An oil spill from Shell’s operations in the Arctic is unlikely, but we take the consequences of any potential incident very seriously. A spill in the Arctic would pose unique challenges and we have put in place advanced programs to locate, contain and remove oil in various ice conditions.

Shell has several decades of experience operating in a number of Arctic and sub-Arctic regions, and we stand ready to explore offshore Alaska. Our track record when it comes to safety and the environment is strong. We have spent the last six years preparing for exploration in the shallow waters off the coast of northern Alaska. In that time, Shell has worked with Alaskan Native communities, government agencies, and industry to ensure our plans and designs are appropriate for the conditions in the Arctic. We have augmented robust oil spill prevention systems, created an unprecedented oil spill prevention and response plan, and put in place environmental protections and arrangements with local communities that go beyond what is required to minimize impacts and ensure safety. Our planning and safety measures meet or exceed regulatory requirements for operating in the Arctic. Shell would not consider moving ahead with anything less.
A TRACK RECORD OF SUCCESS IN THE ARCTIC

The 40-year history of offshore oil exploration in the Arctic shows it can be done safely and without lasting environmental impact, even before recent advancements in technology. Shell has been a leader throughout this history and has accumulated valuable expertise.

Drilling exploration wells in the offshore Alaskan Arctic is not new for Shell. Shell drilled multiple wells in the Chukchi and Beaufort Seas in the 1980s and 1990s. In fact, Shell has decades of experience drilling in challenging conditions throughout Alaska, including in the Bering Sea, St. George Basin, Gulf of Alaska and Cook Inlet, where Shell installed Alaska’s first platforms. Those platforms are still producing oil today.

In total, more than 500 exploratory, production, and disposal wells have been drilled in the Arctic waters of Alaska, Canada, Norway, and Russia. More than 150 wells have been drilled offshore in Arctic waters of the US and Canada and more than 50 wells have been drilled in the US Beaufort and Chukchi Seas. Shell has drilled 33 wells in Alaska, 32 of which were offshore.

During these 40 years of offshore operations, there has never been an oil spill caused by a well blowout in state or federal waters in the Alaskan and Canadian Arctic.

PREVENTING SPILLS DURING DRILLING

When drilling for oil, spill prevention is achieved through well control. Pressure generally increases with depth, so careful and continuous monitoring of well conditions is used to equalize this pressure with a column of drilling fluid (often called “mud”) that is very heavy and also functions to lubricate the drill and carry rock pieces up out of the hole. However, the strength of surrounding rock can vary with depth, so drill pipe casings are needed to prevent the mud weight from fracturing weaker rock and leaking out. A process of drilling down until the mud weight approaches the rock strength and then adding a concentric section of drill pipe casing is repeated until the desired well depth is reached.

Although very rare, spills during drilling operations can be the result of blowouts, when the pressure in a well cannot be contained and causes the uncontrolled flow of hydrocarbons to the surface. This is less likely to occur when water and well depth are shallow and rock layers are consistently strong, because pressures are more uniform and fewer drill pipe casings are needed. Conditions in the planned exploration wells in Alaska are relatively well known from prior exploration activities in the 1980s and 1990s: the wells are shallow (less than 7,000 feet), in shallow water (less than 150 feet), and in relatively uniform and strong rock with normal pressure conditions. In other words, these are simple wells from a well control standpoint.
Redundancy: Shell applies a multi-layered well control system designed to eliminate the possibility of a low probability, high impact event. If any one system or device fails, it should not lead to a blowout. Before exploratory drilling begins, seismic and other surveys provide essential information about the geology. Information is also gathered on pressure and temperature fluctuations that could be encountered during drilling, and the well itself is carefully designed to account for these. Sensors down the well convey real-time information about pressure and temperature back to operations centers so that any potentially dangerous fluctuations can be picked up immediately, and the pressure adjusted.

The Safety Case Approach: Shell is a leader in offshore oil and gas development because of its approach to safety and the environment. As an example, Shell has used the “Safety Case” approach recommended by the National Commission on the BP Deepwater Horizon Oil Spill and Offshore Drilling for all its contracted drilling rigs, globally, for many years. A Safety Case requires the drilling contractor and the operator to thoroughly assess, document, and choose mitigation measures for offshore drilling risks before a project is underway.

Safety Culture: Since 90% or more of all incidents are caused by human error, a true culture of safety that permeates and guides all activities is perhaps the most important method of spill prevention. Yet it is often the most difficult to measure and manage. Consequently, constant vigilance is required to build and maintain a strong culture of safety.

Blowout Preventer: In the unlikely event that measures of early detection fail, mechanical barriers such as blowout preventers (BOP) can seal off the well. These are a series of valves that can be closed in sequence, providing backup in case one device should fail. Blowout preventers are activated automatically in the event of a power failure on the drilling rig.

Ice Management: Shell’s exploration activities will occur during a four-month period from mid-July through October, in predominantly open water conditions. However, to address the natural variability of ice conditions during thaw and freeze up, Shell has developed an Ice Management Plan (IMP) to ensure safe drilling operations and identify conditions that may put operations at risk.

Shell’s ice management system is a combination of ice monitoring, forecasting, and management techniques. Monitoring includes satellite-based Synthetic Aperture Radar, airborne and vessel reconnaissance. Forecasting incorporates data from the National Oceanic and Atmospheric Administration and the Canadian Ice Service. Shell will use specialized software to integrate ice speed and direction data from the vessel’s radar, aerial reconnaissance, and satellite imagery in order to predict individual ice floe movement, allowing modification of ice management operations on a real-time basis. Shell has established strict protocols to be followed in the event of potential hazards. Ice management vessels can be used to deflect approaching ice around the rig and, if necessary, the rig can quickly stop drilling, secure the well, and move safely off-site.
Shell has used its extensive global offshore experience to create one of the most comprehensive spill prevention and control plans ever developed for an exploration program. It starts with state of the art methods and then is tailored specifically for Arctic conditions based on a thorough investigation of what works and what doesn’t.

Shell’s exploration activities will occur during a four-month period, after the near-shore ice has broken up and in predominantly open water conditions, from mid-July through October. However, because of the possibility of ice incursions during the open water period and the natural variability of the timing and duration of freeze-up, Shell’s oil spill response strategies and tactics are designed to cover a wide range of open-water and ice conditions.

Shell verifies the plans, and its own preparedness, every year through large-scale exercises that include Shell personnel, US Coast Guard, local and state agencies, and other external entities.

Subsea capping and containment systems: A sub-sea capping system can be installed at the sea floor in the event of a loss of well control and in the event of BOP failure. The valves on this sub-sea system are then closed to shut off flow. Additionally, a containment system is designed to capture and recover hydrocarbons from a sub-sea well. Recovered oil would be transferred to a surface processing facility for separation of oil, gas, and water fractions.

Mechanical containment and recovery: The rapid containment and recovery of oil at or near the source is provided by on-site spill response vessels. Mechanical skimmers can be used to remove oil from the water surface and transfer it to a storage vessel. Skimmers work most efficiently on thick oil layers, and floating barriers, including oil booms, are used to collect and contain spilled oil into a thicker layer. A variety of designs have been optimized for Arctic sea conditions and several have been proven to work well in the Arctic.

Controlled in situ burning: In addition to mechanical recovery, oil on water or between ice can be disposed of quickly, efficiently and safely by controlled burning. This technique works most efficiently on thick oil layers, so the oil is contained by fire-resistant booms or ice.

Through burning, on average, about 80%-95% of oil volume is eliminated as gas, 1%-10% as soot and 1%-10% remains as a residue. Following the burning, this residue can be recovered from the water surface. Controlled burning is a proven response strategy developed by the oil industry, emergency response authorities, and scientists over several decades using extensive laboratory and tank testing, large-scale field experiments and lessons from real incidents. It can reduce the environmental impact by rapidly removing large volumes of oil. Burns can eliminate 1,000 barrels of oil per hour over a burn area only 100 feet in diameter. In situ burning has been proven to work well in the Arctic.

Dispersants: Chemical dispersants are another addition to the toolkit for cleaning up spills and have proven highly effective in the Arctic. Dispersants are like detergents, designed to enhance the breakup of oil into fine droplets that can then be dispersed and biodegraded in the sea. The use of dispersants offshore is generally recognized as an efficient way of rapidly treating large areas of spilled oil, providing greater protection to shorelines, birds and marine mammals. They can be applied from fixed-wing aircraft, helicopters, and vessels.

The Flexibility to Adapt: The flexibility to use a broad range of response options, as conditions change, is important. For example, as ice concentrations progress from open drift to heavier pack ice conditions, mechanical recovery systems experience progressively lower oil recovery rates, but the potential for in situ burning or dispersant use improves. Combined, Shell’s response toolkit provides effective response across a broad range of Arctic conditions.
WILL THE RESPONSE TOOLKIT WORK IN THE ARCTIC?
RESULTS FROM OIL-IN-ICE STUDIES

The effectiveness of options in the spill response toolkit under Arctic conditions has been tested, including three years of field trials conducted by the Joint Industry Program (JIP) on Oil Spill Contingency for Arctic and Ice Covered Waters. Challenges associated with remoteness, low temperatures, seasonal darkness, and the presence of ice were studied. Conclusions include the following.

- Cold water and ice can aid oil spill response operations by slowing oil weathering, dampening wave action, and limiting the spread of oil.
- For in situ burning, the window of opportunity can be larger (up to 5 days) and effectiveness can be greater (>90% efficiency proven) in the Arctic for elimination of free floating oil in ice and oil collected in fire resistant booms.
- As increasing ice conditions reduce the effectiveness of mechanical recovery, the potential for in situ burning improves.
- For chemical dispersion of oil, a larger window of opportunity for dispersant application exists due to slower weathering of oil, and dispersal remains effective in ice-covered water. A newly-developed spray unit enables new strategies for use of dispersants in high ice coverage (80-90%).

- Fire-resistant booms were shown to be effective in drift ice.
- The shallow water depth in the Alaskan Arctic offshore helps to reduce the area of spreading as oil floats to the surface. In addition, remote sensing equipment, a combination of remote sensors operating from aircraft, helicopters, vessels, satellites and the ice surface can be used to detect oil trapped under snow on the ice and to detect oil trapped under solid ice.
- The movement of spilled oil in Arctic snow and ice, and where it might accumulate, can be forecast.

Shell is committed to continuing research in the area of Arctic oil spill response and to the deployment of program results into our operations worldwide. Shell became a member of a new Arctic JIP administered by the International Association of Oil & Gas Producers. Participation is being sought from Governmental agencies and key scientific institutions to establish a portfolio of prioritized projects to advance year-round Arctic spill response capability. A coordinated effort will ensure the most efficient use of resources and facilitate dissemination of results, furthering the mission of the JIP.

Future Studies
SHELL’S ALASKA SPILL RESPONSE CAPABILITIES

Shell has designed multiple layers of response to ensure that, in the unlikely event of a blowout or accidental spill, the well could be shut down and any oil discharged could be contained, collected or burned off. Dedicated personnel and equipment will be staged onsite in close proximity to the drilling rigs, in a constant state of readiness. Drilling will not commence until all of the planned response and containment assets are in place.

On-site Subsea Intervention and Containment: There are multiple barriers designed to prevent a blowout. However, if one should occur, the blowout preventer (BOP) is designed to close the well within seconds. Shell has implemented an enhanced BOP design and testing regimen based on learnings from the BP Deepwater Horizon spill, including an extra set of redundant shear rams and testing every 7 days.

If the BOP should fail, a remote-operated vehicle (ROV) kept on-site will be used to enable remote subsea activation of the BOP. The waters are shallow enough that divers may also be used in some circumstances. If needed, a second drillship capable of commencing a relief well will be available in Alaskan waters.

Shell’s sub-sea intervention and containment system will be in Alaska, ready to deploy immediately upon notice. This system will feature devices for capping a subsea blowout and a containment dome that can be placed over the discharging well, capturing oil before it reaches the surface and routing it to a purpose-built ice-reinforced floating surface processing facility.

Response Strategies and Equipment: Shell will have pre-staged boats, booms, skimmers, helicopters, barges and other assets ready to begin oil recovery within an hour. Ice-capable vessels and equipment can be activated immediately and operate for extended periods in open water and broken-ice conditions to mechanically contain and recover spilled oil or eliminate oil using controlled burning. The assets are designed for use in Arctic conditions, with things like reinforced hulls, storage capacity to account for the remote location, and materials appropriate for cold temperatures.
Examples of selected Arctic capable equipment include the following:

- The Nanuq is a 300-foot purpose-built ice class oil skimmer with 12,000 barrels storage capacity;
- An ice-strengthened Arctic tanker is staged onsite for oil recovery, with 513,000 barrels storage capacity;
- Ice management vessels;
- High-volume-throughput skimmers, boom and small vessels.

Nearshore: Shell has additional oil spill response vessels ready to respond between the drilling rig and the Alaskan coast in the event any oil is not fully contained by the on-site assets.

Onshore: If any oil does move close to the shore, Shell will employ aircraft and wind/current models to predict where the oil could potentially make landfall. In the event landfall is likely, Shell will use pre-staged trained personnel, oil containment booms, boats and skimmers to intercept the oil before it reaches the coastline.

**IN SHORT**

In our efforts to meet growing global energy demand, Arctic resources will play a critical role. We understand that one of the biggest concerns among those opposed to Arctic development is the possibility of an Arctic oil spill. Shell’s approach to exploration and development minimizes the chances of a spill, and Shell has put a comprehensive program in place to clean it up and mitigate its effect in the unlikely event a spill does occur. Recent independent international research confirms that there are effective tools and techniques in place to respond to Arctic spills. Shell is also dedicated to continuous improvement, and is always learning more. Shell and the industry continue to invest in research to improve equipment and operational readiness.

Our track record

Shell has a good record of spill prevention in the Arctic and sub-Arctic. Our experience from operations in places like Canada, Russia, and Norway has given us the expertise to work in extreme weather and sea ice conditions, far from populated centers and support facilities.

Shell has worked for nearly a half century in Alaska, safely drilling 11 exploration wells in the Beaufort and Chukchi seas during the late 1980s and early 1990s. Shell’s pioneering work in Alaska is still visible today in Cook Inlet, where platforms Shell installed in the 1960’s are still producing.

The goal for Shell’s spill response plan – with sub-sea capping and containment, offshore, onshore and near-shore equipment, and teams ready 24-hours a day and operational within an hour – is to make sure we never have to use it.