craig George, a senior wildlife biologist with the North Slope Department of Wildlife Management in Barrow, Alaska. Michael Macrander, an environmental ecologist with Shell in Alaska, counters that the