Deep Sea Drilling

This information sheet explains how government agencies manage offshore drilling and drilling in deep water in New Zealand.

New Zealand Government

Department of Conservation *Te Papa Atawbai*

NEW ZEALAND PETROLEUM & MINERALS

Ministry for the Environment

Environmental Protection Authority *Te Mana Rauhī Taiao*

Nō te rere moana Aotearoa MARITIME NEW ZEALAND

WORKSAFE NEW ZEALAND | MAHI HAUMARU AOTEAROA

Introduction

Offshore drilling for petroleum in New Zealand began in the 1960s. To date, over 200 offshore wells have been drilled in New Zealand, 10 of which have been in deep water, without any significant incidents. Offshore drilling has been undertaken around the world for over a century. The first offshore well was drilled on a platform that was constructed at the end of a wharf in California in the 1890s. Since then, developments in technology have allowed operators to explore further and further out into the ocean – initially on pillars, then on artificially constructed islands and now on the mobile platforms and vessels that the petroleum industry use today.

Provided the activity is properly managed, resourced and carried out by competent operators, continuing improvements in technology and technique are allowing operators to drill safely and with minimal impact in ever increasing deeper water.

In New Zealand, deep sea in the context of drilling is defined as ocean depths greater than 300 metres. However, this definition varies in other parts of the world, with some countries defining deep water as more than 500 metres. Ultra-deep wells are drilled at water depths of 1.5 km or more.

According to the International Association of Oil and Gas Producers, more than 14,000 deep water wells have been drilled throughout the world over the past 20 years. Deep water petroleum production has grown from a very small contribution to more than five percent of global oil supply. This is expected to double to 10 percent by 2030.

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The challenges of deep water drilling

Drilling in deep water is more complex and challenging than drilling at shallower depths. One of the challenges is accessing the seabed. Seabed temperatures often approach freezing, making it impossible to use diving teams. Equipment is installed and maintained by remotely operated vehicles (ROVs) from the drilling rig.

An additional challenge is the pressure present at these depths. At great depth there is intense pressure on equipment and it has to be heavier and stronger than equipment used at shallower depths. Equipment may also be subject to significant pressure arising from the drilling of the reservoir. Working at those depths has led to a range of engineering developments in drilling equipment including the 'riser', a pipe that connects the drilling platform to the well on the sea floor and ensures that drilling muds do not spill.

Weather conditions may also be more challenging as deep water areas are usually far from shore and more exposed than in coastal areas. To counter this, dynamic positioning equipment has been developed that keeps a ship on the same spot to within 30 centimetres without the need for anchors.

Recent technological advances such as floating production, storage and offloading (FPSO) vessels allow operators to process, store and transfer petroleum at sea enabling more remote offshore locations to be developed without the need for a pipeline back to shore over challenging seafloor conditions. This is of benefit in regions such as New Zealand where active faults may cause additional engineering risks to seafloor pipelines.

Experienced operators using the appropriate equipment, expertise and processes are able to effectively manage these challenges.

What are the risks?

The primary risks when drilling offshore are blow-outs and spills.

A blow-out is an incident where an influx of pressurised oil or gas from the reservoir flows in an uncontrolled way from the well. A spill is the release of oil, or another hazardous substance, into the ocean as the result of mismanagement or mishandling.

While the likelihood of a well blow-out or an oil spill from a correctly designed, constructed and operated well is extremely small, the consequences can be severe.

Oil and gas deposits come in many forms; they can be waxy and immobile, in a free-flowing liquid state or present as gas and condensate. The environmental effects of a spill would depend upon many factors, including the type and amount of oil spilled, but has the potential to impact marine life and local ecosystems.

In New Zealand there have never been any offshore well blow-outs, however there have been several oil spills. The largest spill to date was 23 tonnes of oil from the Umuroa floating production, storage and offloading vessel on the offshore Tui Field in 2007. In comparison, the oil spill caused by the MV Rena shipping container vessel grounding on the Astrolabe Reef off the Tauranga coast in 2011 was 350 tonnes.

How does the Government manage these risks?

Considerable emphasis is placed on risk mitigation and prevention throughout the petroleum regulatory regime. Before an operator begins exploratory drilling work, they must demonstrate to multiple regulators that they can undertake the proposed work to very high safety and environmental standards.

If an operator wants to drill for petroleum in New Zealand, they need to obtain a permit from **New Zealand Petroleum and Minerals** (NZP&M). NZP&M manages the Government's oil, gas, mineral and coal resources in accordance with the Crown Minerals Act 1991.

Before granting any permits NZP&M assesses an operator's technical and financial capability and compliance history. It will also undertake a preliminary, high level assessment of an operator's capability and systems that are likely to be required to meet applicable health, safety and environmental legislation. NZP&M ensure that only the most responsible companies are able to undertake oil and gas exploration and production in New Zealand's waters.

The operator also needs a marine consent which is issued by the **Environmental Protection Authority** (EPA). The EPA is the government agency responsible for regulating the effects of restricted activities such as drilling in the Exclusive Economic Zone (EEZ) and Continental Shelf (CS). The EEZ is the area from 12 to 200 nautical miles offshore and the CS is the seabed and subsoil from the 12 nautical mile limit out to the end of New Zealand's submerged landmass.

Under the Exclusive Economic Zone and Continental Shelf (Environmental Effects) Act 2012 operators are required to submit detailed impact assessments as part of the marine consent process.

Impact assessments should include the identification of any effects on the environment and existing interests resulting from undertaking the proposed activities, and the measures that the operator will take to avoid, remedy or mitigate any potential adverse effects.

The EPA may grant an unconditional consent or attach conditions to the consent to address any potential adverse effects of the proposed activity on the environment and existing interests. If an application is granted and conditions are set, the EPA will monitor and enforce compliance with those conditions.

The EPA can also decline the consent. One of the reasons the EPA may decline consent is if it does not have adequate information to determine the application.

If the drilling activity is in territorial waters, which extend from the coast out to the 12 nautical mile limit, **Regional Councils** are responsible for managing the environmental impact under the Resource Management Act 1991 (RMA).

Operators will be required to obtain a resource consent which involves an assessment of the environmental impacts in a similar manner to the marine consenting process of the EPA. Deep water is unlikely to occur within territorial waters.

Drilling is also subject to the Health and Safety at Work (Petroleum Exploration and Extraction) Regulations 2016. Before work can commence, the operator is required to submit a safety case which has to be approved by **WorkSafe New Zealand**. WorkSafe is responsible for enforcing the rules that ensure that the oil 'stays in the pipe' and that the risk of harm to people from a well failure is as low as reasonably practical.

Through the acceptance and monitoring of an operator's safety case, WorkSafe ensures that operators have a functional well examination scheme that sees that a well is managed through its life cycle in relation to its design, construction, operation, maintenance, modification, suspension and abandonment.

Maritime New Zealand (MNZ) is responsible for ensuring operators have plans in place to respond to a potential oil spill. Before any drilling an operator must submit an Oil Spill Contingency Plan to MNZ for approval. This will show the operator has:

- minimised the risk of an accidental spill
- detailed emergency response plans in place if a spill does occur, including a Well Control Contingency Plan in case of a well blow-out.

MNZ is also responsible for maintaining New Zealand's oil spill response capability and preparedness, and for coordinating any major oil spill responses at a national level.

Before operations start, MNZ inspects vessels involved in the operation to ensure they meet the applicable international standards.

The various regulations and requirements will be continuously monitored by the respective agencies through the life of the operation. Throughout well drilling, the operator is subject to inspection at any time by WorkSafe, MNZ and the EPA. Work can also be stopped at any time if a regulator has particular concerns. The operator can also have their documentation revoked for persistent or major breaches of agreed processes and protocols.

For more information, see the *'Who does what in New Zealand's offshore waters'* factsheet.

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How are these risks managed at an operational level?

Blow-outs are rare events, and only a quarter of those that occur actually result in oil being released into the ocean. A convergence of a whole range of circumstances, which in themselves are very unlikely, would have to occur before a loss of control incident could happen.

Preventing an oil spill and maintaining or recovering well control is, at all times, the responsibility of the operator.

In addition to legislative requirements, operators follow a range of risk mitigating practices and processes both before and during drilling.

Blow-outs

In the event of a blow-out occurring during drilling, drilling mud acts as a first line of defence. Drilling mud is thick fluid consisting of water, clay and additives that is continuously pumped down the well in a contained system as it is being drilled.

The weight of the drilling mud can counteract high underground pressures which are responsible for causing blow-outs.

The well's blow-out preventer (BOP) is the next barrier.

The BOP is a hydraulically operated system of valves and other closure devices that lies on top of the well head on the seafloor.

It is capable of sealing off the well or rerouting fluids and gas into specially designed containment systems.

In the highly unlikely scenario of both of those systems failing, leading to a complete loss of well control by an operator, there are a number of different response options that would be considered.

One intervention technique could be drilling a relief well. A relief well intersects the original well and drilling mud followed by cement is pumped down at pressure to stop the flow of oil from the reservoir. If there isn't damage to the vessel or risk to workers following a blow-out, the same ship or rig can be used to drill a relief well.

Another option could be using a capping stack to contain the oil in the well. A capping stack weighs over 80 tonnes and is designed to fit over a blown-out well, allowing the operator to gradually "shut in" oil flow with a series of hydraulic rams. Capping stacks are only suitable in certain scenarios and are a temporary containment measure to stop oil flow before or during the drilling of a relief well.

Capping stacks are located at various strategic locations around the world, including Singapore – which is the closest location containing a capping stack to New Zealand. Specialist support vessels would also be needed to help fit the cap.

Spills

Robust regulation and best operating practice is at the forefront of managing the risk of potential oil spills.

In the event of a significant oil spill occurring, the operator will be the first respondent. They have the resources, proximity and expertise to do the job and the means to ensure access to local and global resources if required. The operator must describe exactly how they will respond to a potential oil discharge in their Oil Spill Contingency Plan, which must be approved by MNZ before they start drilling.

MNZ is the lead national oil spill response agency. It is responsible for maintaining a nationwide capability to respond to marine oil spills of any size.

International agreements are in place with overseas jurisdictions to provide additional equipment and technical expertise, if a spill response that goes beyond the national capacity is required.

Under the Maritime Transport Act 1994 (MTA), owners and operators of offshore installations are liable for the full costs of any damage to third parties and clean-up costs to government agencies (including any preventative measures undertaken) as a result of any potential oil pollution, without the need to prove fault. This action is supported by a requirement in the MTA for operators of offshore installations to hold liability insurance, or other financial security, that covers the operator's potential liability under the MTA.

Lessons from the Deepwater Horizon

On 20 April 2010, a blowout and subsequent explosion occurred on the Deepwater Horizon oil rig working for BP in the Gulf of Mexico. Eleven workers died and close to five million barrels of petroleum were spilt into the Gulf before the well was closed and sealed.

The cause of the accident was ultimately ruled as the result of a failure of multiple processes and emergency functions. Both regulators and industry have learnt a great deal from it. Many of the large international operators adopted much higher health and safety processes to prevent similar incidents occurring again.

New Zealand was a participant in an international forum on offshore containment led by the United States government, following the Deepwater Horizon accident. The forum set best practice framework for the lifecycle of exploration and production, including containment and management of oil spill incidents.

The New Zealand Government has taken these lessons into consideration and taken several approaches over the last few years to strengthen regulatory processes and extend environmental protection measures.

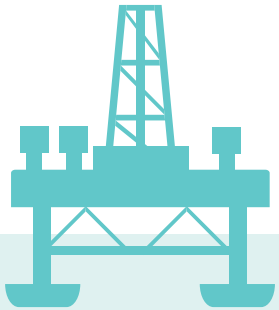
This has included:

- Changes to the Crown Minerals Act 1991 to strengthen regulatory agencies' coordination on health, safety and environmental matters, and ensure regulatory efforts are proactive, coordinated and focus on operations that have the highest technical and geological complexity.
- The establishment of the High Hazards Unit, part of Worksafe, to oversee health and safety practices on oil and gas platforms.
- The establishment of the Exclusive Economic Zone and Continental Shelf (Environmental Effects) Act 2012 (the EEZ Act). Prior to this many of the environmental effects of activities in the EEZ were not regulated.
- MNZ has also issued stricter guidelines to offshore operators on expected levels of oil spill preparedness and response capability.

These changes have significantly increased the range of preventative measures operators must now take before they are permitted to drill and further reduces the likelihood – already very small – of an actual well blow-out. They also ensure that only the most responsible companies are able to undertake oil and gas exploration and production in our waters.

Types of mobile offshore exploration drilling rigs

Type:	Jack-up rigs	Semi-submersible rig	Drill ships
Description:	Jack-up rigs are the most popular type of mobile offshore drilling equipment. The structure is 'bottom-supported' meaning three or four extendable 'legs' are planted into the seabed and used to lift (or 'jack-up') the platform out of the water.	Semi-submersible rigs have a platform-type deck that contains drilling equipment and other machinery. The structure is supported by pontoon-type columns that are submerged in the water. It is the most stable of any floating rig and is often used in harsh conditions because of its ability to withstand rough waters. Semi-submersibles can be anchored or in some cases dynamically positioned.	Drill ships are modern versions of traditional stationary drilling rigs. It is very similar to semi-submersibles with one major exception – it has no anchors and relies on dynamic positioning thrusters to maintain its position over the well.
Capability:	Shallow waters Up to about 100 metres	Approximately 100–500m water	Deep and ultra-deep waters Between 300–3500 metres



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