



Frozen Future

The gaps in Shell's Arctic spill response

Shell is currently moving its drilling rigs to Seattle in anticipation of resuming its US offshore Arctic drilling programme in July. However, it is far from clear that Shell has adequate physical or financial plans to deal with the impacts of a major oil spill in this remote region.

This briefing examines the significant challenges in dealing with such a spill, including a lack of response infrastructure, the ineffectiveness of key response tactics, and a lack of understanding of key aspects of the dynamic Arctic region necessary according to the National Research Council in the US to "make informed decisions about the most effective response strategies."¹ It also outlines specific concerns about Shell's response plans, including a continued refusal to test essential equipment in operational conditions. We suggest questions investors should ask Shell to understand whether the company has adequately assessed and addressed the various risks.

The US government estimates a 75% chance of a major spill over the lifetime of projects in the Chukchi Sea², while US government-funded research from September 2014 raises serious concerns over the ability to deal with such a spill given prevailing environmental conditions.³

Both Lloyd's of London⁴ and the National Research Council have concluded that plans to industrialise the Arctic are far ahead of the development of supporting infrastructure. According to the National Research Council, "The lack of infrastructure in the Arctic would be a significant liability in the event of a large oil spill."⁵

The financial impact of a major oil spill could far exceed Shell's self-insurance per incident limit of \$1.15bn⁶ and pose an unprecedented risk to Shell. The significant costs of spill prevention and mitigation measures, about which the company objected to the US government⁷, further undermine the economic rationale for Shell's Arctic project.

Major risk for investors

- 75% chance of a major spill with winter response options severely restricted
- Lack of spill response infrastructure, even when accounting for Shell's pre-staged resources
- Key equipment not tested in operational conditions
- The risk and scale of an oil spill

The risk and scale of an oil spill

Shell has repeatedly discounted the chances of a large spill or a well blowout. However, major spills have occurred during exploration drilling (including BP's Deepwater Horizon blowout in 2010 and Petronas' spill north of Australia in 2009), and well blowouts have occurred in shallow water (including Total's Elgin gas leak in the North Sea in 2012).

In its revised environmental impact statement, the Bureau of Ocean Energy Management estimated that there is a 75% chance of a spill (over 1,000 barrels) during the lifetime of projects in the Chukchi Sea.⁸ The probability of small spills is close to 100%—as elsewhere, such spills are an accepted fact of oil companies' operations. But in the Arctic they will be associated with more significant technical challenges and therefore higher costs and will be subject to intense civil society and media scrutiny as evidenced by the coverage and criticism of the Kulluk running aground.

Shell's worst-case discharge estimate more than quadrupled from 5,500 barrels per day in its 2010 Chukchi Sea oil spill response plan, to 25,000 barrels per day for 30 days in its 2012 plan.⁹

Shell's worst-case discharge response is based on the highly questionable assumption that mechanical recovery techniques would recover 95% of a major spill before it could reach the shoreline, with 90% being recovered by "primary offshore recovery efforts at the blowout."¹⁰

Shell also assumes that 50% of the oil which escapes the "primary offshore recovery efforts" will be recovered before it reaches the shore by "skimming systems"¹¹. These clean up rates have not been achieved for any large spill anywhere to date with such methods. An estimated 3% of spilled oil was recovered using these techniques after the Deepwater Horizon spill¹² and 8.3% in the case of the Exxon Valdez spill.¹³

Shell does not in its oil spill response plan (OSRP) appear to provide information on the possible timing of transition from one line of its four-part blowout defence to another in the event of a spill. Nor does it provide information on the time required to affix the capping stack. This can be delayed by factors including damage to the drilling rig and the presence of broken equipment on the seafloor.

Questions for Shell

- What precisely does Shell mean when it states that it assumes that only 10% of a worst-case discharge will "escape primary offshore recovery efforts at the blowout"? Does this mean Shell assumes a 90% recovery rate offshore? If so, what assumptions has Shell made to reach this conclusion? If it does not mean an assumed 90% recovery rate, what is Shell's estimate of the amount of oil it will recover offshore?
- Given that in previous large spills, mechanical means have only resulted in removal of approximately 3–8% of spilled oil from water, why does Shell think that it will capture a significantly higher percentage with such means?

Concerns over testing of essential equipment

The Arctic is a uniquely challenging operating environment. The findings of the US Coast Guard investigation into the running aground of the Kulluk make clear that Shell and its contractors have not always appreciated this fact.¹⁴ Industry commissioned research acknowledges that this environment potentially has an impact on spill response technology.¹⁵ The National Research Council has stated unambiguously “there is a need to validate current and emerging oil spill response technologies on operational scales under realistic environmental conditions.”¹⁶

However, despite a delay in drilling since 2012, it does not appear that Shell has taken the opportunity to test its capping stack or containment dome in Arctic waters. Relevant US regulators have approved testing off the coast of Washington state,¹⁷ which does not represent real-life operational conditions. Given the time available to Shell and the emphasis it is placing on ‘safe drilling’, the failure to confirm that it will test essential equipment in Arctic waters is concerning.

Questions for Shell

- Has Shell tested its capping stack and/or containment dome in real-life Arctic conditions or only off the coast of Washington state?
- In light of the delays to its Arctic programme and the level of scrutiny to which this project is subject why has Shell not taken the opportunity to conduct such tests?



At present, it is far from clear that Shell has adequate physical or financial oil spill response plans.

Timing of a spill

A spill would be most damaging if it occurred at the end of the drilling season, when any response would be impeded by changing weather conditions and the return of ice. The maximum period available for drilling activities in the Chukchi Sea is July to October. Shell's spill planning anticipates 20 days before returning ice severely restricts recovery and clean up. Depending on the timing of a spill, Shell may not have this much time.

In September 2014, an independent spill response gap analysis for the US Arctic Ocean by Nuka Research & Planning Group, LLC, funded by the Bureau of Safety & Environmental Enforcement was published¹⁸. This study analyses "how often a particular response tactic could be expected to be ineffective or impossible to deploy based on historic environmental conditions in a certain area".¹⁹ It is important to note that the analysis does not consider the complete picture but hypothesizes a spill response scenario under ideal operational and logistical conditions. The analysis also does not fully estimate the extent to which a response tactic would be effective, such as on-water recovery rate or *in-situ* burn efficiency.

Even in such a hypothetical scenario, the analysis found that all of the traditional oil spill response tactics would be precluded by Arctic conditions for a significant portion of the time, even during the summer drilling window. Nuka found that the most feasible tactic in the summer months was the application of dispersants from vessels, and even that would be possible only 82% of the time. Other tactics performed even worse, including *in-situ* burning ignited from vessels (feasible 66% of the time), open-water mechanical recovery (57%), application of dispersants by air (50%), and *in-situ* burning ignited from the air

(44%). The situation in the winter months was considerably worse, with only *in-situ* burning having any likely feasibility at all, though it would still be impossible more than half the time (42% when ignited from vessels, 25% when ignited from aircraft) and does not include the collection of burn residue. The analysis portrays the very different conditions in an Arctic summer and winter, indicating the need for very different planning and approaches based on seasonal conditions.

The analysis calculates the total number of hours available for a particular response. Therefore, the response window does not necessarily represent consecutive hours of favourable conditions. A consecutive period of hours will obviously be necessary to mount an effective response.

Shell's 2012 OSRP contains an illustrative response to its assumed worst-case discharge²⁰. Although the illustration refers to varying weather conditions, it models a response on the basis that ice will begin to form on day 9 and impact spill response (requiring ice-breakers) on day 14, with full freeze-up conditions occurring on day 21. However, no information is provided on the impacts on Shell's response in the event that any of its assumed conditions vary e.g. if icebreakers are required or full freeze-up occurs sooner. We are limited to an illustrative example as opposed to a detailed modelling of a response in a variety of likely scenarios.

***In-situ* burning - the only option in winter**

In-situ burning involves corralling oil with fire resistant booms (or as Shell also proposes natural ice formations) and igniting it. Oil in open water will often spread until it is too thin to ignite, so the oil must be concentrated for this tactic

to work. Joint Industry Programme research, funded by Shell, showed that *in-situ* burning was only a viable option for approximately five days after oil is spilled and that it is not effective at all in 30–70% ice conditions, reporting that: “after six days the oil was so mixed with slush that both mechanical recovery and *in-situ* burning were evaluated as not effective.”²¹ Despite Shell referring in its OSRP to studies showing high clean up rates with this tactic, in practice only 1% of the Ixtoc I oil spill²² and 5% of the Deepwater Horizon spill was burned.²³ Due to weather, very little burning was used during the Exxon Valdez clean up. In situ burning leaves behind residue that must be collected—the NUKA gap analysis says this would not be possible in the case of a winter spill response effort.

Questions for Shell

- What is Shell’s response to the US government commissioned spill response gap analysis?
- The analysis finds that in the case of a winter spill, all other spill response tactics other than *in-situ* burning are ineffective more than 90% of the time. In light of this and of the *in-situ* burning clean up rates in previous major oil spills, why is Shell confident that it can deal with such a spill?
- Has Shell modelled responses to a worst-case discharge spill in a number of scenarios with varying environmental and operational conditions e.g. full freeze-up earlier than day 21?
- How many consecutive hours of good weather at the drilling sites do Shell estimate it needs in order to mount an effective response to a worst-case discharge spill?
- If *in-situ* burning was implemented, how would the impacts be monitored (primarily air quality) and mitigated (i.e. residue collected) if people cannot operate in the area for much of the year? Even if you can ignite the oil, how will you minimise the release of residue into the water column?



All of the traditional oil spill response tactics would be precluded by Arctic conditions for a significant portion of the time, even during the summer drilling window.

Oil trapped under ice

Shell's OSRP states that if oil removal becomes impossible because of ice encroachment, oil that is trapped within the ice can be monitored and tracked and then recovered "when it becomes naturally exposed in the spring/summer period."²⁴ However, the National Research Council identified "Investment in detection and response strategies for oil on, within, and trapped under ice" as "necessary for contingency planning"²⁵ showing that the detection and clean up of oil trapped in ice is far from certain. Depending on ice movement it is also possible that oil will cross international borders during the winter, complicating clean up efforts and meaning that Russia and/or Canada may need to be involved in any clean up efforts. In such a scenario Shell may find itself subject to regulatory penalties for causing an oil spill in more than one country. In October 2014 a barge slipped its tow in US arctic waters. It has since travelled, trapped in ice, some 1300 miles and is now in Russian territory demonstrating the possibility and unpredictability of ice movement.²⁶

Lack of appropriate infrastructure

The infrastructure to mount a large-scale oil spill response simply isn't in place. In its 2014 report on Arctic spill response, the National Research Council stated: "it is unlikely that responders could quickly react to an oil spill unless there were improved port and air access, stronger supply chains, and increased capacity to handle equipment, supplies, and personnel."²⁷

The nearest Coast Guard station is in Kodiak, roughly 1000 miles from drilling sites, and the nearest large deep water port is hundreds of miles from Barrow, in Dutch Harbor. The Coast Guard's ability to oversee oil spill response

has been described as "admirable but inadequate".²⁸

Shell's OSRP designates Anchorage airport as the key arrival point for equipment and personnel for onward transfer within Alaska. US based resources are estimated to arrive in Anchorage airport in less than 24 hours, with international arrivals in less than 72 hours.²⁹ Anchorage is 711 miles (or, depending on the type of aircraft, a 2.4 to 7 hour flight) from Wainwright, the closest village to Shell's drilling sites.³⁰

Shell claims that it is unlikely that out-of-region resources will be required to deal with a spill. However, in the case of a significant spill, it is likely that additional out-of-region responders will be required to be transported to Alaska. Shell's OSRP specifies a total of up to 848 responders, with 309 being in-region personnel on Shell's fleet (of whom 67 are designated to nearshore response vessels).

Approximately 160 are listed as available from other operators in the North Slope and an additional 379 would be available under contracts.³¹ It is unclear whether this is the total number of in-region responders available to Shell. To assess the adequacy of in-region numbers it's important to note that spill response efforts will include offshore, nearshore and onshore clean up teams with workers operating on a shift basis. The Spill Tactics for Alaska Responders (STAR) is a manual developed by an expert working group convened by the State of Alaska to detail what is required to successfully implement different spill response tactics. The STAR manual includes a Nearshore Operations Response Strategy. Developed for spills over 10,000 barrels, it estimates that up to 832 specialist personnel and 73 support personnel could be required for nearshore and sensitive area protection, depending

on the number of sites to be protected and up to a maximum of 30 sites.³² Shell's OSRP lists 35 individual 'Priority Protection Sites' along the Chukchi Shoreline.³³ Shell does not reference the STAR manual in its OSRP. Reference is made to 2000 Shell staff (US and global) potentially being made available³⁴ but information as to what level of spill would trigger their deployment and the timing of their release from other duties and arrival in Alaska is not provided.

Shell acknowledges the lack of accommodation facilities outside of Anchorage. It states that a temporary camp for 200 people can be transported by air and assembled within 5 days. The company does not state how many such camps it anticipates having to build.

Questions for Shell

- What is the total number of in-region spill responders available to Shell? What assumptions has Shell used in calculating the number of responders required for its worst-case scenario spill, compared to the Alaska state assessment for nearshore and sensitive area protection?
- In the event that Shell has to deploy significantly more responders e.g. the 2000 additional Shell staff, will this result in logistical challenges? e.g. the time required to deploy those staff, additional man-camp provision and/or sufficient aircraft capacity to transport people from Anchorage in a timely manner?



There is a need to validate current and emerging oil spill technologies on operational scales under realistic environmental conditions.

Conclusion

In addition to significant financial penalties in the form of clean up costs, fines and litigation resulting from a major spill, Shell would also likely face uncertain impacts on share price and credit ratings, unprecedented reputational damage, and a threat to its ability to operate in the US. In this context, it's notable that Shell finds its most high-risk and mishap-prone project subject to international media, political and civil society scrutiny.

Successive research reports have raised serious concerns that Alaska and Shell are unprepared to deal with a major spill. As with Macondo, it appears that drilling appetite is outpacing emergency response development.

Investors must question whether Shell is striking the correct balance between ambition and ability, and between risk and return.

Questions for Shell

- Does Shell assume a 90% recovery rate offshore? If so, what assumptions underpin this? If not, what is Shell's estimate of the amount of oil it will recover offshore?
- Given that in previous large spills, mechanical means have only resulted in removal of approximately 3-8% of spilled oil from water, why does Shell think that it will capture a significantly higher percentage with such means?
- Has Shell tested its capping stack and/or containment dome in real-life Arctic conditions or only off the coast of Washington state?
- In light of the delays to its Arctic programme and the level of scrutiny to which this project is subject to, why has Shell not taken the opportunity to conduct such tests?

- What is Shell's response to the US government commissioned spill response gap analysis?
- The analysis finds that in the case of a winter spill, all other spill response tactics other than *in-situ* burning are ineffective more than 90% of the time. In light of this and of the *in-situ* burning clean up rates in previous major oil spills, why is Shell confident that it can deal with such a spill?
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