NEW ZEALAND PETROLEUM & MINERALS

Ministry of Business, Innovation & Employment

Hydraulic fracturing (fracking)

Questions and Answers

1. What is hydraulic fracturing?

Hydraulic fracturing – also known as fracking – is an engineering process used to create micro-fissures in rock deep underground to help release oil and gas deposits that would otherwise be uneconomical or impossible to recover.

Hydraulic fracturing has been used in oil and gas production around the world for more than 60 years. Similar techniques can be used to stimulate water wells and geothermal energy developments.

2. How is hydraulic fracturing carried out?

- Hydraulic fracturing is a highly specialised activity that is tailored to the conditions of the identified site. It only occurs after the geology of the area has been evaluated by experts and found suitable for hydraulic fracturing and meets resource consent conditions. In New Zealand, hydraulic fracturing is only carried out by trained and experienced specialist operators.

For oil and gas production, the fractures are created by pumping a mixture of water, sand or ceramic beads (proppant) – together about 98 percent of the fracture fluid – and chemical agents into the well under pressure to create micro-fissures – fracturing – in the rock layers. When the pressure is reduced, the sand or ceramic beads hold the micro-fissures open, freeing the oil or gas to flow up the well.

Even though the cracks in oil- or gas-bearing rock are widened by just a few millimetres by the micro-fissures, it makes a substantial improvement to the ultimate recovery of oil and gas.

Once the rock has been fractured and the well depressurised, between 25 and 75 percent of the hydraulic fracturing fluid flows back to the surface and is disposed of in a safe manner. Some of the remaining fracturing fluid is extracted during the process of obtaining the oil and gas from the well, with a small amount of fluid that is impossible to recover remaining underground.

3. Why is hydraulic fracturing carried out?

Hydraulic fracturing has been used around the world for more than 60 years to help release oil and gas deposits that would otherwise be uneconomical or impossible to recover.

4. What are the hydraulic fracturing fluids made up of?

Water and sand, or ceramic beads usually makes up at least 98 percent of the fluid used in hydraulic fracturing. In addition, chemical additives are used.

Hazardous substances added to the frack fluid must be stored, handled and disposed of in conjunction with the conditions of the Hazardous Substances and New Organisms Act 1996 and relevant resource consent conditions.

5. How is hydraulic fracturing regulated in New Zealand?

In New Zealand, all drilling operations are subject to the provisions of the Resource Management Act 1991 (RMA), administered by local authorities, and must meet any and all obligations required under the RMA where the environmental effects of any proposed activity are assessed, managed and monitored by local authorities.

The design, construction, operation, maintenance, suspension and abandonment of all petroleum operations and related well drilling operations, whether they involve hydraulic fracturing or other techniques, are subject to the provisions of the Health and Safety in Employment (Petroleum Exploration and Extraction) Regulations 1999, administered by the Labour Group of the Ministry of Business, Innovation and Employment.

All substances used on a petroleum exploration well site are also subject to the Hazardous Substances and New Organisms Act 1996, administered by the Environmental Protection Authority.

6. What standards exist for hydraulic fracturing operations?

Hydraulic fracturing has been limited to a small number of regions in New Zealand. That expertise is being shared between regional councils, who are working collaboratively to ensure that adequate processes are in place across all councils for dealing with applications for hydraulic fracturing.

As part of the collaborative work between councils, Taranaki Regional Council is developing guidelines on appropriate controls for hydraulic fracturing and its related activities (e.g. air emissions) to assist other councils. Taranaki Regional Council has already published reports on groundwater and induced seismicity.

Improved coordination and communication between central government and local authorities is also assisting with improving information and processes around hydraulic fracturing nationally.

Most operators in New Zealand and overseas adhere to the American Petroleum Institute's standards for hydraulic fracturing, as well as their own company standards.

7. How is the government strengthening regulation and management of petroleum and minerals activity?

The government is committed to ensuring that New Zealand has a world-class and robust regulatory environment for the safe and environmentally responsible exploration, production and transportation of our petroleum resources. A number of initiatives this year aim to strengthen the regulatory regime, including:

- proposed changes to the Crown Minerals Act that will 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
- strengthening the health and safety regulation of wells and well drilling activities following international best practice
- the establishment of a new High Hazards Unit with a marked increase in the number of inspectors and the appointment of a Chief Inspector;

and for offshore operations only:

- putting in place a comprehensive regime to manage the environmental effects of all petroleum exploration activities in the Exclusive Economic Zone (EEZ) and on the continental shelf
- strengthening guidelines for minimising acoustic disturbance to marine mammals from seismic operations.

8. How is the government strengthening the health and safety regime?

The Health and Safety Employment (Petroleum Exploration and Extraction) Regulations provide for the safe exploration for, and production of, petroleum resources and apply to every petroleum operation under the control of an employer at which employees carry out duties relating to petroleum operations.

A core principle of these regulations is that the employer is responsible for identifying and assessing hazards taking 'all practicable steps' to manage them.

This year work has been progressed to ensure that health and safety regulation of petroleum exploration and production activities in New Zealand – both onshore and offshore – is consistent with international best practice and to take account of key lessons learnt from major accidents overseas. They are expected to be in force by mid-2013.

The key proposals to strengthen the regulation include:

- enhancing the existing safety case regime for offshore installations and extending that to onshore installations

- introducing a major accident prevention policy requirement
- making goal setting regulations to cover activities over the full lifecycle of a well
- introducing a well examination scheme requirement
- introducing notification and reporting of dangerous occurrences.

These proposals are designed to:

- strengthen the management of hazards having the potential to cause a major accident;
- reduce the likelihood of an uncontrolled release of oil and gas (or blowout) occurring during well operations
- ensure the regulator has sufficient data to inform the targeting of regulatory interventions and the preparation of preventative guidance.

9. Why has hydraulic fracturing been banned in some overseas jurisdictions?

The activity of hydraulic fracturing is a widely accepted and utilised technique throughout the world, but it has been banned by a handful of jurisdictions.

Generally where moratoria are in place, the jurisdiction has placed a ban on hydraulic fracturing because of a lack of suitable environmental regulation to assess and manage the environmental effects of the hydraulic fracturing activity. The ban is a response until such time as the regulations have been updated.

Moratoria on hydraulic fracturing have been lifted in New South Wales (Australia) and South Africa.

New Zealand has a robust regulatory regime for managing the environmental effects of oil and gas operations, which includes the technique of hydraulic fracturing.

10. How risky is hydraulic fracturing?

The actual act of fracturing, in a properly designed and constructed well, is the lowest risk action involved in the well development process, especially in wells more than about 2,000 metres deep.

The potential environmental effects are not specific to hydraulic fracturing – many of the environment effects can also occur with conventional oil and gas development or with other activities, such as geothermal development. Key concerns that people have include:

- water contamination
- high water use
- inducing earthquakes
- venting and flaring
- impacts on neighbours.

Any potential adverse environmental effects will be considered by a council when considering an application for a resource consent.

11. Can hydraulic fracturing contaminate water?

The risk of water becoming contaminated by hydraulic fracturing is very low.

There has been no evidence of water contamination directly attributed to the activity of hydraulic fracturing in New Zealand, and it is unlikely that hydraulic fracturing could contaminate water supplies in New Zealand.

Hydraulic fracturing in New Zealand has been undertaken hundreds to thousands of metres below aquifers used for drinking water or irrigation. Well bores that penetrate aquifers above hydraulic fracturing zones are isolated and protected by multiple layers of steel casing that is cemented in place.

The sources of potential water contamination are:

- leaks through inadequate well casings
- leaks through rocks
- accident spills at the surface.

12. How likely are leaks through inadequate well casings?

The most likely source of groundwater being contaminated is through an inadequate well casing. Well integrity is the most important factor in protecting groundwater quality. The multiple steel and cement casings inside a well act as a barrier between the well and its fluids or gases and any surrounding aquifer. A study of leaky wells in Canada showed that some of the wells had only a single casing or were left uncased except for a section from the surface to just below an aquifer.

Wells that are soundly constructed, safely operated and have multiple safeguards should not leak.

In New Zealand, wells are designed to have a sufficient number of casings suitable for the conditions. Well integrity is regulated under the Health and Safety in Employment (Petroleum Exploration and Extraction) Regulations 1999 and the RMA.

13. How likely are leaks through rocks?

It is theoretically possible for groundwater to be contaminated by fluids moving towards the surface from the frack zone, but it is extremely unlikely. Hydraulic fracturing occurs very deep underground, far below aquifers, and is separated by several impermeable layers called geological seals. These seals stop oil and gas from naturally coming up to the surface, and will also stop any fracturing fluids.

14. How can accidental spills be avoided?

The risk of an accidental spill is present on any site, but the risk can be minimised through the appropriate storage of chemicals (e.g. through storing in double-walled containers or with bunding), good procedures, training, and ensuring any spill is contained and cleaned up. Accidental spills can also occur through the transport of chemicals.

The use of hazardous substances on a well site is regulated by the Hazardous Substance and New Organisms Act, the Health and Safety in Employment Act, and the RMA.

15. How much water does hydraulic fracturing use?

Overseas, a well might require between a few thousand to up to 20,000 cubic metres of water. In Taranaki, wells have used between 77 and 1500 cubic metres, drawn largely from the municipal supply.

Greater quantities of water are required to unlock oil or gas in shale – such as what exists on the East Coast. If large quantities of water are required, water will be allocated by the regional council in accordance with the RMA.

16. Does hydraulic fracturing cause earthquakes?

There is no evidence that hydraulic fracturing has caused earthquakes in New Zealand that are damaging or even noticed.

Hydraulic fracturing is known to cause very low magnitude earthquakes. Perhaps the most well-known examples are the two micro-earthquakes in 2011 near Blackpool in the United Kingdom that were conclusively linked with hydraulic fracturing. These two earthquakes were of magnitude 1.5 and 2.3.

In New Zealand, GNS Science reports that these human-induced micro-earthquakes are typically below a magnitude of 2.0, are undetectable to all but the most sensitive equipment and the induced effect is minor compared to natural background seismicity. New Zealand experiences around 18,000 seismic events in an average year – approximately 4,300 of these events are recorded at a magnitude of 2.0 or lower.

GNS Science has also completed a comprehensive assessment of the effects of hydraulic fracturing on seismicity for the Taranaki region. The scientific study concluded that hydraulic fracturing activities in Taranaki between 2000 and mid-2011 have not triggered nor had any observable effect on natural earthquake activity, nor are likely to induce any earthquakes that would have a significant effect in the region.

It is standard practice for operators to assess seismic risk in an area before they drill. Taranaki Regional Council requires applicants in their resource consent applications to provide information on active faults in the area, assess the risks of inducing seismic activity and provide details of any seismic or vibration monitoring to be carried out. We expect all Councils to follow this approach.

17. What is venting and flaring?

Venting is the direct release of natural gas into the atmosphere. Flaring is burning off natural gas as a waste product when it is uneconomic to sell or conserve, or in emergency situations when accumulations of gas become a safety concern. Flaring can be associated with both exploration and mining activities.

Venting gas into the atmosphere releases the potent greenhouse gas methane. It can also be noisy. Flaring gas is noisy and any light overspill can disturb people's sleep. Both practices waste the resource and result in lower revenue for company and lower royalties being paid to the government.

However, venting and flaring are essential practices in the oil and gas production process, mainly for safety reasons. Being able to vent or flare the gas enables the gas to be disposed of safely in an emergency, if equipment breaks down or gas is being produced that cannot be stored or used commercially. If venting or flaring was not allowed in these circumstances, a build-up of gas could be explosive.

The Draft Petroleum Programme discourages venting and flaring, and goes further than current practice. The draft Programme sets out the Government's expectation that permit holders should implement practical and economic options to collect and use gas, and permission to vent will not be granted except in exceptional circumstances (e.g. an

emergency shutdown). Councils will also impose resource consent conditions to minimise any environmental impacts.

18. What impacts are there for people who live near sites that are hydraulically fractured?

Oil and gas production in general will have some local environmental effects. Constructing a well site and the process of drilling may generate dust, noise and light. Such effects tend to be short-lived and are rarely experienced far from the site, but may bother neighbours.

The actual process of hydraulic fracturing is actually very short – typically a couple of hours. Neighbours may notice increased truck movements from transporting water, proppant and chemicals to the site, and there may be noise from diesel generators.

These activities are regulated by district councils under the RMA.

19. Does a petroleum exploration or mining permit provide a company automatic access to land under a permit?

No – a permit does not give its holder a right to go on to land covered by a permit. Should a permit holder require access to land to explore or mine for oil and gas they must have a land access arrangement in place with the landowner and land occupiers. The exception is where access is required for minimum impact activities such as surveying on the land under permit – a land access arrangement is generally not required in these circumstances but the landowner and occupier must receive notice of the intention to enter the land at least 10 working days ahead of the surveying activity.

Land owners and occupiers are encouraged to seek legal advice on a land access arrangement and know what their rights are. To ensure the rights of landowners are upheld, the Crown Minerals Act 1991 sets out a process for reaching a land access arrangement. The process starts with a permit holder notifying the land owners and occupiers in writing of its intention to obtain a land access arrangement.

A land access arrangement will cover the terms of land access as agreed by the permit holder and landowner and occupier. It should incorporate provisions about compensation and how the environment will be protected.

If a land access arrangement can't be settled within 60 days, a permit holder may request that an arbitrator be appointed. An arbitrator will determine a land access arrangement that gives the permit holder access to the land based on reasonable conditions. Arbitration is considered to be a matter of last resort by the industry and is used very infrequently.

The costs of land access negotiations, including arbitration should it be required, are to be met by the permit holder.

A land access arrangement is not required for activities conducted underground that do not require access to surface of the land. However, such activities must not cause any damage to the surface nor have any detrimental effect on the future use and enjoyment of that land