

REPORT TO THE SECRETARY OF THE INTERIOR



REVIEW OF SHELL'S 2012 ALASKA OFFSHORE OIL AND GAS EXPLORATION PROGRAM

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I. Introduction

Last year, Shell attempted a long-planned exploratory drilling program offshore Alaska in the Beaufort and Chukchi Seas. Shell's goal for the summer drilling season was to confirm a major discovery of oil in commercially-viable quantities in the Alaskan Arctic Ocean.

Shell was not able to achieve its goal and did not complete any exploration wells last summer. The company experienced major problems with its 2012 program, some of which have been well-publicized. Shell's difficulties have raised serious questions regarding its ability to operate safely and responsibly in the challenging and unpredictable conditions offshore Alaska. As a result, Secretary of the Interior Ken Salazar ordered this review of Shell's 2012 Alaska offshore drilling program in the Beaufort and Chukchi Seas. The purpose of this review is to assess, at a high level, Shell's performance across all aspects of its 2012 Alaska offshore exploration program, identify key lessons to be learned from Shell's experience, and make recommendations applicable to any future exploration drilling operations that may be proposed for the Arctic Outer Continental Shelf (OCS). The Secretary directed that this report and its accompanying findings and recommendations be completed within 60 days.¹

This review has confirmed that Shell entered the drilling season not fully prepared in terms of fabricating and testing certain critical systems and establishing the scope of its operational plans. The lack of adequate preparation put pressure on Shell's overall operations and timelines at the end of the drilling season. Indeed, because Shell was unable to get certified and then deploy its specialized Arctic Containment System (ACS) – which the Department of the Interior (DOI) required to be on site in the event of a loss of well control – the company was not allowed to drill into hydrocarbon-bearing zones. Shell's failure to deploy the ACS system was due, in turn, to shortcomings in Shell's management and oversight of key contractors. Likewise, additional problems encountered by Shell – including significant violations identified during United States Coast Guard's (USCG) inspection of the *Noble Discoverer* drilling rig in Seward last November, the lost tow and grounding of the *Kulluk* rig near Kodiak Island in late December, and violations of air emission permits issued by the Environmental Protection Agency (EPA) – also indicate serious deficiencies in Shell's management of contractors, as well as its oversight and execution of operations in the extreme and unpredictable conditions offshore of Alaska.

Although Shell's difficulties prevented the company from fully executing its drilling plans last summer, the company successfully completed some important elements of its drilling program. In particular, Shell succeeded in drilling “top hole” sections of two wells in the Arctic Ocean, and it did so safely without any significant injuries to workers or spills. Shell employed weather forecasting and ice management systems that enabled it to respond effectively to changing sea ice conditions, including the encroachment of a major ice floe on Shell's Burger A well site in the Chukchi Sea. Shell also coordinated well with Alaska Native communities and subsistence hunters, even under circumstances that delayed its drilling program in the Beaufort Sea.

¹ Department of the Interior, “Secretary Salazar Launches Expedited Assessment of 2012 Arctic Operations,” January 8, 2013. <http://www.doi.gov/news/pressreleases/secretary-salazar-launches-expedited-assessment-of-2012-arctic-operations.cfm>

Because of the difficulties that Shell encountered in conducting its drilling program during the summer of 2012, the review team recommends that Shell make certain affirmative showings before it is allowed to resume its drilling program in the Arctic. Those undertakings are set forth below. In light of Shell's announced pause in its Alaska offshore program, in order to "prepare equipment and plans for a resumption of activity at a later stage," DOI expects that Shell will be able to complete these undertakings on a timely basis and in advance of its next proposed drilling season.²

1. **Development of a Comprehensive and Integrated Operational Plan.** Shell should submit to DOI a comprehensive, integrated plan that describes its future drilling program and related operations, including detailed information about the program's vessel and equipment configurations, the overall preparation schedule including contractor work on critical components, mobilization schedule, in-theater drilling program objectives and timelines for each objective, preparation and staging of spill response assets, and plans for demobilization and offseason repair and maintenance following the drilling season.
2. **Third-party Management Systems Review.** Shell should commission and complete a full third-party audit of its management systems, including, but not limited to, its Safety and Environmental Management Systems (SEMS) program, with particular focus on ensuring that the management and oversight shortcomings identified with respect to all aspects of the company's 2012 operation have been addressed and that the company's management structure and systems are appropriately tailored to Shell's Arctic exploration program.

DOI has been – and continues to be – supportive of industry's efforts to evaluate the offshore oil and gas resource potential on the Alaskan OCS. The Department has insisted, however, that activities proceed with caution and respect for the extreme and unpredictable conditions found offshore Alaska. This review, and the recommended undertakings expected of Shell before it returns to exploration activity in the Beaufort and Chukchi Seas, are consistent with the Department's cautious approach to offshore oil and gas exploration in the Arctic.

II. Findings and Recommendations

Secretary Salazar directed Tommy P. Beaudreau, the Director of the Bureau of Ocean Energy Management (BOEM) and Principal Deputy Assistant Secretary for Lands and Minerals Management at the Department of the Interior (DOI), to lead this review. Key members of the review team included Director James A. Watson of the Bureau of Safety and Environmental Enforcement (BSEE), senior leadership from BOEM and BSEE headquarters and regional staffs, and a technical advisor from the USCG. DOI retained the international consulting firm PricewaterhouseCoopers LLP (PwC) to provide expertise and support in reviewing issues related to safety and operational management systems. The review team received significant participation and contributions from the Federal agencies involved, along with DOI, in overseeing Shell's 2012 activities, including the National Marine Fisheries Services (NMFS), the

² "Shell announces pause in Alaska drilling program," Feb. 27, 2013.
<http://www.shell.us/aboutshell/projects-locations/alaska/events-news/02272013-alaska.html>.

National Weather Service (NWS) and others at the National Oceanic and Atmospheric Administration (NOAA); the USCG; EPA; and the U.S. Fish and Wildlife Service (USFWS).

Shell cooperated with this review. Among other things, Shell personnel made presentations to, and were interviewed by, the review team in Washington, DC; Anchorage, Alaska; Seattle and Bellingham, Washington; and Houston, Texas. During these discussions, Shell personnel were forthcoming about their perspectives on the 2012 operations and lessons they have drawn from the experience. Shell also made documents and materials available for the review. The review team also met with personnel from some of the key contractors that Shell retained for work related to its Alaska operations.

The involvement of Alaskans was extremely important to this review. The State of Alaska and its people, including Alaska Natives living on the North Slope, have a direct and strong interest in ensuring that any oil and gas operations and maritime activity offshore Alaska is conducted safely and responsibly. The review team met with representatives from the State of Alaska, including high-level officials in the State's Department of Natural Resources and Department of Environmental Conservation, and members of the Alaska State Legislature. The review team also met with the Mayor of the North Slope Borough, representatives from the Arctic Slope Regional Corporation, and leadership from the Inupiat Community of the Arctic Slope. Senior leaders from DOI, NOAA, USCG and EPA discussed Shell's 2012 operations, and received direct input from the Alaskan Native whaling community, during the Alaska Eskimo Whaling Commission's (AEWC) convention in Barrow in February.

The review also sought information and perspectives from a broad range of other stakeholders and experts. The team met with representatives from the oil and gas and maritime industries working in Alaska, and also received substantial input from a broad range of conservation non-governmental organizations, both in Alaska and in Washington, DC.

This review has identified seven key principles and prerequisites for safe and responsible offshore exploration drilling in the Alaskan Arctic – five applying to industry and two relevant to government oversight. As discussed in detail in this report, in 2012 Shell fell short of successfully addressing all but the last of these principles.

- 1. All phases of an offshore Arctic program – including preparations, drilling, maritime and emergency response operations – must be integrated and subject to strong operator management and government oversight.**

Arctic offshore operations are extremely complex, and there are substantial environmental challenges and operational risks throughout every phase of the endeavor, including preparations, mobilization, in-theater drilling operations, emergency response and preparedness, and de-mobilization.

As discussed below, Shell experienced significant problems during phases of the operation that were outside of the core drilling-related competencies devoted to the project, including during the fabrication of critical systems such as the ACS and maritime operations such as the *Kulluk* tow. Thus, although Shell generally performed safely while in-theater conducting drilling operations, and while subject to intense regulatory oversight, it is clear that all phases of an offshore exploration operation in Alaska must be managed and overseen as an

integrated endeavor and subject to robust and direct operator management and government oversight.

2. Arctic offshore operations must be well-planned, fully ready and have clear objectives in advance of the drilling season.

Because of the inherent geographic, logistical and environmental challenges associated with working on the Arctic OCS, the operating plan and objectives of any offshore Arctic program must be well-planned and designed to provide operational clarity, while also allowing for ample flexibility in light of variable and changing conditions and the need for safe demobilization.

In contrast, Shell entered the 2012 drilling season with substantial uncertainty about the readiness of critical systems such as the ACS and air emission controls, as well as its timelines and operational objectives for the open water drilling window. These uncertainties, and the resulting delays, led to pressure on safety-related deadlines at the end of the season, and contributed to Shell's request to extend, by up to nearly three weeks, the period in which it would be allowed to drill in hydrocarbon-bearing zones beyond the original September 24 cessation date set by BOEM.³ There should be no loose ends or unnecessary improvisation with critical equipment, assets or drilling plans once operations are scheduled to begin.

3. Operators must maintain strong, direct management and oversight of their contractors.

Arctic offshore operations are complex and require operators to bring to bear equipment, systems and personnel with capacity across a broad set of specializations and competencies, some of which must be supplied by contractors. Rigorous and effective operational management is extremely important to establishing sound oversight and internal process management. Moreover, operators must tailor their management and oversight programs to Arctic conditions, and the programs must cover preparations in advance of the drilling season and maritime operations as well in-theater drilling operations.

A recurring theme from Shell's 2012 experience is that there were significant problems with contractors on which Shell relied for critical aspects of its program – including development of the ACS, the air emission mitigation technology applied to the rigs' engines, the condition of the *Noble Discoverer*, and the *Kulluk* towing operation.

4. Operators must understand and plan for the variability and challenges of Alaskan conditions.

Reliable weather and ice forecasting play a significant role in ensuring safe operations offshore Alaska, including but not limited to the Arctic. Robust forecasting and tracking technology, information sharing among industry and government, and local experience are

³ As discussed below, in response to Shell's request to adjust the end of season deadline, NOAA prepared a sophisticated analysis forecasting probabilities of the freeze-up date in the Chukchi Sea. This analysis did not support the adjustment Shell proposed, and freeze-up ultimately occurred around November 1 as originally projected by BOEM. However, Shell's request to extend the approved period for drilling in hydrocarbon-bearing zones was rendered moot by the failure of the ACS containment dome test (the deployment of which in the Arctic was a prerequisite to entering any hydrocarbon-bearing zones), and BOEM did not act on Shell's request.

essential to managing the substantial challenges and risks that Alaskan conditions pose for all offshore operations.

The weather forecasting and ice management systems Shell employed daily during drilling operations in the Arctic were one of the strengths of its program. As experienced during the *Kulluk* tow incident, however, Alaska's weather changes quickly and produces hurricane-force winds and extremely dangerous sea conditions.

5. Respect for and coordination with local communities.

Alaska Native communities on the North Slope are closely connected to the Arctic Ocean culturally, socially and economically. It is commonly said in Alaska Native communities that “the ocean is our garden,” which illustrates the importance of subsistence hunting and fishing, including whaling, to North Slope villages. At the same time, many on the North Slope recognize, and hope to benefit from, the economic and employment opportunities that offshore oil and gas exploration may offer. Accordingly, it is imperative that offshore exploration in the Arctic be harmonized with the needs of North Slope communities, including traditional subsistence use. Moreover, it is an operator's safety and environmental performance that is the ultimate measure of how well and responsibly the company works with North Slope communities and Alaska Natives.

As discussed below, Shell performed well in many aspects of coordinating with Alaska Native and local communities, including abiding by the company's Conflict Avoidance Agreement (CAA) with the AEWC under challenging operational circumstances.

A. Recommended Undertakings by Shell

Based on these findings and as discussed above, the review team has identified two specific undertakings that Shell should complete before the company proceeds with additional offshore exploratory drilling activity in future seasons. First, Shell should develop, and submit to DOI, a comprehensive and integrated operational plan describing in detail its future drilling program. Second, Shell should commission and complete a full third-party audit of its management systems.

B. Government Oversight

This report also defines important principles for government oversight of offshore drilling activity in the Arctic that must be carried forward and further developed. These include, in particular, (1) the importance of continued close coordination among government agencies in the permitting and oversight process, and (2) the need to continue to develop and refine standards and practices that are specific to the unique and challenging conditions associated with offshore oil and gas exploration on the Alaskan OCS.

1. Continued strong coordination across government agencies is essential.

The Federal government – including DOI, NOAA, USCG, EPA and others – engaged in a robust and unprecedented level of interagency coordination, information-sharing and cooperation related to the regulatory approval process and oversight of Shell's 2012 program. This process, which is being applied to Federal oversight of all major Alaskan energy issues

through the Alaska Interagency Working Group established by Presidential Executive Order 13580, led to the more efficient and effective reviews of permits and approvals, stronger oversight of Shell's operations, better communication with local communities, greater awareness by Federal agencies of activities potentially impacting their areas of responsibility, and more efficient use of limited Federal resources. Still, the intensity of the regulatory review process and the devotion of substantial assets by DOI, USCG, NOAA and others to oversee Shell's 2012 program caused significant strain on Federal resources, especially in Alaska. Public engagement by Federal agencies, including providing as much transparency and opportunity for public input as reasonably possible, is also important. This is an area of success from the 2012 experience that should be carried forward and improved upon in the future.

2. Industry and government must develop an Arctic-specific model for offshore oil and gas exploration in Alaska.

As Shell's 2012 experience has made absolutely clear, the Arctic OCS presents unique challenges associated with environmental and weather conditions, geographical remoteness, social and cultural considerations, and the absence of fixed infrastructure to support oil and gas activity, including resources necessary to respond in the event of an emergency. Shell's 2012 drilling program was subject to a number of Arctic-specific conditions and standards – including, among others, deployment of subsea containment systems as a prerequisite to drilling into hydrocarbon-bearing zones, limitations on the Chukchi Sea drilling season to provide time for open-water emergency response, a blackout on drilling activity during the subsistence hunts in the Beaufort Sea, and deploying pre-laid boom around vessels during fuel transfers.⁴ Shell also undertook additional measures, such as agreeing to transport out drilling muds and cuttings from its Beaufort Sea operation instead of discharging them into the ocean.

Examples include: (1) access to systems with the ability, in the event of a loss of well control, to cap the well and contain hydrocarbons at the source of the discharge; and (2) the availability of a rig, located in the Arctic, that is capable of promptly drilling a relief well. Both of these areas are fundamental to safe and responsible operations in the Arctic, where existing infrastructure is sparse, the geographical and logistical challenges of bringing equipment and resources into the region are daunting, and the time available to mount response operations is limited by changing weather and ice conditions at the end of the season.

Government and industry should continue to evaluate the potential development of additional Arctic-specific standards in the areas of drilling and maritime safety and emergency response equipment and systems. The United States has a leading role among Arctic nations in establishing appropriately high standards for safety, environmental protection and emergency response governing offshore oil and gas exploration in the Arctic Ocean. It is incumbent, therefore, on the United States to lead the way in establishing an operating model and standards tailored specifically to the extreme, unpredictable and rapidly changing conditions that exist in the Arctic even during the open water season.

Finally, DOI should encourage operators working in the Arctic to enter into resource sharing and mutual aid agreements to provide each other with access to operational and

⁴ These Arctic-specific standards applied to Shell's 2012 Beaufort and Chukchi Seas program are discussed throughout the report, including at Section III.C. below.

emergency response resources. The traditional operator-specific, “go it alone” model common with exploration programs in other regions is not appropriate for Arctic offshore operations. A cooperative, consortium-based model offers potential logistical and commercial efficiencies, as well as safety and environmental advantages through the reduction of cumulative operational risks and footprints (including air emissions). Following the *Deepwater Horizon* blowout and spill and after DOI’s establishment of clear guidance requiring subsea containment in support of all deepwater drilling operations, industry pulled together resources, equipment and expertise to establish consortia designed to provide offshore operators with access to critical safety and emergency response equipment, such as capping stacks and other equipment necessary to respond to a subsea blowout. Arguably the need for mutual assistance and resource sharing covering both operational and emergency response assets and resources may be even greater in the Arctic.

III. Background

The oil and gas industry’s interest in the Arctic OCS is driven by the region’s substantial resource potential. BOEM estimates that the Chukchi Sea Planning Area may hold more than 15 billion barrels of technically recoverable oil and nearly 78 trillion cubic feet of technically recoverable natural gas, which is second only to the Central Gulf of Mexico in terms of resource potential offshore the United States. The Beaufort Sea also has significant resource potential – an estimated 8 billion barrels of oil and nearly 28 trillion cubic feet of natural gas.⁵

Other Arctic countries are moving forward with offshore oil and gas exploration in the Arctic Ocean, including Russia, Norway, Canada, Denmark (including Greenland and the Faroe Islands), and Iceland. Proven offshore oil and gas fields have been found along Russia’s vast Arctic shelf in the Barents, Pechora and Kara Seas, although there has been no significant offshore oil and gas production in the Russian Arctic to date. Chevron operates two exploration licenses in the Canadian Beaufort Sea, and in 2012 Chevron undertook an exploratory seismic program there. The Norwegian Arctic is seen as a possible source to replace declining output from mature fields in the North Sea. For example, Norway recently announced that the Norwegian portion of a formerly disputed area with Russia in the Barents Sea could hold an estimated 1.9 billion barrels of oil equivalent, an increase of 15 percent from previous estimates. In 2010, Greenland drew significant attention by awarding seven oil and gas exploration licenses in Baffin Bay, and additional licenses are expected to be awarded off eastern Greenland in 2013.

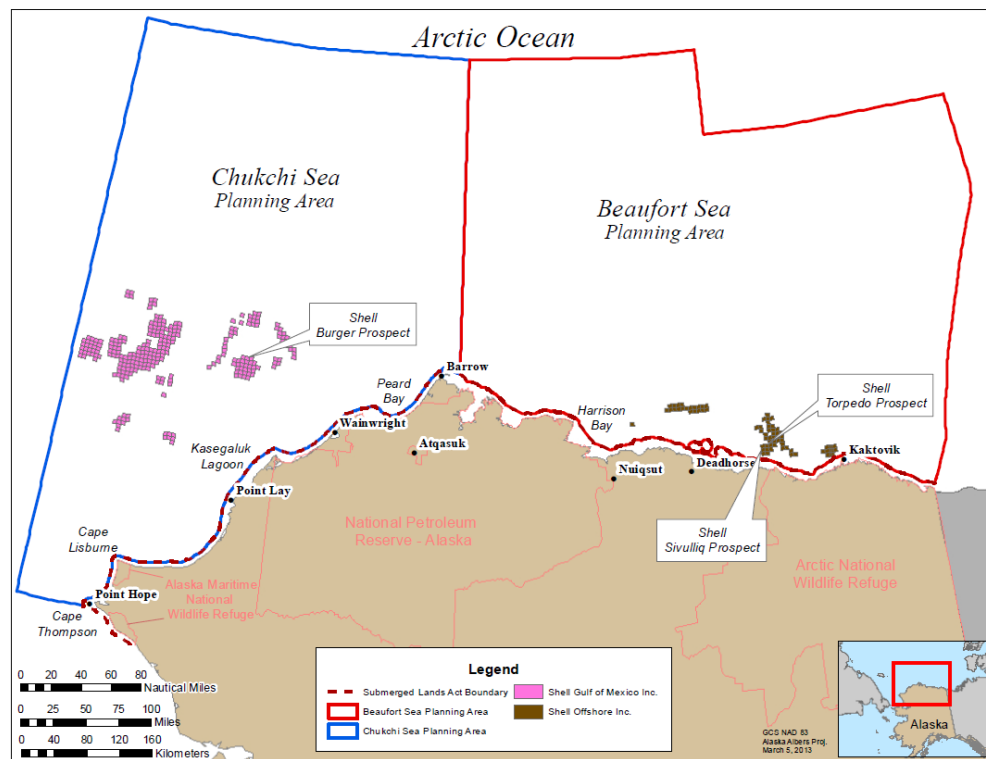
The United States is at the forefront in evaluating the economic and energy potential of safe and environmentally responsible offshore oil and gas development in the Arctic, as well as the multitude of challenges facing the region, including the consequences of rapid climate change. It is essential that the United States understand the resource potential of the Arctic, and offshore oil and gas exploration has a role in developing that understanding. However, exploration must be conducted cautiously, safely, and responsibly in relation to the sensitive Arctic environment and the Alaska Natives who are closely connected to the Arctic Ocean for subsistence and fundamental aspects of their culture and traditions.

⁵ BOEM Assessment of Undiscovered Technically Recoverable Oil and Gas Resources of the Nation’s Outer Continental Shelf, 2011.

For example, in July 2011 the President signed Executive Order 13580, establishing the Interagency Working Group on Coordination of Domestic Energy Development and Permitting in Alaska.⁶ The working group is chaired by Deputy Secretary of the Interior David J. Hayes, and is designed to promote interagency coordination “for the safe, responsible, and efficient development of oil and natural gas resources in Alaska...while protecting human health and the environment, as well as indigenous populations.” The Alaska Interagency Working Group was also closely involved in coordinating Federal regulatory and oversight efforts leading up to the 2012 drilling season. These coordinating efforts embodied at a high level the major, and in many respects unprecedented, focus that the Federal government placed on the review and oversight of Shell’s Arctic drilling program, which is discussed further below.

A. History of Leasing and Exploration in the Arctic OCS

Most of the exploration wells in Federal waters in the Beaufort and Chukchi Seas were drilled during the late 1970s through the mid-1980s. Prior to this past summer, only three exploratory wells had been drilled in the Alaska OCS in the past 18 years, the most recent in 2003 near Prudhoe Bay in the Beaufort Sea. Below is a map of Shell’s leases in the Beaufort Sea and Chukchi Sea OCS Planning Areas as well as the location of prospects Shell included in its 2012 exploration program.



⁶ Exec. Order No. 13,580, “Interagency Working Group on Coordination of Domestic Energy Development and Permitting in Alaska,” July 12, 2011.

1. The Beaufort Sea OCS Planning Area

The majority of offshore exploration activity in the Arctic OCS has taken place in the Beaufort Sea, primarily near Prudhoe Bay, which has supported oil and gas activity since the late 1960s. Prior to last summer, industry had drilled a total of 30 exploratory wells in Federal waters in the Beaufort Sea, mainly in water depths of approximately 100 feet or less, with Shell drilling or partnering on eleven of those wells. In the 1980s, the Union Oil Company, in partnership with Shell and Amoco, drilled two exploration wells at the Hammerhead prospect, which since has been renamed Sivulliq. Although oil was discovered at Hammerhead, the companies determined that the prospect was uneconomic to develop at that time, and the leases were relinquished in 1998.

Shell currently owns or has an interest in approximately 138 leases in the Beaufort Sea Planning Area. At present, Shell is focused on exploration in the Camden Bay area, which includes its Sivulliq prospect located in the western portion of Camden Bay about 45 miles east of Cross Island, as well as the nearby Torpedo prospect. Shell has conducted multi-year 3D seismic surveys, shallow hazard surveys, and environmental and ecological impact studies in this area in preparation for offshore exploration drilling.

2. The Chukchi Sea OCS Planning Area

BOEM estimates that the Chukchi Sea, which comprises the western side of the United States' Arctic Ocean, holds more undiscovered technically recoverable oil and natural gas than any other OCS planning area except for the Central Gulf of Mexico. Federal waters in the Chukchi Sea have a more limited history of leasing and exploration than the Beaufort Sea. Between 1989 and 1991, Shell drilled four exploration wells in the Chukchi Sea at its Burger, Klondike, Crackerjack, and Popcorn prospects. Chevron drilled a fifth exploration well at the Diamond prospect. All of the wells resulted in the discovery of hydrocarbons, although none was considered commercial for development at the time. All of the leases under which these five exploration wells were drilled have expired.

Chukchi Sea Oil and Gas Lease Sale 193, held in 2008, reflected renewed industry interest in the Arctic OCS and resulted in 487 leases sold for approximately \$2.7 billion. Shell alone purchased 275 Chukchi Sea leases for about \$2.1 billion. The areas with previous hydrocarbon discoveries remain among the most desirable for further exploration, with Shell's 2012 Chukchi Sea exploration program concentrating on the Burger prospect. Shell acquired all of its current Chukchi Sea leases in Sale 193.

A group of non-governmental environmental organizations and certain North Slope communities challenged the legality of Sale 193. In July 2010, the Federal District Court for Alaska remanded Sale 193 to DOI to address specific deficiencies related to the National Environmental Policy Act (NEPA) analysis conducted in advance of the lease sale. The Court also enjoined activities under the Sale 193 leases, which barred the leaseholders, including Shell, from conducting, among other things, exploration drilling in the Chukchi Sea OCS. In response to the Court's remand, BOEM prepared a Supplemental Environmental Impact Statement (SEIS) addressing the specific deficiencies identified by the Court, as well as providing an updated risk assessment in light of the *Deepwater Horizon* oil spill, and including an additional analysis of the potential impacts of a very large oil spill in the region. Following completion of the SEIS, DOI

affirmed Sale 193 in October 2011. The Court lifted the injunction on October 26, 2011, which allowed Shell to proceed with the submission to BOEM of a Chukchi Sea exploration plan.

B. Background Regarding Shell's Arctic Exploration Program

Shell's Chukchi Sea and Beaufort Sea exploration programs evolved over the course of a number of years and in response to changes in regulatory and operational requirements, legal challenges, and lessons learned from the *Deepwater Horizon* oil spill.

1. The Beaufort Sea Program

Shell submitted a Beaufort Sea exploration plan in 2007, which the Minerals Management Service (MMS) approved.⁷ The plan was met with legal challenges by environmental organizations, the North Slope Borough, and the AEW. In May 2009, Shell submitted a revised exploration plan proposing to drill two exploration wells in the Camden Bay area during the 2010 drilling season, which MMS approved in October 2009. Shell never submitted an application for permit to drill (APD) under the 2010 Beaufort Sea exploration plan.⁸

In October 2010, Shell submitted an update to its Beaufort Sea exploration plan that proposed exploration drilling at the Sivulliq prospect during the summer of 2011. In February 2011, Shell withdrew from pursuing exploration drilling in the Beaufort Sea during the 2011 season, citing difficulties in obtaining the requisite air permits. Shell then turned to planning, and working to obtain the necessary approvals, for proposed exploration activity during the 2012 season. In May 2011, Shell submitted a revised Beaufort Sea exploration plan for the 2012 season, and ultimately received conditional approval from BOEM.

2. The Chukchi Sea Program

In May 2009, along with its Beaufort Sea program, Shell submitted an exploration plan proposing drilling in the Chukchi Sea during the 2010 season, which MMS approved in December 2009. This plan proposed drilling up to three wells at three different Chukchi Sea prospects – Burger, Crackerjack, and Shoebill. Shell submitted one preliminary APD for a well in the Chukchi Sea during the 2010 season. However, in the midst of the ongoing response to the *Deepwater Horizon* blowout and oil spill in the Gulf of Mexico, Shell withdrew this APD in early June 2010 and did not move forward with exploration drilling offshore Alaska in 2010.⁹

⁷ MMS was abolished by Secretarial Order in May 2010. The Bureau of Ocean Energy Management, Regulation and Enforcement (BOEMRE) replaced MMS from May 2010 through September 2011 while DOI implemented a comprehensive reorganization and strengthening of Federal offshore energy oversight in the wake of the *Deepwater Horizon* oil spill. The reorganization was completed on October 1, 2011 with the establishment of BOEM and BSEE.

⁸ As discussed below, Shell submitted, and then withdrew, an APD to drill an exploration well in the Chukchi Sea during the 2010 season.

⁹ As discussed in Section IV.A. below, in May 2010, Shell committed to developing and deploying a subsea containment system in support of its Arctic exploration program, based on lessons from the *Deepwater Horizon* incident. On June 24, 2010, Shell requested that DOI issue directed suspensions of its leases in the Beaufort and Chukchi Seas. Later in 2010, the State of Alaska filed a lawsuit in Federal District Court in Alaska claiming that

Although Shell submitted an updated Beaufort Sea exploration plan for the 2011 season, it was unable to propose any exploration drilling in the Chukchi Sea during the summer of 2011 because of the Court-ordered injunction that was imposed in June 2010. As discussed above, the Court lifted its injunction of activity under the Sale 193 leases in October 2011, after which BOEM proceeded with its review of Shell's revised 2012 Chukchi Sea exploration plan for exploration drilling at the Burger prospect.

C. Overview of Federal Regulatory Approvals for the 2012 Season

In order to move forward with its Alaska offshore exploration program in 2012, Shell engaged with agencies across the Federal government to pursue approvals under a host of statutory and regulatory authorities. On March 26, 2012, Shell also signed a CAA with the AEWG designed to manage and mitigate conflicts with North Slope communities' subsistence activity in the Beaufort Sea, where Shell's proposed Camden Bay drilling sites are in close proximity to the bowhead whale migrations. This section briefly describes the various Federal authorities governing offshore oil and gas exploration on the Arctic OCS, and Shell's work to obtain regulatory approvals leading up to the 2012 season. As described above, the Alaska Interagency Working Group promoted an unprecedented level of close communication and coordination across the relevant Federal agencies involved in reviewing, and then overseeing, Shell's 2012 Alaska offshore exploration program.

1. The Exploration Plans

The OCS Lands Act authorizes DOI to grant leases for the exploration, development and production of oil and natural gas on the OCS, which is generally defined as the submerged lands beyond three miles off each coastal state. In order to propose exploration drilling under a lease, an operator must submit an exploration plan to BOEM that describes the proposed activities and their timing, and provides detailed information about, among other things, the drilling rig, the location of each proposed well and the potential onshore and offshore environmental impacts that may occur as a result of the activity proposed under the plan. BOEM conducts a regulatory review of the exploration plan, as well as an environmental review under NEPA, to ensure that the activities meet standards for safe and environmentally responsible operations. As discussed below, the review of Shell's 2012 Chukchi Sea and Beaufort Sea exploration plans resulted in the imposition of a number of Arctic-specific conditions and mitigation measures that governed Shell's drilling operation program.

Shell's Beaufort Sea exploration plan describes drilling up to four exploration wells, beginning in the 2012 drilling season and continuing into subsequent seasons, in the Camden Bay area about 20 miles offshore and in waters approximately 120 feet deep. On August 4, 2011, BOEM approved Shell's revised Camden Bay exploration plan for the Beaufort Sea subject to eleven conditions.¹⁰ These conditions included, among other things, requirements that Shell (1) obtain specific permits and authorizations from BSEE, EPA, NMFS and USFWS; (2)

DOI had imposed a "moratorium" on Arctic offshore drilling, which DOI denied by pointing out, among other things, Shell never submitted any APDs for the Beaufort Sea and withdrew the Chukchi Sea APD. On January 26, 2011, the Court granted summary judgment in DOI's favor and dismissed the State's case.

¹⁰ Approval letter from BOEMRE to Shell, dated Aug. 4, 2011, attached at Tab 1.

confirm the staging and location of a relief well rig; (3) conduct a field exercise demonstrating the company's ability to deploy its capping and containment system; and (4) suspend any exploratory drilling operations in the Beaufort Sea by August 25 and not resume activity until after subsistence whalers from the Alaska Native villages of Nuiqsut and Kaktovik completed their subsistence hunts and Shell received BOEM's approval to resume.¹¹

Shell's Chukchi Sea exploration plan proposed drilling up to six exploration wells beginning in the 2012 drilling season and continuing over multiple seasons. The well sites are located about 85 miles northwest of the coastal village of Wainwright, in waters approximately 140 feet deep. On December 16, 2011, BOEM approved Shell's revised Chukchi Sea exploration plan subject to fifteen conditions.¹²

In addition to containing similar conditions as the Camden Bay exploration plan approval with respect to permits and authorizations, successful deployment testing of the capping and containment system and relief well operations, BOEM established Condition 4 governing when Shell would be required to stop drilling in hydrocarbon-bearing zones at the end of the drilling season. Under Condition 4, BOEM required Shell to cease drilling into hydrocarbon-bearing zones within 38 days of a "trigger date" of November 1, established by BOEM based on analysis of historical data from 2007 to 2011 regarding the date of first ice encroachment over the proposed Burger drill site. Condition 4 was designed to provide time for open water emergency response in the event of an incident occurring near the end of the drilling season. Based on the November 1 trigger date, Shell was required to stop drilling in hydrocarbon-bearing zones by September 24. However, BOEM provided for the possibility of adjusting the trigger date – either earlier or later – based on reliable, scientific ice forecasting data capable of predicting with a high degree of certainty when ice would likely encroach on the drill site.¹³ While Condition 4 operated to limit the end of the season when Shell would be able to drill into hydrocarbon-bearing zones, Shell would be permitted to conduct other activities, including drilling short of hydrocarbon-bearing zones, up to October 31.

2. Air Permits

The Clean Air Act authorizes EPA to develop and enforce regulations that protect the public from airborne contaminants known to be hazardous to human health. EPA requires operators to obtain permits prior to emitting regulated pollutants at quantities above established thresholds, and each permit typically contains pollution control, monitoring, and reporting requirements. EPA has exercised jurisdiction over OCS sources in the Beaufort and Chukchi Seas since 1990.¹⁴ EPA regulations define an OCS source to include drilling vessels while they

¹¹ *Id.*

¹² Approval letter from BOEM, dated Dec. 16, 2011, attached at Tab 2.

¹³ *Id.*

¹⁴ In December 2011, Congress transferred authority for air pollution control for the Beaufort Sea OCS and Chukchi Sea OCS from EPA to BOEM. Under an exception for pending or existing permits, EPA retains the responsibility for implementing and enforcing the permits for Shell's exploration operations in the Beaufort and Chukchi Seas, but future regulation of emissions from new oil and gas exploration or production activities in the Beaufort and Chukchi Seas will be the responsibility of BOEM.

are attached to the seafloor, along with other associated support vessels within 25 miles of a drilling vessel that is attached to the seafloor.

The air permit process related to Shell's Alaska exploration drilling program dates back to 2007. For its 2012 Beaufort and Chukchi Sea programs, Shell obtained EPA approval of a revised permit for the *Noble Discoverer* in September 2011, which reduced permitted emissions, primarily through the application of control technologies applied to the rig's engines, of most key air pollutants by more than 50 percent from the levels allowed in earlier permits issued by EPA.¹⁵ These permits were upheld by the Environmental Appeals Board (EAB) in January 2012. EPA approved a draft permit for the *Kulluk* in July 2011, and a modified version of the permit on October 21, 2011, incorporating stricter pollution controls, and reducing key emissions including sulfur dioxide, nitrogen oxides, carbon dioxide, and greenhouse gases. The *Kulluk* permit was appealed to the EAB and upheld on March 30, 2012. Shell obtained final permits for the *Kulluk* and its Beaufort Sea operations on April 12, 2012, and for the *Noble Discoverer* and its Chukchi Sea operations on September 19, 2012.¹⁶

3. Clean Water Permits

The Clean Water Act prohibits the unauthorized discharge of pollutants from a point source into United States waters.¹⁷ A general National Pollutant Discharge Elimination System (NPDES) permit that covered oil and gas exploration in the entire Arctic region expired on June 26, 2011. Under EPA regulations, an operator may continue under the terms of a previous, expired permit if it submits a timely application to do so in the form of a Notice of Intent (NOI). On December 16, 2010, Shell submitted NOIs covering the proposed drill sites in the Beaufort and Chukchi Seas. On June 23, 2011, EPA authorized Shell to discharge eleven waste streams in the Chukchi Sea and six waste streams in the Beaufort Sea.¹⁸

In its CAA with the AEWG, Shell also agreed not to discharge into the Beaufort Sea any drilling muds or cuttings. Under this agreement, Shell was required to store and transport away from the *Kulluk* drilling fluids and cuttings, rather than discharge those materials into the ocean as is the common practice in other regions.

¹⁵ Earlier permits were appealed to, and overturned by, the EAB. The EAB is an independent body that is the final decision-maker with respect to administrative appeals of actions taken by EPA, including the issuance of air permits.

¹⁶ As described in detail later in this report, Shell ultimately operated the *Discoverer* under an EPA-issued compliance order for the 2012 season.

¹⁷ EPA may authorize such discharges by issuing an NPDES permit. For offshore oil and gas activities, EPA typically issues general permits, which EPA describes as "appropriate mechanisms for authorizing discharges from multiple sources that involve the same or substantially similar types of operation." Individual operators may then submit NOIs to discharge pollutants consistent with the terms and conditions established under the general permit.

¹⁸ On January 31, 2012, EPA issued new draft general permits for the Beaufort Sea and the Chukchi Sea. These general permits became effective on November 28, 2012.

4. Marine Mammal Authorizations

The Marine Mammal Protection Act (MMPA) prohibits the unauthorized “take” of marine mammals. The term “take” is broadly defined, and includes any “harassment” of marine mammals. Operators whose activities may incidentally (but not intentionally) take marine mammals may apply for an incidental take authorization, which can be in the form of a Letter of Authorization (LOA) or an Incidental Harassment Authorization (IHA). NMFS has jurisdiction over take authorizations for whales and seals, while the USFWS has jurisdiction over walrus and polar bears. Shell received incidental take authorization for its 2012 Beaufort and Chukchi Sea exploration drilling operations from both NMFS and USFWS. Shell’s CAA with the AEWC helped the company address the MMPA requirement that applications for incidental take authorizations include either a plan of cooperation or information that identifies what measures will be taken to minimize any adverse effects on the availability of marine mammals for subsistence uses.¹⁹

5. Oil Spill Response

Pursuant to the Oil Pollution Act of 1990, owners or operators of oil handling, storage, or transportation facilities located offshore are required to submit an oil spill response plan (OSRP) to BSEE for approval. This plan must demonstrate that the owner or operator can respond quickly and effectively if oil is discharged from that facility. The OSRP must also be consistent with the provisions of the National Contingency Plan and with applicable Area Contingency Plans. Under BSEE regulations, companies must review their OSRPs at least once every two years and submit updated plans to BSEE for approval.

In May 2011, Shell submitted to BSEE revisions to its OSRPs for the Beaufort and Chukchi Seas, which had previously been approved in 2009. DOI circulated the revised plans to the agencies within the Alaska Interagency Working Group for review and comment, and also posted the OSRPs on the internet for public review. BSEE, NOAA and other Federal agencies engaged in extensive discussions with Shell regarding the revised OSRPs during the fall of 2011.

BSEE approved Shell’s Chukchi Sea OSRP in February 2012, and Shell’s Beaufort Sea OSRP one month later. In advance of approving these plans, BSEE – under the auspices of the Alaska Interagency Working Group – received input from other agencies including USCG, EPA, and NOAA. Each plan covers leases owned by Shell in the Chukchi and Beaufort Seas and provides for the mutual use of equipment between both theaters. The approved OSRPs were changed considerably from previous versions of Shell’s plans. Specifically, Shell was required to reformat its plans and to demonstrate compliance with specific Federal regulations, include much higher estimates for worst case discharges, develop longer-run trajectories for spills, and provide additional details on the logistics of bringing equipment in from outside the region if necessary. Shell also committed in its OSRPs to deploying the ACS containment system to address the contingency of a well blowout. Shell’s adherence with the terms of the OSRPs was verified by a series of tabletop exercises, drills, and equipment inspections.

¹⁹ BOEM’s lease stipulations governing activities at Shell’s Beaufort Sea and Chukchi Sea drill sites contain similar requirements.

6. Maritime Vessel Requirements

The USCG administers navigation and vessel inspection laws and regulations governing marine safety, security and environmental protection. USCG also is responsible for inspecting the vessels to which those laws and regulations apply. Certain U.S. flag vessels, including the *Arctic Challenger* vessel, must be inspected and receive a Certificate of Inspection (COI). USCG issues a COI only after the vessel passes an inspection confirming that it complies with all applicable statutes and regulations and can be operated safely without endangering life or property.

Foreign flag mobile offshore drilling units (MODUs), including the *Noble Discoverer* and the *Kulluk*, must have a valid Certificate of Compliance (COC) prior to engaging in activities on the OCS. The USCG issues a COC to a MODU after examining the rig and determining it complies with applicable U.S. and international standards. In order for the COC to remain valid, the rig must be maintained and operated in compliance with all applicable marine safety and environmental protection laws and international conventions. USCG and international regulations require self-propelled vessels, such as the *Noble Discoverer*, to have a Safety Management System (SMS) to help ensure safety at sea, prevent the occurrence of human injury or loss of life and avoid environmental and property damage.

7. State and Federal Consultations

The Coastal Zone Management Act (CZMA) encourages coastal states to develop comprehensive programs to manage and balance competing uses of and impacts to coastal resources. However, the Alaska Coastal Management Program (ACMP) expired on July 1, 2011, and has not been reauthorized by the State. As a result, the associated ACMP regulations and all local coastal management plans lost their statutory authority and became unenforceable on July 1, 2011. The expiration of the ACMP removed an important means of formal consultation between the Federal government and the State and local governments concerning OCS matters.

The Endangered Species Act (ESA) prohibits the unauthorized take of species listed as endangered or threatened, and prohibits the destruction or adverse modification of listed species' designated critical habitat. As under the MMPA, "take" is defined quite broadly, and may be authorized by USFWS or NMFS. In addition to imposing restrictions on operators, the ESA also requires Federal agencies to consult with USFWS and NMFS to ensure that authorized actions do not jeopardize the continued existence of endangered or threatened species, or destroy or modify their designated critical habitat. There are a number of endangered, threatened, and candidate species present within the Beaufort and Chukchi Seas. The Federal agencies responsible for authorizing Shell's 2012 exploration drilling activities satisfied their ESA obligations through a series of consultations conducted with NMFS and USFWS and receipt of requisite Biological Opinions and Incidental Take Statements. Shell's adherence to the terms of

its MMPA incidental take authorizations also constitute compliance with ESA provisions concerning take.²⁰

8. Drilling Permits

Operators must obtain drilling permits from BSEE prior to beginning drilling operations on the OCS. On January 31, 2012, Shell submitted APDs for two wells: the Burger A site in the Chukchi Sea and the Torpedo H site in the Beaufort Sea. On April 17, 2012, Shell submitted eight additional APDs, covering each of the remaining wells under its approved exploration plans. In each case, the initial applications were incomplete, and an iterative process began wherein BSEE would request additional information from Shell, which in turn amended its APDs. BSEE required between four and seven additional submittals from Shell on each APD before the APDs were complete and accurate enough to act upon. In the case of the Burger A well, Shell did not submit a complete APD until August 8, well into the drilling season.

As discussed above, Shell was required, as conditions of the approvals of its exploration plans and OSRPs, to have the ACS containment system fully tested by BSEE and deployed in the Arctic before any drilling into hydrocarbon-bearing zones could occur. Because the deployment test of Shell's ACS system failed, BSEE limited its approval of Shell's APDs to top hole sections. On August 30, BSEE partially approved Shell's Burger A drilling permit to allow Shell to construct a mud-line cellar and set the first two casing strings of the well, but not to drill deep enough to enter potential hydrocarbon-bearing zones. On September 20, BSEE approved a top hole permit for the Sivulliq N site in the Beaufort Sea, and later approved three additional top hole permits that Shell did not proceed with prior to the end of the season.

IV. Evaluation of Shell's 2012 Alaska Offshore Exploration Program

Shell's 2012 offshore drilling operations in the Alaskan Arctic were complex, involving logistical challenges at sea, in the air, and onshore. Shell's two floating rigs, the *Noble Discoverer* and the *Kulluk*, were supported by 20 additional vessels, including icebreakers, supply vessels, tankers, tugs and specialized oil spill response boats, most of which performed multiple missions while in theater. Shell coordinated more than one thousand flights to move personnel to and from the theater and to make protected species and ice observations. This activity required considerable onshore presence and support as well, including the temporary housing of workers in camps and the staging of oil spill response assets.

Shell experienced a number of significant problems when operating outside of its core drilling competencies, and in particular when relying on contractors to deliver critical components or to conduct certain operations. These shortcomings offer important lessons for Shell and other operators, as well as for government regulators, regarding the challenges associated with conducting safe and effective offshore exploration operations in the Arctic.

²⁰ USFWS issued its Revised Biological Opinion and Conference Opinion for Oil and Gas Activities in the Beaufort and Chukchi Sea Planning Areas on May 8, 2012. NMFS issued ESA Incidental Take Statements to Shell on June 4, 2012 and to BOEM on June 11, 2012.

When conducting operations within its core competencies during the open-water drilling season, and while subject to daily oversight, Shell generally performed safely. Shell was able to drill top hole sections in both the Chukchi and Beaufort Sea theaters with no spills, no significant injuries to workers and virtually no reported impacts on subsistence activities. With the significant exception of air permit violations, one minor safety-related incident of non-compliance on the *Noble Discoverer* that was promptly addressed, and other relatively minor issues discussed below, Shell's operations in the Beaufort and Chukchi Seas generally complied with applicable regulations and the conditions of its plans and permits.

A. The Arctic Containment System

In May 2010, while efforts to control the Macondo well blowout in the Gulf of Mexico were still ongoing, Shell submitted to DOI a list of safety measures that Shell pledged to incorporate into its Arctic drilling program, based on lessons Shell stated it had already learned from the *Deepwater Horizon* incident.²¹ Among those measures was Shell's commitment to deploy a pre-positioned, "pre-fabricated coffer dam" to collect hydrocarbons in the event of a subsea blowout. In late September 2010, during a hearing of the National Commission on the BP *Deepwater Horizon* Oil Spill and Offshore Drilling, Shell's Alaska Vice President presented a slide showing a "proposed sub-sea containment system," which consisted of a subsea containment dome that could be placed over a hydrocarbon leak at the seafloor and a hose leading from that dome to a surface support vessel that would collect, process, flare, and store the hydrocarbons as needed. These commitments related to subsea containment were subsequently formalized in Shell's exploration plans and OSRPs, and were a key basis for DOI's approval of those plans.

Shell's commitment in the summer of 2010 to deploy a subsea containment system to support its Arctic operations led to the development of the ACS. The ACS is a containment system designed to capture oil and gas from a capping stack or from a containment dome with a capacity of at least 25,000 barrels per day. The primary components of the ACS are (1) a staging and processing system mounted on a floated barge, the *Arctic Challenger*; (2) high pressure hoses designed to connect to a capping stack; and (3) a containment dome and associated connecting hoses. The containment dome itself is designed to contain and separate hydrocarbons from water through discrete flows of oil and gas to the processing facilities while returning most of the separated water through the bottom of the dome. The ACS represents a last line of defense to a serious loss of well control incident. Initial defenses include: (1) the injection of kill-weight drilling muds into the well, (2) activation of the blowout preventer, and (3) deployment of a capping stack to shut in the well. If these measures fail, the ACS containment dome is designed to capture flows from the well and facilitate their separation and storage.

Shell contracted with Superior Energy Services (Superior) to design, fabricate, own and operate the ACS. Shell informed the review team that the company selected Superior to design and build the ACS based on the extensive experience of two of Superior's subsidiaries, Wild Well Control and Marine Technical Services, with well control and containment dome system deployments in the Gulf of Mexico. Even though Shell committed to building and deploying a subsea containment system in support of its Arctic operations in mid-2010, work on designing

²¹ Letter from Marvin Odum to S. Elizabeth Birnbaum, dated May 14, 2010, attached at Tab 3.

and fabricating the ACS, including the retrofitting of the *Arctic Challenger*, did not begin until late 2011, less than nine months before Shell intended to begin the 2012 drilling season.

1. The Arctic Challenger

In April 2011, after consulting with Shell about potential surface support vessels for the ACS, Superior selected the *Arctic Challenger*, an ice class barge built in 1976. The *Arctic Challenger* had been used to supply North Slope oil fields until 2001, but was inactive for about ten years. In preparation for the 2012 drilling season, the *Arctic Challenger* entered a Portland, Oregon shipyard in November 2011 to begin undergoing inspections, structural modifications and repairs. It was not until late March 2012 – only four months before the planned start of the Arctic drilling season – that the *Arctic Challenger* was moved to Bellingham, Washington for the beginning of construction of the facilities that would allow the barge to perform as the surface support vessel of the ACS.

Before it could operate, the *Arctic Challenger* needed to be classed by the American Bureau of Shipping (ABS) and certified by the USCG.²² Shell, Superior, and ABS met with the USCG in August 2011 to initiate discussions regarding the requirements for classification and certification, and the USCG accepted Shell's proposed standards for classification and certification of the vessel in December.

Shell was not actively involved in overseeing Superior's progress, and in developing solutions to emerging problems, during most of the refurbishment and classification process for the *Arctic Challenger*. Indeed, Shell personnel described Superior's work on the ACS during late 2011 and the first half of 2012 as a "black box." Moreover, Shell did not have naval or marine engineering expertise to advise on the *Arctic Challenger* refurbishment and to identify and troubleshoot problems alongside Superior. Shell has acknowledged these weaknesses in its oversight of the ACS development.

On May 10, 2012, ABS informed Superior that there were significant technical issues that led ABS to believe that "the project will not be able to attain the required design approval in a time frame suitable to your needs."²³ On May 31, ABS notified Superior about "serious concerns" regarding engineering calculations intended to demonstrate that the vessel would be able to operate in Arctic wind and sea states.²⁴

It was not until June 2012 that Shell engaged directly and at a high level on the problems with the *Arctic Challenger* classification and certification process. From June through September 2012, there were frequent meetings between Shell, USCG, BSEE, ABS, and Superior to resolve a litany of technical issues related to classification and USCG certification, most of which were safety related. It was at this time that Shell poured tremendous manpower resources into the *Arctic Challenger* project. Shell man-hours devoted to the ACS project leapt from fewer

²² A vessel classed by ABS is designed, constructed and periodically surveyed to verify compliance with ABS technical standards and mitigate safety and environmental risks.

²³ Letter from ABS to Superior Energy Services, dated May 10, 2012.

²⁴ Letter from ABS to Superior Energy Services, dated May 31, 2012.

than 2,000 in May 2012 to approximately 7,000 in July. Despite Shell's increased direct management, devotion of substantial personnel and financial resources, and focused attention on rapidly resolving outstanding issues during the summer of 2012, it did not obtain classification and certification of the *Arctic Challenger* until October 2012, missing the entire 2012 drilling season.

A number of factors contributed to Shell's inability to bring the *Arctic Challenger* on line in time for the 2012 drilling season, including: (1) the selection of a vessel in need of significant retrofitting; (2) the late start of design and construction operations, all contributing to unrealizable timelines for construction, testing, and obtaining Federal approvals; (3) insufficient engagement by Shell management and technical personnel; and (4) turnover of certain Superior personnel working on the retrofitting project.

2. The Containment Dome

The other major component of the ACS is the containment dome, which Superior designed with new technology intended to minimize water collection and hydrate formation while deployed over a leak. The development of the dome suffered from similar delays to those associated with the *Arctic Challenger*, which resulted in repeated postponements of the BSEE-required dome deployment test. Again, there were significant communication problems between Shell and Superior. For example, during the containment dome testing process, Superior acknowledged that it did not completely understand the details of how the dome would need to be deployed in the Arctic, particularly in the water depths in which Shell would be drilling.

The government's inspection of the containment system involved two steps. First, on August 26 and 27, BSEE engineers confirmed that the surface treatment and storage components on the *Arctic Challenger* could process a flow equal to twice the expected worst case discharge rate. The second test involved the deployment of the dome. The dome deployment test began on board the *Arctic Challenger* in Puget Sound on September 11, 2012, while work on the vessel to obtain USCG certification was still ongoing. During the inspection, BSEE staff observed the absence of clear lines of authority on the vessel, and the operation was beset by problems such as the tangling of a remotely-operated vehicle in the dome's rigging, a loose connection on one of the winches, and a serious miscalculation of the amount of weight attached to the dome to keep it submerged.

Shortly after midnight on September 15, the containment dome, which had been positioned at a depth of more than 100 feet, rose rapidly through the water and breached the surface. A few minutes later, the tanks providing buoyancy to the dome vented, and the dome quickly plunged. It sank too rapidly to allow for pressure equalization, and the upper chambers of the dome were crushed. Shell and Superior investigated the causes of the dome's failure, which led to significant changes to the dome's design and construction, including adding buoyancy, installing a protective frame, stiffening of the tank, and installation of larger equalization vents. Because of the failure of the containment dome deployment test, Shell could not obtain permits to drill into potential hydrocarbon-bearing zones, meaning the dome deployment test failure was decisive in limiting Shell from making a potential discovery during the 2012 drilling season.

Finally, Shell's failure to develop a functional ACS in advance of the 2012 drilling season also prevented the company from conducting live training of the crews that would man and operate the *Arctic Challenger* in the event of a loss of well control. Instead, Superior conducted crew training at its newly-built simulation center in Anchorage. While this simulation center is impressive in many respects, preparations for Arctic operations should include the opportunity for crews to participate in live exercises aboard the same vessels they would be expected to man and operate under emergency conditions.

B. Rig Preparations and Fleet Mobilization

There is no consensus with respect to whether floating drilling rigs or jack-up rigs provide the optimal configuration for Arctic exploration operations, and there are advantages and disadvantages associated with each. The ability to disconnect from the well quickly when ice is approaching is considered to be one of the strengths of a floating rig configuration, although operating a floating rig in shallow water depths and rough Arctic seas requires a rigid mooring system to ensure that the rig remains centered over the well. The *Noble Discoverer* has a "turret mooring" system, which allows the vessel to "weathervane" or rotate into the wind or waves without needing to disconnect from the well. However, this procedure requires frequent engine activity, which contributes to air emissions from the operation.

In planning its Arctic exploration program, Shell chose to refurbish existing floating drilling rigs. The *Kulluk* is a conical drilling unit that was purpose-built in 1983 to drill in ice conditions, and drilled approximately a dozen wells in the United States and Canadian Beaufort Sea between 1983 and 1993. Shell purchased the *Kulluk* in 2006, and then retained Frontier Drilling to refurbish, staff, and operate the rig. Noble Drilling purchased Frontier in 2010 and took over operation of the *Kulluk*. The *Noble Discoverer* was originally built for a non-drilling purpose in the mid-1960s and then was converted to a drillship in the mid-1970s. Shell refurbished the *Noble Discoverer* by, among other things, winterizing the vessel and reinforcing the hull for ice.

Both the *Kulluk* and *Noble Discoverer* were refurbished at the Vigor Marine Shipyard in Seattle. The initial USCG examination of the *Noble Discoverer* on June 6, 2012 identified 23 deficiencies. The deficiencies were addressed by June 20, at which point USCG issued a COC for the *Noble Discoverer*. The initial USCG examination of the *Kulluk* took place on June 15 and found 19 deficiencies. Those deficiencies were addressed, and a COC for the *Kulluk* was issued on June 24. On June 27, the *Noble Discoverer* and *Kulluk* departed Seattle for Dutch Harbor, Alaska, and arrived on July 7 and July 15, respectively.

On July 14, the *Noble Discoverer* dragged its anchor in Dutch Harbor, drifted nearly 700 yards, and came within 100 yards of grounding. Shell stated that its investigation found that the drifting stemmed from Noble's use of only the minimum amount of anchor chain and the absence of contingency plans to sufficiently address weather conditions. Shell reported that it took a number of actions as a result of the anchor drag, including reviewing and updating company guidance for anchoring a ship in certain configurations, and reviewing the management

system on board the *Noble Discoverer*.²⁵ The vessel was undamaged in the incident, and on August 25 it left Dutch Harbor for the Chukchi Sea.²⁶

In addition to the two drilling vessels, Shell assembled a fleet of 20 support vessels for the operation. Three vessels were built specifically to support Shell's operations: the *Nanuq* oil spill response vessel, the *Aiviq* anchor handler, and the *Sisuaq* offshore supply vessel. Another eight were upgraded by Shell. Nearly all of the support vessels served multiple functions. For example, the *Nanuq* was primarily designed as an oil spill response vessel, but it also assisted with ice management, conducted scientific data gathering, handled anchors, and served as crew quarters, among other functions.

C. Shell's Drilling Operations in the Beaufort and Chukchi Seas

1. Operational Logistics

To prepare for and conduct operations in the Arctic last year, Shell employed and managed a complex set of vessel, equipment, and personnel movements. Shell's vessels traveled a total of approximately 240,000 nautical miles, conducted 23 ice reconnaissance missions, participated in 500 vessel-to-vessel personnel movements, and transferred 3.25 million gallons of fuel in 23 operations with no reported pollution. Shell pre-laid boom during all fuel transfers, as required by the terms of its leases, an Arctic-specific standard that is not required elsewhere on the U.S. OCS.

The complexity of Shell's marine and drilling operations in theater was increased further by air permit emissions limitations. These restrictions limited the number of support vessels that could come within 25 miles of the drilling rigs at any one time. Shell's efforts to comply with the air permits included the use of individual vessels for multiple missions. In order to manage in-theater logistics under the terms of the air permits, Shell developed an internal vessel tracking and planning system after the season already was underway. Although the tracking system appears to have worked, this is an example of a critical system that was not established in advance of the drilling season. Shell informed the review team that it intends to refine and improve this system for use in future operations.

Shell coordinated nearly 12,000 passenger trips on flights to and from the North Slope, with over 650 personnel stationed offshore at any given time. When combined with flights to conduct required protected species monitoring and ice observations, there were a total of 562 helicopter flights and 535 fixed wing flights during the 2012 operation. Terms in the CAA required flights to be routed to minimize impacts on marine mammals, and Shell coordinated with subsistence hunters daily to obtain rerouting information intended to minimize this conflict.

Although largely successful and virtually free of incident, Shell did experience challenges with its in-theater logistical operations, particularly in the area of aviation. BSEE inspectors reported that on multiple occasions that Shell's helicopter contractor did not enforce survival suit requirements for trips offshore. In addition, the helicopters lacked deicing equipment and,

²⁵ Shell has not yet provided DOI with documentation related to this management review of the *Noble Discoverer*.

²⁶ The *Kulluk* departed Dutch Harbor for the Beaufort Sea on August 20.

significantly, were unable to fly under Instrument Flight Rules (IFR), creating operational constraints on personnel movement and potential safety issues. The IFR problems might have been resolved if Shell had engaged the FAA earlier in discussions with its aviation contractors. Early engagement with the FAA might also have benefited airspace awareness and coordination efforts.

The first Shell vessel to transit north of the Bering Strait in 2012 was the icebreaker *Nordica* on July 22. Next were the anchor handlers *Tor Viking* and *Aiviq*, which pre-laid anchors for the *Noble Discoverer* at the Burger A drill site in the Chukchi Sea from August 8 through 10. Each anchor was laid several hundred meters further than described in the pattern approved by BOEM in Shell's Revised Chukchi Sea exploration plan. Although the anchor pattern deviated from the exploration plan, BOEM had analyzed the environmental and geohazard impacts of a larger anchor pattern footprint than provided in exploration plan. Although BOEM admonished Shell for the deviation, the larger pattern did not present any potential environmental impacts that had not been considered by BOEM.

2. Timing of Drilling Operations

Shell originally planned to begin drilling operations as early as the second week of July 2012. Shell initially attributed delays to the start of its drilling program to persistent ice in the Chukchi Sea. However, the most significant reason for delays in Shell's drilling operations was the company's inability to complete and deploy the ACS.

On August 30, BSEE approved a limited drilling permit for Shell, which authorized Shell to drill a top hole at the Burger A well site, consisting of a mudline cellar and the first two casing strings down to approximately 1,400 feet.²⁷ This depth was considerably shallower than the expected liquid hydrocarbon-bearing zones, based on geological and geophysical data for the area. On September 9, Shell began the first exploratory drilling operations in the Chukchi Sea in over two decades. Approximately twelve hours after the start, however, Shell stopped drilling and prepared to move off location due to an unusually large piece of multi-year ice that it had observed moving towards the Burger A site in the Chukchi Sea. At a point when the ice was still approximately three days away from the Burger site, the crew of the *Noble Discoverer* initiated their disconnect procedures and successfully moved off the well.

This sequence of events involving an encroaching ice floe at the Burger site is an example of Shell implementing its Ice Management Plan (IMP).²⁸ Shell successfully followed its operational protocols with respect to sea ice incursion and other environmental conditions included in its exploration plans, consistent with BOEM's regulatory requirements for operators

²⁷ A mudline cellar is a large hole dug into the seafloor that is intended to house the blowout preventer in order to protect it from passing ice.

²⁸ Shell's IMP is part of its Critical Operations and Curtailment Plan (COCP), and is designed to "[facilitate] appropriate decision-making and responses to the threat of hazardous ice[,] and procedures set forth in the IMP prevent damage or harm to personnel, assets, or the environment." The IMP defines five ice alert levels, and establishes roles, responsibilities, and actions for different components of Shell's operations for each alert level. In general, the COCP establishes thresholds and protocols for ceasing operations in response to developing hazards, such as encroaching ice.

proposing to conduct exploration drilling activities offshore Alaska.²⁹ Shell identified potential hazards through its Ice and Weather Advisory Center, an integrated ice forecasting service that incorporates ice and weather forecasting data from the NWS, climate studies, NOAA and Canadian ice services, and advanced satellite imagery to develop daily ice forecasts. While in theater, Shell also effectively employed meteorologists with Arctic forecasting experience to help produce snapshots of current conditions and forecasts of weather conditions into the future.

Shell returned to the Burger A drill site approximately two weeks later, after the ice floe passed. While the Burger ice flow episode provides an example of Shell successfully managing ice conditions and responding appropriately to a potential hazard, it also highlights the inherently unpredictable nature of working in the Arctic. Shell's already-delayed Chukchi operations lost additional time, pointing out the need for ample "float" time in Arctic drilling schedules and objectives. Ultimately, drilling the Burger A top hole took Shell nearly a month longer than the company originally had estimated.

Shell continued its drilling operations at the Burger A site for the remainder of the season without any injuries, spills, or significant safety violations. BSEE inspectors, who were present on the rig throughout the drilling operation, reported one minor violation, for a temporarily removed walkway, that was quickly remedied.

In the Beaufort Sea theater, BSEE issued a top hole drilling permit to Shell for the Sivulliq N site on September 20. However, because Shell was required by the terms of the CAA and BOEM's conditional approval the exploration plan to wait until the end of the subsistence whale hunt before beginning operations, Shell was not able to start drilling operations in the Beaufort Sea until October 3. As in the Chukchi Sea, the drilling operations were conducted without injuries, spills, or significant safety violations. However, also as with the Chukchi Sea operations, the Sivulliq well took much more time than Shell originally projected. In particular, Shell experienced complications in constructing the mudline cellar for the Sivulliq well. Shell reported that it constructed the mudline cellars extremely cautiously due to a lack of backup equipment and a crew that was inexperienced with the use of a mudline cellar bit, because mudline cellars generally are not used outside of the Arctic OCS. Shell also encountered unexpected boulders during drilling at the Sivulliq site, which delayed completion of the mudline cellar. Ultimately, Shell was only able to set one casing string at Sivulliq, rather than the two casing strings that BSEE permitted, before the drilling season ended.

In submissions to DOI, Shell consistently underestimated the length of time required to complete each step of its drilling operations. The timelines provided by Shell proved to be unrealistic and did not account for complications and delays that should be budgeted for when operating in the Arctic. While Shell's internal expectations might have been more modest than the estimates it provided DOI, a better practice would be to have clear communication between the operator and regulator about objectives, schedule, and variables, including anticipating float time in drilling schedules due to variability of Arctic conditions.

²⁹ BOEM regulations establish special requirements for operators proposing to conduct exploration drilling activities offshore Alaska that include the submission of "emergency plans" as well as critical operations and curtailment procedures. Among other things, operators must identify "ice conditions, weather, and other constraints under which the exploration activities will either be curtailed or not proceed."

3. Conflict Avoidance and Coordination with Local Communities

To minimize any cultural or resource impacts to subsistence whaling activities from Shell exploration operations, and to satisfy requirements imposed by MMPA incidental take regulations and applicable BOEM lease stipulations, Shell took a number of important steps to work with the AEWG and North Slope communities.

Beginning in January 2009, Shell held numerous public meetings with North Slope communities and organizations to inform community leaders about proposed operations and to obtain input on potential environmental, social, and health impacts, as well as proposed mitigation and conflict avoidance measures. As an outgrowth of these meetings, Shell developed a Communication Plan with local communities to coordinate with local subsistence users, such as village whaling captains, to minimize the risk of interfering with subsistence hunting. As part of this plan, Shell set up Communications Centers (Com Centers) in coastal villages along the Chukchi and Beaufort Seas, which were manned during exploration activities. Shell also employed local subsistence advisors from these villages to provide consultation and guidance regarding whale migration and subsistence activities. The subsistence advisors' responsibilities included reporting subsistence-related comments, concerns, information, coordinating with Com Center personnel, and advising Shell how to avoid conflicts with subsistence hunting activities.

In the Beaufort Sea, Shell also worked under its CAA with the AEWG. Under the CAA, as well as a condition of BOEM's approval of the Camden Bay exploration plan, Shell was required to suspend all operations in the Beaufort Sea beginning on August 25 for the Nuiqsut and Kaktovik subsistence bowhead whale hunt, resuming drilling operations only after the hunt concluded. This whaling deferral period was designed to avoid a potential source of conflict between Shell and local subsistence users by establishing a schedule for different uses of overlapping offshore areas. The CAA also included a range of other terms – some of which demonstrate best practices for operating in the Arctic. For example, Shell agreed to “zero discharge” into the water of drilling muds and cuttings.

The relationship between Shell and the AEWG, and the terms of their CAA, helped to facilitate ongoing coordination and avoid potential conflicts over the course of the season. On September 24, 2012, Shell requested approval to move the *Kulluk* drill rig onto the drill site at Sivulliq, but not to commence drilling operations. At that time, the village of Nuiqsut had completed its hunt, but Kaktovik had one strike remaining, with their hunt having been unexpectedly delayed by the funeral of a whaling captain. The AEWG supported Shell's request, and on September 25 BOEM granted its approval of the rig move, but stressed that Shell was not allowed to commence exploration drilling operations without receiving specific approval from BOEM following the completion of the Kaktovik bowhead whale subsistence hunt. The AEWG agreed to allow Shell to commence drilling by October 9 regardless of whether Kaktovik had completed whaling. Ultimately, Kaktovik successfully completed its hunt on October 3, allowing Shell to commence drilling operations, with BOEM approval, later that day.

4. Federal Oversight During the Drilling Season

The Federal government also mobilized considerable resources to the North Slope and Arctic OCS during the 2012 open water season. Although the USCG's closest base to the Arctic is in Kodiak, Alaska, approximately 940 miles south of Barrow, the USCG has in recent years

increased its presence above the Arctic Circle during the summer and early fall. In 2012, as part of Operation Arctic Shield 2012, the USCG deployed substantial assets to the region, including multiple cutters, two ice-capable buoy tenders, two MH-60 helicopters stationed in Barrow, plus air, ground, and communications crews. Operation Arctic Shield also features significant community outreach and capability assessment components.

USCG helicopters and personnel were used in late September to conduct joint BSEE-USCG unannounced inspections of oil spill response (OSR) assets stationed in Prudhoe Bay, Wainwright, and offshore in the Beaufort Sea. These field inspections were the last in a series of OSRP verification activities held throughout 2012, including table-top exercises in March, May, and September, and a May field inspection by BSEE of OSR equipment, deployment exercises, and training activities. Some intended inspections and deployments could not be conducted on the North Slope in September due to the Beaufort Sea whaling season and weather conditions. However, the tabletop exercises and inspections demonstrated that Shell was in compliance with its OSRPs.

To ensure that Shell was conducting drilling operations in a safe and environmentally protective manner, BSEE had an inspector on board each rig full-time from the start of drilling operations to the end, an Arctic-specific practice on the OCS. The inspectors were invited to all meetings on the rigs, and were responsible for monitoring compliance with all drilling regulations, as well as lease stipulations and EP approval conditions addressing operational requirements. These inspectors, like all BSEE inspectors, had the authority to shut down operations if they found serious violations. BSEE issued one incident of non-compliance to Shell for the *Noble Discoverer* crew's failure to replace a section of walkway that had been removed to facilitate the movement of the mudline cellar bit. Shell immediately corrected the conditions that led to the issuance of the violation. The inspectors reported that the operations were being conducted cautiously, and in compliance with the regulations under their purview. The constant presence of BSEE inspectors added an additional oversight element directed towards ensuring compliance with environmental standards and monitoring requirements.

5. Compliance with Air Permits

Before the start of the season's activities, Shell began to anticipate challenges complying with the terms of its EPA air permits, as testing showed that emission levels provided by Shell's contractor, D.E.C. Marine, and incorporated into the terms of the permits were unrealistic. Shell's most significant problems were the six main generators on the *Noble Discoverer*.³⁰ By June 28, 2012, Shell submitted a revised permit application for the *Noble Discoverer*. Among other issues, the application detailed problems with the D.E.C. Marine SCR emission control equipment, which had not performed in testing at the levels specified by D.E.C. Marine and included in the permit. Only once in more than 60 tests had the equipment met the NOx limit, and even then not under conditions approximating those in which the engines would be functioning in the Arctic. Moreover, equipment testing revealed structural deficiencies, such as

³⁰ Testing demonstrated that achievable emissions rates for NOx were inconsistent with technical specifications provided to Shell by D.E.C. Marine. Shell began working with a different manufacturer, Caterpillar, and identified the need to increase specifications for the *Discoverer*'s release of particulate matter and for emissions from the proposed oil spill response vessel.

problems with the catalyst breaking down.”³¹ Shell belatedly switched contractors to Caterpillar CleanAIR Systems, a company that it believed had the significant international experience and relevant technical expertise to be beneficial for the “remoteness of the Arctic.”³²

In light of the need for the revised permit to undergo public comment prior to finalization, EPA issued a Compliance Order on September 7, 2012, for the purpose of supporting 2012 operations. The compliance order was based on Shell’s June 2012 application to revise the permit for future years. The compliance order imposed temporary limits for some emission sources higher than in Shell’s permit, but EPA expected the fleet’s overall emissions for 2012 to be lower than the original permit allowed due to Shell’s shortened operating season. Shell also identified the need for minor revisions to the *Kulluk* permit.

Over the course of the season, Shell’s equipment was unable to perform at the revised levels specified in the compliance order and permit revision applications. EPA issued two separate Notices of Violation to Shell, citing multiple permit violations for both the *Kulluk* and *Noble Discoverer* and associated fleets that operated in the Chukchi and Beaufort Seas in 2012. The violations were based on EPA’s inspection of the *Noble Discoverer* and Shell’s self-reports of excess NOx emissions for the *Noble Discoverer* and the *Kulluk*. EPA also terminated the September 2012 Compliance Order for the *Noble Discoverer*’s permit. Issuing a Notice of Violation is a common first step once EPA has identified permit violations,³³ and this action does not preclude Shell from applying for future permits. Shell has once again revised its permit application for the *Discoverer*, and a revised permit is expected to be available for public comment in early 2013.

In addition to reflecting the need for improved communication with and oversight of contractors and manufacturers, Shell’s air permit challenges underscore the need to better understand the performance of different technologies in the Arctic. Much of Shell’s emissions control equipment was untested in Arctic conditions, and Shell and its manufacturers learned that some equipment did not perform as expected in those circumstances – for example, cold temperatures may have limited Shell’s ability to bring its incinerator up to a specified temperature prior to burning waste, leading to a less complete combustion and, thus, a greater amount of pollution. All told, Shell’s efforts over the years to work with EPA to revise the permits, improve technological controls, and develop more realistic projections have generated significant lessons about the ways in which key equipment may function differently in Arctic environments.

³¹ See page 5:
http://www.epa.gov/region10/pdf/permits/ocs/shell/Shell_application_to_revise_Discoverer_Chukchi_air_permit_June_28_2012.pdf

³² *Id.*

³³ Next steps can include a consent decree for penalties, orders to correct the violations, and possible mitigation measures. Consent decrees are subject to public notice and comment.

6. Environmental Monitoring and Collection of Scientific Data

Shell was required to undertake extensive environmental monitoring efforts in order to comply with a broad range of environmental protection requirements – for example, the terms of EPA Clean Air Act and Clean Water Act permits, as well as NOAA’s marine mammal take authorizations. In addition to collecting data through environmental monitoring measures like those noted above, Shell undertook additional efforts to understand the physical environment and ecosystems at its drill sites.³⁴ During the three years leading up to the 2012 drilling season, Shell dispatched teams of physical and biological oceanographers to conduct sampling at each of its drill sites to provide an understanding of pre-existing conditions and inter-annual variability. During the drilling season, Shell monitored the following:

- Meteorological and physical oceanographic conditions, including surface wind direction and speed, ambient air temperature, current speed and direction in the water column, and water temperature and salinity through the water column;
- Water chemistry and characteristics, including an assessment of metals and organics, turbidity, and oxygen content through the water column; and
- Biological sampling and observations, including an assessment of benthos, epibenthos, zooplankton and phytoplankton, and fishes, as well as characterization of the communities of these organisms and sampling of biota.

Information derived from these efforts is expected to further the understanding of the local environment and help inform future decision-making.

D. Demobilization and Post-Drilling Season Problems with Both Rigs

Many of the most significant lessons to be learned from Shell’s experience in 2012 are from the end of the drilling season and the demobilization of the program. Due to a number of factors – including Shell’s lack of preparation with respect to the ACS system, delays associated with the unpredictability of Arctic ice and weather conditions, and circumstances that extended the drilling blackout during subsistence hunting in the Beaufort Sea into early October – Shell got a very late start on its drilling program in both the Chukchi and Beaufort Seas. The late start, and continuing uncertainty about whether Shell would be able to deploy the ACS, put significant internal pressure on Shell to make as much progress as possible with its drilling program at the end of the season, which is not an optimal operating posture. Moreover, Shell experienced problems with its demobilization at the end of the year, including most significantly the lost tow and grounding of the *Kulluk* during a winter storm in rough Alaskan seas in late December.

1. Ice Forecasting at the End of the Season

As discussed above, Condition 4 of BOEM’s approval of Shell’s Chukchi Sea exploration plan required that Shell cease drilling into hydrocarbon-bearing zones 38 days from

³⁴

This work is noted in Section 10.0 of Shell’s Beaufort EP and Section 10.0 of Shell’s Chukchi EP.

an established “trigger date” of November 1, which was set based on an analysis of the date of earliest ice excursion over the Burger drill site, using satellite imagery from 2007 through 2011. The purpose of Condition 4 was to provide time for open water response in the event of an end of season incident or spill. Condition 4 specifically provided that adjustment to the trigger date, from which the 38-day open-water period is calculated, be based on convincing scientific information predicting with a high degree of certainty that ice encroachment over the well site was likely to actually happen in 2012 at a date different than November 1.

On August 21, 2012, Shell submitted a request to BOEM to adjust the trigger date based on a forecasting approach that relied on reference to an “analog year” with similar overall weather patterns. Shell argued that 2006 was an appropriate analog year and forecasted freeze-up at the Burger site would occur sometime between November 12 and 18, which would constitute a two to three week adjustment to the trigger date.³⁵ In response to Shell’s request, BOEM and NOAA, including NOAA’s NWS and National Ice Center (NIC), engaged in an intensive review of Shell’s request and forecasting methodology. NOAA developed a sophisticated forecasting analysis of ice conditions at the end of the 2012 season, which projected a 1 in 3 chance of freeze-up at the site by October 28; a 50-50 chance of freeze-up in the November 8 to 12 timeframe; and a 7 in 10 chance freeze-up by November 22. Ultimately, freeze-up occurred on approximately November 1. In light of the failure of the ACS containment dome test on September 15, BOEM did not respond to Shell’s request to adjust the trigger date. Because Shell could not drill into hydrocarbons without deploying the ACS, the question of calculating the date on which Shell was required to stop drilling into hydrocarbon-bearing zones was moot.

The close working relationship between BOEM, NWS and NIC on weather monitoring issues is a significant success coming out of the 2012 exploration season, and the relationship should be continued. In light of the importance of robust ice forecasting capability, as evidenced this past summer, BOEM and NWS are working towards initiating a joint study in Fiscal Year 2013 that aims to further improve the resolution and interpretation of available data about ice formation, including new ice as well as pack ice incursion timing, growth, distribution, density, and velocity. The agencies are focused on both beginning and end-of-season ice predictions, as well as the reliability of forecasting storm events both in and around the Arctic operating theater.

2. Demobilization

By October 26, the *Noble Discoverer* completed permitted drilling operations and finished temporarily abandoning the Burger A top hole. The rig then disconnected from its anchors, which were permitted to be left in place over the winter, and by October 28 began to travel south to Dutch Harbor, with the ultimate goal of reaching Seattle for off-season repairs and resupply. However, the ship’s propulsion system soon exhibited problems. On November 6, the main engine had to be secured because of severe shaft vibration, and the vessel needed to be towed into Dutch Harbor. On November 16, an attempt to start the main engine resulted in a backfire and the ignition of insulation in the engine room, which was extinguished by the crew. The vessel left Dutch Harbor under tow assist on November 21, and five days later it was towed into Seward, Alaska.

³⁵ Letter from Shell to BOEM, dated on August 21, 2012.

The *Kulluk* completed well operations on October 30, but poor weather conditions kept the rig on location until November 8. As with the *Noble Discoverer*, DOI approved Shell's request to leave the *Kulluk* anchors embedded in the seafloor at the drill site, after confirming there would be no safety or environmental impact. Also like with the *Noble Discoverer*, Shell's intent was to tow the *Kulluk* to Seattle for repairs and resupply. On November 22, the *Kulluk* arrived in Dutch Harbor, where an examination by the USCG found 13 deficiencies, although they were not as significant as the ones identified on the *Noble Discoverer*, discussed below, and did not warrant Federal intervention or detention. The *Kulluk* departed for Seattle under tow by the *Aiviq* on December 21.

3. Inspection of the *Noble Discoverer*

While at port in Seward, the USCG conducted a three-day inspection of the *Discoverer* that identified 16 deficiencies, including substantial problems with the main engine, unauthorized piping and equipment modifications, and a failure to adhere to the vessel's Safety Management System (SMS).³⁶ As a result of these deficiencies, and in particular the problems with the SMS, the USCG placed the vessel under a Port State detention, a serious condition to prevent the rig from departing until corrective actions are implemented, which only occurs as a result of approximately 1% of USCG foreign vessel safety examinations.³⁷ Some of the deficiencies were remediated quickly. However, several problems were significant enough, including the problems with the propulsion system, that the *Noble Discoverer* has been loaded onto a heavy lift vessel to be dry-towed to Asia for repairs.

The USCG lifted the Port State detention on December 19, 2012. However, based on possible violations of MARPOL, the International Convention for the Prevention of Pollution from Ships, USCG referred the case to the Department of Justice for further investigation.

4. Tow Failure and Grounding of the *Kulluk*

On December 27, in the midst of a series of severe storms in the Gulf of Alaska, the towline between the *Aiviq* and the *Kulluk* parted. Early on December 28, all four engines on the *Aiviq* failed, although one engine was restarted soon afterwards and used to maintain position. As conditions worsened that morning, the first USCG vessel arrived, and by later that day a number of other USCG and Shell-dispatched vessels arrived, including the *Nanuq*, which connected a towline to the *Kulluk*. On December 29, the USCG was able to rescue the eighteen crewmembers from the *Kulluk*, and a second engine was restarted on the *Aiviq*. Severe weather continued, however, and towlines between the *Kulluk* and the *Aiviq* and *Nanuq* parted on December 30. The following morning, the *Aiviq* was able to reattach to the *Kulluk*, but that towline broke that afternoon and the *Kulluk* grounded on Sitkalidak Island on December 31. No injuries were reported and the fuel tanks of the *Kulluk* were not breached, but lifeboat debris washed up on the beach, potentially releasing up to 272 gallons of diesel fuel. More than 700

³⁶ Specifically with respect to the SMS, the USCG found that preventive maintenance was not being performed, audit records were not available, and crewmembers were unfamiliar with details of the ship's SMS.

³⁷ A detention is pursued by the U.S. when the condition of a foreign flag ship or rig does not correspond substantially with the applicable international conventions, and ensures the vessel does not proceed to sea until it can do so without presenting a danger to persons on board or an unreasonable threat of harm to the marine environment.

people and dozens of boats and aircraft participated in the response. The rig was refloated on January 6 and towed to a nearby bay for initial damage assessments. On January 4, the USCG launched a formal marine casualty investigation into the incident.

The causes of the equipment failures on the *Aiviq* and subsequent grounding of the *Kulluk*, as well as the details surrounding development and execution of the tow plan, are the subject of the ongoing USCG investigation. According to members of the maritime industry experienced with Arctic towing operations, tows occur across the Gulf of Alaska year round, and there is nothing inherently unsound about conducting tow operations in this area during winter. However, given the frequency of strong storms and dramatic sea states in this region, operators should incorporate proper planning, risk assessment, and risk mitigation. Additional precautions, such as the use of multiple towlines, should be taken during winter tow operations.³⁸ Concerning the timing of the *Kulluk* tow from Dutch Harbor, there have been suggestions that Shell attempted to move the rig outside of Alaskan waters before January 1 to avoid having to pay state taxes. The State of Alaska, however, has stated that it would not have attempted to levy taxes on either the *Kulluk* or the *Noble Discoverer*. On February 26, 2013, Shell began towing the *Kulluk* from Kiliuda Bay to Dutch Harbor. It arrived on March 5, 2013 and is currently being prepared for loading onto a heavy lift vessel and dry-tow to Asia for repairs.

E. Shell's Operational Oversight and Management Systems

Complex operations, including offshore oil and gas exploration, require comprehensive, robust and integrated systems for managing risks and ensuring safe operations. These system-based safety programs are referred to generally as Health, Safety, Security, and Environment (HSSE) programs, and cover a broad swath of activities, including risk assessment, employee training, contractor selection, analyzing changes in processes, incident investigations, and considerably more. Examples of specific HSSE programs include the SEMS programs required by BSEE for offshore oil and gas operations, and the International Safety Management Code, created by the International Maritime Organization, and required by USCG for vessels.

Our review assessed Shell's SEMS program and analyzed Shell's overall management, oversight, and risk control processes. This review found that Shell demonstrated all the programmatic design elements of a safety and environmental management program, appeared to comply with BSEE's regulatory requirements for SEMS, and in general Shell promoted a feedback-oriented safety culture. However, the existence of programmatic design elements does not guarantee a functional and effective risk management program, and the review team identified a number of weaknesses indicating that Shell's management systems were insufficiently robust, particularly in the area of contractor oversight, to successfully manage and minimize overall operational risks. Shell's focus appeared to be on compliance with prescriptive safety and environmental regulations required for approvals and authorizations, rather than on a holistic approach to managing and monitoring risks identified during operational planning.

An effective risk management framework at the beginning of a project incorporates a multitude of components, including planning, vessel design, contractor selection, and an

³⁸ One such operator conducted a tow of the *Kulluk* in August 2012, using two tugs. The failed *Kulluk* tow was conducted with only one tug. The tow of the *Kulluk* from Kiliuda Bay to Dutch Harbor is using three tugs.

assessment of regulatory requirements for all facets of the project, including mobilization and demobilization. By focusing on risks and priorities at the beginning of a project, the need for improvisational management or ad hoc responses to unexpected situation is reduced. The review team was unable to find clear evidence that Shell applied an integrated risk management approach to its 2012 operations, other than through the elements required as part of SEMS. SEMS, however, relates only to offshore oil and gas drilling operations, and does not involve overseeing the risks associated with ancillary maritime transportation or logistics activities. A more appropriate risk assessment framework for operations as complex as Arctic offshore drilling programs would also provide for rigorous assessments throughout the program, including, for example, the status and suitability of new vessel and equipment fabrication and retrofitting. This is exactly the type of undertaking that the review team recommends Shell complete in advance of its next proposed drilling season.

It was also not clear the extent to which Shell tailored its global HSSE elements to the 2012 Alaska offshore operations. For example, the Job Safety Analysis checklists used by Shell were generic and not specifically designed for the risks and challenges with operating in the Arctic. The Shell Contractor Health, Safety, and Environmental Handbook also appeared to originate from the global Shell corporate level, without specific adaptations for applicability in the Arctic.

The most significant shortcomings in Shell's management systems were in the area of contractor management and oversight. The review found that several major issues that arose during the 2012 season stemmed at least in part from this fundamental weakness:

- The air permit violations can be traced back to Shell's failure to provide adequate oversight to verify the data from its contractor prior to submitting that data in the air permit applications;
- The delays in the completion of the *Arctic Challenger* and the failure of the containment dome deployment test arose from Shell's lack of rigorous and direct contractor oversight for a complex first-of-its-kind project, as well as the selection of a contractor that did not have ABS or ISO certification for ship design and build work;³⁹ and
- The anchor dragging and Port State detention of the *Noble Discoverer* can be attributed, in part, to Shell's failure to adequately monitor Noble's compliance with the appropriate management systems on-board the vessel.

The *Arctic Challenger* delays, *Noble Discoverer* deficiencies, and *Kulluk* tow also appeared to result in part from Shell not employing its internal marine expertise in these situations. Shell has acknowledged the need to better integrate its corporate maritime expertise, which resides in its downstream programs, with its upstream exploration program for the Arctic.

The problems with the *Noble Discoverer* also highlight a weakness in Shell's auditing program. In addition to internal audits and independent third party audits, Shell employs a

³⁹ Shell's selection of Superior appeared to be based on its long-term relationship with that contractor in the Gulf of Mexico. This is not necessarily inappropriate, and may offer certain commercial and operational advantages, but the decision to contract with Superior also should have been informed by a robust analysis of the scope and risks of the ACS project specifically.

process called a “local level audit” that consists of self-assessments using a series of checklists, with little consistency on who performs these or when. A more rigorous audit process might have enabled Shell to identify the deficiencies in the management systems on the *Noble Discoverer* during Shell’s investigation of the anchor drag incident. Furthermore, in areas where Shell did identify deficiencies in the management systems on board the *Noble Discoverer*, the review team was not provided evidence of follow-up during the drilling season demonstrating that Shell confirmed those deficiencies were remedied.

Shell has acknowledged shortcomings in its management systems, particularly around contractor oversight, and has indicated that it would take additional steps to address those shortcomings before returning to Arctic operations. One of the management changes being taken by Shell is the implementation of an Integrated Activity Plan (IAP), which is designed to increase operational efficiencies and manage delays. However, if the IAP is to be effective, Shell must ensure that it is focused on identifying operational risks, and is not designed only to improve budgetary decision-making and efficiency.

V. Conclusion

In 2012, Shell started drilling the first wells in the Alaskan Arctic in nearly two decades. To do so, the company assembled and deployed two floating drilling rigs and an armada of support vessels, some of which had been built for purpose and others refurbished. Shell also spent years obtaining the Federal regulatory approvals and authorizations necessary to move forward with its exploration program in both the Beaufort and Chukchi Seas in 2012. And yet, after all the time and investment, when the opportunity finally arrived last summer for Shell to begin exploration drilling in the remote and challenging Alaskan Arctic, Shell fell short of its goal to make discoveries and experienced significant problems that have caused the company to pause its Alaska offshore program.

As detailed in this report, the past drilling season offers lessons for Shell, other companies interested in offshore Arctic exploration, and government regulators. The stakes are high in the Arctic. The oil and gas resources in the Alaskan Arctic are potentially world class, and exploring for them requires years of planning and enormous up front capital expenditures. The risks are substantial and unique as well. As Shell’s experience last year makes clear, the waters off Alaska present myriad challenges and dangers during every phase of an offshore operation. A significant accident or spill in the remote and inhospitable Alaskan Arctic could have catastrophic consequences on fragile ecosystems and the people who depend on the ocean for subsistence. For all of these reasons, this review presents seven key principles that are fundamental to safe and responsible offshore oil and gas operations in the uniquely challenging conditions of the Arctic. The review also identifies specific undertakings expected of Shell before it proposes to resume its Arctic offshore program. These undertakings are intended to ensure that Shell has indeed learned from its experience in 2012.

TAB A

Beaufort Sea Exploration Plan
Letter of Approval
August 4, 2011



United States Department of the Interior

BUREAU OF OCEAN ENERGY MANAGEMENT, REGULATION AND ENFORCEMENT

Alaska Outer Continental Shelf Region
3801 Centerpoint Drive, Suite 500
Anchorage, Alaska 99503-5823

AUG 4 2011

Ms. Susan Childs
Shell Offshore, Inc.
3601 C. Street, Suite 1000
Anchorage, AK 99503

Dear Ms. Childs:

The Bureau of Ocean Energy Management, Regulation and Enforcement (BOEMRE) has reviewed Shell's revised OCS Lease Exploration Plan, Camden Bay, Beaufort Sea, Alaska (EP) dated May 2011 and supporting information. The BOEMRE hereby approves the revised EP subject to the eleven conditions below.

- 1) No exploratory drilling activities may be conducted without an approved Application for Permit to Drill (APD). Shell is advised that its APD must comply with all applicable BOEMRE regulations and Notice to Lessees 2010- N10.
- 2) No drilling activities may be conducted beyond each casing shoe unless approved by BOEMRE. BOEMRE will evaluate the condition of the well, results of safety equipment tests, the nature and duration of the next phase of the drilling program, existing and forecasted environmental conditions, and the procedures under an approved contingency plan [30 CFR 250.417(c)(2)] that addresses design and operating limitations of the drilling unit as well as the actions necessary (i.e. suspension, curtailment, or modification of drilling or rig operations) to remedy various operational or environmental situations in order to maintain safety and prevent damage to the environment; including implementing well capping and containment or relief well drilling plans.
- 3) No exploratory drilling activities can be conducted until Shell receives an approved Marine Mammal Protection Act (MMPA) authorization from the National Marine Fisheries Service (NMFS) and the U.S. Fish and Wildlife Service and the BOEMRE has received a corresponding Endangered Species Act (ESA) Incidental Take Statement (ITS).
- 4) No exploratory drilling activities can be conducted until Shell receives a New Source Review (NSR)/Title V Outer Continental Shelf air permit or a Prevention of Significant Deterioration (PSD) permit from the EPA, as appropriate.
- 5) The BOEMRE concludes that Shell has demonstrated that its oil and gas exploration drilling activities will be scheduled and will be located to prevent unreasonable conflicts

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with subsistence activities in compliance with Lease Sale's 195 and 202 Lease Stipulation No. 5.

No exploratory drilling activities may be conducted until Shell has documented to the satisfaction of the Regional Supervisor that the monitoring and mitigating measures detailed in the Plan of Cooperation (POC) to prevent unreasonable conflicts with subsistence activities are in place and operational prior to the Camden Bay program drilling season.

Shell must provide this office with daily summaries on the POC activities and daily monitoring results, including, but not limited to Marine Mammal Observer's and local Subsistence Advisors reports and notifications and Shell's responses to each incident. Shell must include the BOEMRE contact number (907) 334-5300 in the Subsistence Advisory Handbook with specific instructions for the Subsistence Advisor to call BOEMRE if they are unable to contact Shell and/or if any subsistence uses conflict has not been resolved. A copy of the handbook must be submitted to this office prior to commencement of exploratory drilling operations.

- 6) No exploratory drilling activity can be conducted from August 1 through October 31 without an approved site-specific bowhead whale monitoring program in accordance with Lease Stipulation No. 4. As provided for under this stipulation, Shell is seeking an Incidental Harassment Authorization (IHA) from the NMFS in lieu of meeting the requirement of Stipulation No. 4. The BOEMRE will coordinate with the NMFS to assure that the IHA monitoring program and peer review process satisfy the requirements of Stipulation No. 4.
- 7) Exploratory drilling operations must be suspended by August 25. Exploratory drilling operations may not resume until after Nuiqsut and Kaktovik have completed their bowhead whale subsistence hunting activities and Shell has received approval from BOEMRE. The BOEME will consult with the NMFS to confirm that subsistence hunting activities have been completed.
- 8) Prior to commencement of exploratory drilling operations, Shell must confirm the final staging location and schedule for mobilizing the designated relief well rig to the drill site and that the response times for commencement and completion of a relief well are consistent with the approved EP.

Prior to commencement of drilling operations, Shell must demonstrate that the relief well drilling unit meets the requirements of 30 CFR 250.417 and BOEMRE must approve the relief well drilling unit for use in the Beaufort Sea.

Prior to commencement of drilling operations, Shell must also document that it has the capability to construct a well cellar if deemed necessary as part of the relief well planning effort.

Prior to commencement of exploratory drilling operations, Shell must confirm in writing that relief well equipment and supplies as described in the EP are available and will be made available in time to implement the relief well drilling program.

- 9) Shell has committed to having a subsea well capping and containment system. The system is currently in the design stage. Prior to commencement of exploratory drilling operations, Shell must provide documentation that the system is designed for the projected worst case discharge conditions for approval by BOEMRE. Shell must also submit documentation on the procedures for deployment, installation and operation of the system under anticipated environmental conditions, including the potential presence of sea ice for approval by BOEMRE. Shell will also be required to conduct a field exercise to demonstrate Shell's ability to deploy the system.
- 10) No exploratory activities may be conducted until BOEMRE completes Endangered Species Act consultation with the U.S. Fish and Wildlife Service regarding the polar bear critical habitat.
- 11) Shell's fuel-transfer plan does not fully comply with the requirement of Lease Stipulation No. 6 to surround the fuel barge with oil-spill containment boom before fuel transfer. Prior to conducting exploratory drilling operations, Shell must either modify their fuel-transfer plans to comply with the stipulation or provide justification of how their proposed alternative configuration would provide an equivalent level of response preparedness. This information must be submitted to this office for approval.

As provided by 30 CFR 250.284, the BOEMRE will periodically review the activities conducted under the approved EP and may require Shell to submit updated information or revise the approved EP. BOEMRE plans to conduct this review annually, prior to each subsequent open water season, but may review the plan earlier if it receives substantial new information at an earlier date.

If you have any questions regarding this action, please contact me directly at (907) 334-5300.

Sincerely,



Jeff Walker

Regional Supervisor, Field Operations

TAB B

Chukchi Sea Exploration Plan
Letter of Approval
December 16, 2011



United States Department of the Interior
BUREAU OF OCEAN ENERGY MANAGEMENT

Alaska Outer Continental Shelf Region
3801 Centerpoint Drive, Suite 500
Anchorage, Alaska 99503-5823

DEC 16 2011

Ms. Susan Childs
Shell Gulf of Mexico, Inc.
3601 C Street, Suite 1334
Anchorage, Alaska 99503

Dear Ms. Childs:

The Bureau of Ocean Energy Management (BOEM) Alaska Region has reviewed the Shell Gulf of Mexico Inc. (Shell) Revised 2012 Outer Continental Shelf Lease Exploration Plan, Chukchi Sea, Alaska (EP) for OCS Leases Y-2280, Y-2267, Y-2321, Y-2294, Y-2278, and Y-2324.

BOEM hereby approves the EP subject to the conditions below:

1. Shell must inform the Regional Supervisor for Leasing and Plans (RS/LP) before deviating from activities specified under the EP.
2. No exploratory drilling operations may be conducted under this EP until Shell has satisfied the Bureau of Safety and Environmental Enforcement (BSEE) requirements with respect to the Oil Spill Response Plan (OSRP). Once BSEE's requirements are met, Shell must submit a copy of the OSRP to the RS/LP.
3. No exploratory drilling activities can be conducted without an approved Application for a Permit to Drill (APD) issued by BSEE. Shell must submit a copy of the approved APD to the RS/LP prior to commencing drilling operations.

Shell is advised that the APD must comply with all applicable BSEE regulations and Notice to Lessee 2010-N10. In accordance with 30 CFR 250.410-418 (MODU), BSEE must receive all required information for APD approval. This includes a current Certificate of Inspection or Letter of Compliance from the U.S. Coast Guard (USCG), current documentation of any operational limitations imposed by an appropriate classification society, and other fitness requirements for the M/V Noble Discoverer (Discoverer) mobile offshore drilling unit required in accordance with 30 CFR 250.417 (Certification of the Drilling Unit).

4. In consideration of the distance to limited support infrastructure on the Chukchi coast, as well as limited drilling experience in the Chukchi Sea, and in keeping with the Secretary of the Interior's desire to proceed cautiously with oil and gas exploration and development in the Chukchi Sea, BOEM will require the following condition designed to reduce risks associated with the proposal by assuring a greater opportunity for response and cleanup in the unlikely event of a late season oil spill.

No exploratory drilling will be allowed below the last casing point set prior to penetrating a *zone capable of flowing liquid hydrocarbons in measureable quantities into the well* within 38 days of a "trigger date" established each year by BOEM, based upon the date of first ice encroachment over the drill site within any of the last 5 years. For 2012, based upon interpretation of satellite imagery for the period 2007 to 2011, BOEM has determined November 1 as the earliest date in which sea ice covered the Shell drill sites listed in the EP. Accordingly, Shell must not drill below the casing shoe of the last string of casing set before penetrating a zone capable of flowing liquid hydrocarbons in measureable quantities into the well after September 24, 2012. In all other aspects, Shell can continue to operate as conditions permit up to October 31. A new trigger date will be established by the RS/LP for each subsequent year that operations are conducted under the EP.

Consistent with adaptive management principles, the RS/LP may revise its method for determining the trigger date based upon changes to best available scientific information (i.e., availability of a reliable ice forecasting system capable of predicting with a high degree of certainty when ice will likely encroach upon the drill site locations).

5. No exploratory drilling activities can be conducted until Shell has received an approved Marine Mammal Protection Act (MMPA) authorization from the National Marine Fisheries Service (NMFS) and the U.S. Fish and Wildlife Service (USFWS) for the specific activity, and the RS/LP has received a corresponding Endangered Species Act Incidental Take Statement (ITS) for threatened, endangered and protected species. Shell must submit a copy of the approved IHA or LOA to the RS/LP prior to commencing operations.
6. Shell's EP includes a marine mammal monitoring program and Shell has applied for an Incidental Harassment Authorization (IHA) from the National Marine Fisheries Service (NMFS) and a Letter of Authorization (LOA) from the US Fish and Wildlife Service (USFWS). The EP describes Shell's plans for aerial monitoring, on-vessel marine mammal observers, real time acoustical recorders, and site-specific sound source verification to confirm acoustic safety zones prior to commencement of drilling operations. The RS/LP, in consultation with the NMFS and the USFWS, may modify lease operations as necessary to comply with the requirements of authorizations issued by NMFS and USFWS.
7. Shell has developed a Plan of Cooperation (POC) designed to prevent unreasonable conflicts with subsistence activities in compliance with Lease Stipulation 5 (Conflict

Avoidance Mechanisms to Protect Subsistence Whaling and Other Subsistence-harvest Activities). Stipulation 5 applies to support activities, such as vessel and aircraft traffic, that traverse the blocks listed or Federal waters landward of the sale during periods of subsistence use regardless of lease location.

No support activities may be conducted on the blocks listed or on Federal waters landward of the Sale 193 area until Shell has documented to the satisfaction of the RS/LP that the monitoring and mitigating measures detailed in the POC to prevent unreasonable conflicts with subsistence activities for the Chukchi Sea program are in place and operational prior to mobilization of each drilling season.

BOEM retains the authority to restrict lease-related use if it is determined that it is necessary to prevent unreasonable conflicts with local subsistence hunting activities. Shell must provide this office with daily summaries on POC activities and daily monitoring results including but not limited to Marine Mammal Observers' and local Subsistence Advisors' reports and notifications and Shell's responses to each incident. Shell must also include the BOEM contact number (907) 334-5200 in the Subsistence Advisors Handbook with specific instructions for the Subsistence Advisors to call BOEM if they are unable to contact Shell and/or if any subsistence use conflict has not been resolved. A copy of the handbook must be submitted to this office prior to commencement of exploratory drilling operations.

The POC states that Shell plans to have continuing engagement with local subsistence users to discuss and possibly further supplement the POC. Shell must inform the RS/LP (or designee) promptly of any deviation from or alteration of the POC that Shell intends to take as a result of these ongoing community meetings.

Shell shall inform the RS/LP of any presentation/meeting Shell intends to conduct under the POC to allow the RS/LP (or designee) to attend such engagement.

8. Prior to commencement of exploratory drilling operations, Shell must confirm the final staging location and schedule for mobilizing the designated relief well rig to the drill site and the consistency of response times for commencement and completion of a relief well with the approved EP. Confirmation must be sent to the RS/LP.

Prior to commencement of drilling operations, Shell must demonstrate that the relief well drilling unit meets the requirements of 30 CFR 250.417 and confirm that they have received approval from BSEE for the relief well drilling unit for use in the Chukchi Sea. Shell must present a copy of BSEE's approval letter to the RS/LP prior to commencing operations.

9. Shell has committed to having a subsea well capping and containment system. The system is currently in the design stage. Prior to commencement of exploratory drilling operations, Shell must confirm that they have documented and received approval from BSEE that the system is designed for the projected worst case discharge conditions. Shell must also confirm that they have documented and received approval from BSEE

regarding the procedures for deployment, installation and operation of the system under anticipated environmental conditions, including the potential presence of sea ice.

Shell will also be required to conduct a field exercise to demonstrate their ability to deploy the system. Shell must confirm that they are in compliance with any agreement concerning well capping and containment reached with BSEE.

Shell must present a copy of BSEE's approval letter to the RS/LP prior to commencing operations.

10. An orientation program that will satisfy the requirements of Lease Stipulation 2 (Orientation Program) must be submitted to the RS/LP annually for approval prior to commencing drilling operations.
11. If Shell transits to the Chukchi Sea from the Beaufort Sea during the fall bowhead whale migration and before or during Barrow's fall bowhead whale subsistence hunt, Shell shall meet with the appropriate whaling captains to coordinate vessel transit routes westward through the Beaufort Sea to prevent any deflection of the bowhead whale migration and any conflicts with Barrow's fall whaling season. Emergency operations will take precedence over this condition.
12. The Marine Mammal Observers (MMOs) on vessels underway in the Chukchi Sea must monitor the ocean waters near the vessel for surfacing whales. If a surfacing whale is observed within 300 ft (100 m) of the vessel, the vessel must disengage propellers to avoid potential propeller injury to the whale (prop strike) and, to a lesser degree, collision. Propellers must remain disengaged until the whale moves beyond 300 ft (100 m). Safety of the vessel and its personnel will take precedence over this condition.
13. In addition to the measures committed to by Shell in its Bird Strike Avoidance and Lighting Plan to comply with Lease Stipulation 7 (Lighting of Lease Structures to Minimize Effects to Spectacled and Steller's Eider), the following measures also are required pursuant to the September 3, 2009, FWS *Biological Opinion for Beaufort and Chukchi Sea Program Area Lease Sales and Associated Seismic Surveys and Exploratory Drilling*:
 - a. Routine deck searches for dead or injured birds should be performed, especially during or following periods of darkness or inclement weather. Most avian collisions occur during periods of darkness and/or inclement weather such as rain or fog.
 - b. Birds perching on ship structures (such as antennas or rigging) should be allowed to rest and depart on their own.
 - c. All bird fatalities shall be documented and reported within 3 days to the RS/LP. Minimum information will include species, date/time, location, weather,

identification of the vessel involved and its operational status when the strike occurred. Carcasses should be returned to the sea.

Photographs are not required, but would be very helpful in verifying species as part of the collision report. If photographs are taken, FWS has requested the following views of any birds killed by collision: wingspread (if possible), top and bottom views, and head.

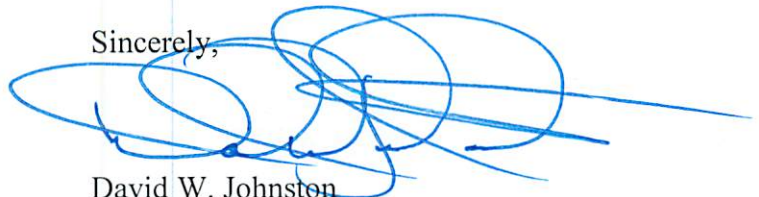
If a bird strikes and remains on the vessel, leave it to recover and depart on its own. If necessary to take it out of harm's way, move it to a dry place where it can depart on its own. If the bird does not depart after about 12 hours but is still alive, carefully return it to the sea surface.

14. Shell's fuel-transfer plan does not fully comply with the requirements of Lease Stipulation 6 to surround the fuel barge with oil-spill containment boom before fuel transfer. Prior to conducting exploratory drilling operations, Shell must either modify its fuel-transfer plans to comply with the stipulation or provide justification of how the alternative configuration would provide an equivalent level of response preparedness. This information must be submitted to the RS/LP for approval.
15. No exploratory activities may be conducted until BOEM completes its ongoing Endangered Species Act consultation with the U.S. Fish and Wildlife Service.

As provided by 30 CFR 550.284, BOEM will annually conduct a pre/post review of the activities conducted under the approved EP and may require Shell to submit updated information or revise the approved EP. BOEM plans to conduct this review annually, prior to each subsequent open water season, but may review the plan earlier if it receives substantial new information.

If you have any questions regarding this action, please contact me directly at (907) 334-5200.

Sincerely,



David W. Johnston
Regional Supervisor, Leasing and Plans.

cc: State of Alaska - Office of the Governor
 Office of the Governor - EXECUTIVE OFFICE ANCH, ATT: Jeffrey Jones, Special Staff Assistant
 Department of Natural Resources OPM-OFFICE PRJ MGMT/PERMIT, ATT: Sara Longan
 Alaska Oil & Gas Conservation Commission, ATT: Steve Davies
 Department of Natural Resources Division of Geological and Geophysical Surveys, ATT: Patty Burns
 Department of Environmental Conservation Commissioner's Office
 Department of Environmental Conservation Commissioner's Office, Prog Coordinator, ATT: Gary Mendivil
 U.S. Department of Environmental Conservation, Division of Water
 U.S. Department of Environmental Conservation, Division of Air
 U.S. Department of Environmental Conservation, Spill Response
 U.S. Department of Environmental Conservation, Division of Spill Prevention & Response, ATT: Larry Iwamoto
 U.S. Department of Environmental Conservation, Division of Spill Prevention & Response, ATT: Dale W. Gardner
 U.S. Department of the Interior, Office of the Secretary, Environmental Policy and Compliance, ATT: Pamela Bergmann
 U.S. Fish and Wildlife Service Region 7, Regional Director, ATT: Geoff Haskett
 U.S. Fish & Wildlife Service – Endangered Species, ATT: Tim Jennings
 U.S. Fish & Wildlife Service – Endangered Species, ATT: Ted Swem
 U.S. Fish & Wildlife Service – Marine Mammal Management, ATT: Craig Perham
 U.S. Fish & Wildlife Service – Marine Mammal Management, ATT: Christopher Putnam
 U.S. Fish & Wildlife Service – Marine Mammal Management, ATT: Joel GarlichMiller
 U.S. Fish & Wildlife Service – Northern Alaska Ecological SVCS
 U.S. Fish & Wildlife Service – Conservation Planning Branch, ATT: Jewel Bennett
 U.S. Fish & Wildlife Service – Conservation Planning Assistance, ATT: Louise Smith
 Alaska Region National Marine Fisheries Service - Alaska Region, ATT: James W. Balsiger
 Alaska Region National Marine Fisheries Service, ATT: Brad Smith
 U.S. NMFS NOAA – Office of Protected Species, ATT: Michael Payne
 U.S. Army Corps of Engineers Regulatory Branch Alaska District, ATT: Chief Kevin Morgan
 U.S. Environmental Protection Agency Region X Alaska, ATT: Diane Soderland
 U.S. Coast Guard Alaska Region, ATT: U.S. Coast Guard Commander
 U.S. Coast Guard Alaska Region, ATT: COMMANDING OFFICER MARINE SAFETY OFFICE
 U.S. National Park Service, ATT: Glen Yankus
 Mayor of Northwest Arctic Borough
 Mayor of North Slope Borough
 North Slope Borough Planning Department, ATT: Dan Forrester
 North Slope Borough Dept of Wildlife Management, ATT: Taqulik Hepa
 North Slope Borough Dept of Wildlife Management, ATT: Robert Suydam
 North Slope Borough, ATT: Andrew Mack
 North Slope Borough, ATT: Tom Lohman
 Mayor of Kaktovik
 Mayor of Nuiqsut
 Mayor of Barrow
 Mayor of Wainwright
 Native Village of Wainwright
 Mayor of Point Hope
 Native Village of Point Hope
 Native Village of Point Lay
 Native Village of Kotzebue
 Inupiat Community of the Arctic Slope
 Alaska Eskimo Whaling Commission, ATT: Harry Brower
 Alaska Eskimo Whaling Commission, ATT: Janice Meadows
 Alaska Beluga Whale Committee
 Alaska Nanuq Commission
 Alaska Ice Seal Committee
 Eskimo Walrus Commission
 Earthjustice, ATT: Erik Grafe
 Alaska Wilderness League, ATT: David Dickson

Center for Biological Diversity, ATT: Rebecca Noblin
Audubon Alaska, ATT: Stanley E. Senner
Defenders of Wildlife, ATT: Richard Charter
Natural Resource Defense Council, ATT: Charles M. Clusen
Northern Alaska Environmental Center, Pamela A. Miller
Ocean Conservancy, Andrew Hartsig
Pacific Oceana, ATT: Jim Ayers
Pacific Environment, ATT: Whit Sheard
Sierra Club, Trish Rolfe
The Wilderness Society, ATT: Eleanor Huffines
World Wildlife Fund, ATT: Layla Hughes

TAB C

Letter from Marvin Odum to S. Elizabeth Birnbaum
May 14, 2010



Shell Oil Company

Marvin E. Odum

President

One Shell Plaza

P. O. Box 2463

Houston, TX 77252-2463

May 14, 2010

S. Elizabeth Birnbaum
1849 C Street, NW
United States Department of the Interior
Minerals Management Service
Washington, DC 20240

Dear Director Birnbaum,

I am writing in response to your letter of May 6, 2010 regarding Shell's proposed exploratory drilling activity in the Chukchi Sea and Beaufort Sea. You requested information that may be pertinent to the review of Shell's Applications to Drill (APDs) that Minerals Management Service (MMS) will undertake in light of the Deepwater Horizon incident; and information about additional safety procedures that Shell plans to undertake in light of that incident.

Before responding to your request, I want to acknowledge the tragedy of the Gulf of Mexico (GOM) blowout and oil spill. I commend the Department of Interior (DOI) for its role in coordinating the unprecedented joint industry-government response effort. Shell is a full participant in this response; and additional Shell resources and expertise are available if needed.

I also commend the DOI for the urgency with which it is pursuing an investigation into the cause of the blowout. Root cause analyses are critically important in order for industry and government to identify steps that should be taken to ensure the safety and integrity of oil and gas operations on the Outer Continental Shelf (OCS). At Shell, we have already begun to enhance our operational excellence in light of this incident and we will continuously make adjustments as new learnings are revealed. We do not believe that best practices are static.

Regarding Shell's Chukchi and Beaufort Sea leases, please consider the following important points. First, Shell is committed to undertaking a safe and environmentally responsible exploration program in the Chukchi Sea and Beaufort Sea in 2010. Second, MMS has diligently and proactively challenged and reviewed Shell's 2010 Arctic exploration drilling program. On Thursday, May 13, 2010, the 9th Circuit Court of Appeals upheld the MMS's approvals of our 2010 exploration plans. At every step, Shell has worked with MMS, other

federal agencies, the State of Alaska, and local communities to develop a program that meets the highest operational and environmental standards. In response to the recent MMS Safety Alert, Shell will check each point raised in the letter against our internal audit of operations. Third, following the Deepwater Horizon incident, Shell initiated its own thorough review of the prevention and contingency plans for our 2010 Arctic exploration plans

I am confident that we are ready to conduct the 2010 Arctic exploratory program safely and, I want to be clear, the accountability for this program rests with Shell.

I appreciate the opportunity to provide information here about Shell's 2010 Arctic exploration program. I will discuss (1) how our program differs significantly from the GOM deepwater exploratory wells; (2) the oil spill prevention, mitigation and response plans included in Shell's current 2010 Arctic exploration plans; and (3) the additional measures that Shell has identified to add to the 2010 exploration plans in light of the GOM incident.

1. Differences between exploration in Alaska and deepwater exploration in the Gulf of Mexico

Drilling conditions for Shell's proposed 2010 Alaska wells are typical of well conditions that have been safely and effectively addressed for more than 30 years. They are much different than those in the GOM deepwater, most notably in terms of water depth and pressure. The Deepwater Horizon was drilling in 5,000 feet of water to a depth of 18,000 feet. This type of well is technically more complex than those wells planned in the Arctic for 2010. The pressure encountered in the Macondo well was about 15,000 psi based on mud weight at total depth. This is 2 to 3 times greater than what Shell expects to encounter in Alaska where 2010 drilling will be in approximately 150 feet of water to a depth of approximately 7,000 to 8,000 feet in the Chukchi and up to approximately 10,200 feet in the Beaufort. We are expecting a pressure at total depth of no more than 6,000 psi in any of these 2010 wells.

Shell has developed extensive reservoir pressure models based on previously drilled wells in the Chukchi and Beaufort Seas. Knowing the pressure profile of the previously drilled wells reduces uncertainty in pore pressure prediction for the 2010 wells. Due to the difference in expected down-hole pressure of the Macondo well versus our planned 2010 wells, our margin to safely operate in Alaska is much greater than that experienced by the Deepwater Horizon. Our biggest safety advantage is the water depth that will allow us to detect and respond to an event quickly and appropriately. Even in the highly unlikely event of Shell's drilling riser failing, the remaining drilling fluid below the seafloor would effectively stop any well flow in such a low-pressure system.

2. Current practices and our plans, which includes our mitigation for prevention and response

Shell has design standards and practices that have enabled us to successfully and safely drill many deepwater and shallow water wells worldwide. These practices include:

- a. Shell generally does not install full string casings through high-pressure zones. It is our practice to install and cement liners then to install and cement casing tiebacks. This practice delivers better cementation and hydraulic isolation across the zone of interest as well as the opportunity to install a liner top packer. We test our liner tops both in pressure and with an inflow test prior to installing a tieback string of casing back to the wellhead; this ensures we have hydraulic isolation prior to installing the tieback casing.

- b. Shell has a two-barrier policy, with each barrier validated in the direction of potential flow for all well operations. During the transition from drilling to temporary abandonment and prior to disconnecting the subsea Blow Out Preventer (BOP) from the well, a mechanical barrier, in addition to the cement and shoe track or plugs, must be installed and tested in all production casings thus ensuring that at least two independent barriers are in place.
- c. Shell policy requires that all casing hangers be locked down and that the seals be engaged. All seals on casing hangers are tested to ensure that we have two independent validated barriers at all times.

Shell will rigorously apply an appropriate similar level of standards in all well operations on the Alaska OCS. Because of lower anticipated down-hole pressure in the planned 2010 Alaska wells, all of the mechanical barriers included in Shell's well design (including contingency equipment) have inherently higher overall safety margin between operating pressure and mechanical barrier design pressures.

Shell's BOP has been and continues to be extensively inspected and tested by 3rd party specialists. The BOP has been validated to comply with the original equipment manufacturer specifications, in accordance with API Recommend Practice No. 53. Further inspection and testing has been performed to assure the reliability of the BOP and that all functions will be performed as necessary including shearing the drill pipe. Before initiating operations, the BOP will have a final test in Dutch Harbor and MMS inspection verification. Shell's BOP is well suited for operating in the Arctic. Our BOP control function is rapid and secure given its full hydraulic control system and relatively shallow working depth. In addition we will have a second BOP available in Dutch Harbor (or closer to drilling locations) for relief well drilling and other intervention techniques. An acoustic switch was considered for our Alaska wells, however placement on some of the components in the mud-line cellar and the shallow water depth diminishes the effectiveness of this approach. Specifically, the angles of transmission are too extreme and therefore unreliable when the secondary activation vessel moves a sufficient distance from the rig.

Shell's 2010 Arctic wells are exploratory and will not be converted for future production operations, thus production casing will not be installed. It is our understanding that production casing had just been run in the Macondo well and may have been a factor in the GOM incident.

The following items are safety aspects of our 2010 plans

- a. We have regional Blow Out Contingency Plans, one for the Chukchi Sea and one for the Beaufort. We also have specific relief well drilling plans for each well, which must be approved by the MMS.
- b. We understand MMS inspectors will be housed on board the Frontier Discoverer 24-hours per day/7 days per week throughout the 2010 drilling program.
- c. We have a comprehensive Critical Operations and Curtail Plan with specific procedures for suspending operations in case of emergency evacuation that properly seal and secure a well site.
- d. We will follow all current MMS plug and abandon procedures; for example, MMS requires a competent cement plug, the top of which must extend to 500' above the top of the upper most hydrocarbon-bearing zone. In addition to the required procedures and as an additional safety barrier, we will add a mechanical plug and appropriately test leak paths.
- e. We have simultaneous operational plans (SIMOPS) that will be managed to avoid well control incidents. In addition, we have full time SIMOPS coordinators to ensure no inappropriate simultaneous operations are conducted. For example, we will not induce an underbalance while waiting on cement. We will have a BOP, riser, and surface casing in place prior to drilling into known

or predicted productive gas or liquid hydrocarbon zones to isolate fragile overlying intervals to avoid fracturing under reservoir pressure.

- f. We can determine drill string position to avoid placing a tooljoint in the sheer/blind rams, a process that is much easier in shallow water than in deep water.
- g. Shell's primary relief well plan for Arctic drilling remains disconnecting the Frontier Discoverer from the wellbore and utilizing the Frontier Discoverer to spud a relief well expeditiously. This remains a robust plan due to the well control procedures and shorter response times as explained above. One of the reasons for selecting the Frontier Discoverer drill ship is its ability to safely and quickly depart from the well location in the event of unmanageable ice. In the event of a blowout, the same riser and anchor disconnect technologies make it probable that the Discoverer and its crew will be moved out of harms way thereby allowing it to drill a relief well. We have prepared for this circumstance by ensuring that we have a full extra set of equipment including a BOP, anchors, drill pipes and casings as well as drilling supplies on or quickly available to the Discoverer. In the unlikely event of a blowout resulting in the loss of the Discoverer, Shell would mobilize the Shell owned Kulluk drilling vessel that is capable of drilling same season relief wells in the Alaska OCS. Shell has made significant capital improvements to the Kulluk and is currently managing rig readiness.

Oil Discharge Prevention and Response Plan

Shell will be ready to respond with oil spill response assets in one hour. Shell has an unprecedented three-tier system consisting of an on-site dedicated oil spill response fleet, near-shore barges and oil spill response vessels, and onshore oil spill response teams. These resources are staffed with trained crews and supported by Alaska Clean Seas and Arctic Slope Regional Corporation.

Arctic conditions create differences in responding to oil in cold and ice conditions. Differences in evaporation rates, viscosity and weathering provide greater opportunities to recover oil. Shell and MMS were among the participants in the SINTEF Joint Industry Project that concluded in 2009. This project demonstrated that, in Arctic conditions, ice can aid oil spill response by slowing oil weathering, dampening waves, preventing oil from spreading over large distances, and allowing more time to respond.

3. Additional measures that we have identified to add in light of the incident in the Gulf of Mexico

Our program is robust and includes high safety and mitigation standards to enable safe operations in the Arctic; we have taken early lessons from the GOM incident and incorporated them into our 2010 drilling plans.

Well control enhancement

- a. In 2010, instead of whole coring objective reservoirs in initial penetrations, we will first evaluate formations using drillpipe- or wireline-conveyed logging tools, and potentially rotary sidewall cores, in the original wellbore. Any whole coring would be performed in a bypass hole only after reservoir parameters (pressure, fluid content, temperature, etc.) have been ascertained in the original wellbore. This will further reduce the risk of a "kick" or unwanted flow in the original wellbore.
- b. BOP testing frequency will be increased from 14-day intervals to 7-day intervals to further assure proper functioning.

Enhancements to Blow Out Preventers

- a. We are evaluating the risks-benefits of an additional set of shear rams, which would provide redundancy for shear blind capabilities. Such changes require careful consideration as it represents a significant departure from our successful and reliable well control training and practices.
- b. A remote hot stab system is being designed that will allow a Remote Operated Vehicle (ROV), diver, or support vessel to actuate the BOP from a sled on the seafloor - a safe distance away from the well connected by an umbilical.
- c. A subsea BOP remote operating panel will be relocated from the bottom of the BOP to the top for easier diver or ROV intervention. This provides two ROV/diver intervention options.

Remote Operating Vehicles and Divers

- a. We will have a fully functional work-class ROV for BOP intervention on one of our previously identified support vessels in addition to the ROVs on the drilling rig and science vessel.
- b. We will have backup launch and recovery capability for divers on a support vessel. If the Frontier Discoverer is disabled, this plan provides for redundant diver support capability.

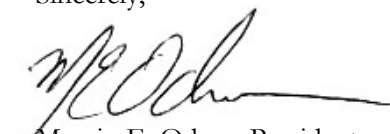
Containment and Response

- a. We will have a pre-fabricated coffer dam pre-staged in Alaska that will take into consideration issues associated with hydrate formation i.e. GOM, and gas/oil separation. We will locate the dome for immediate deployment, if required.
- b. If needed, we will also apply dispersant under water at the source of any oil flow that might occur; however the dispersant would not be used until all necessary permits are acquired.

In closing, I have complete confidence in the technical integrity of our well plans. As described herein, those plans employ a layered approach designed to prevent all types of incidents, including well control incidents like that experienced in the Gulf of Mexico. Furthermore, I also have complete confidence in our ability to execute the 2010 Chukchi Sea and Beaufort Sea exploration plans in a safe and environmentally responsible manner. Those exploration plans, which reflect 60 years of experience conducting exploration and development drilling on OCS lands and were developed over the course of the last three years with direct input from the MMS, other federal regulatory agencies, the state of Alaska and local communities, meet the highest operational and environmental standards.

Please let me know if you have any additional questions. We look forward to receiving your final authorizations to proceed with our 2010 exploration plans.

Sincerely,



Marvin E. Odum, President
Shell Oil Company

cc: Governor Parnell, Senator Murkowski, Senator Begich & Rep. Young