Regional Council Sector Paper on the Management of Hydraulic Fracturing Activities under the RMA 13 October 2011

1.0 Introduction

The Regional Council Chief Executives at their August 2011 meeting decided a paper on hydraulic fracturing should be prepared to guide councils when considering the regulation of this activity under the Resource Management Act 1991 (RMA). The activity is currently receiving much negative media attention. It is also known as fraccing, fracking, or hydrofraccing.

Given experience with researching and regulating the activity in Taranaki in the oil and gas industry, the Taranaki Regional Council was requested to prepare a draft sector paper for consideration by other councils and the Chief Executives group.

2.0 Description and context

In Taranaki, hydraulic fracturing has been mainly used in gas reservoirs, although some oil reservoirs have been subject to the activity. It has also been used in the Waikato in coal seam gas recovery and there is interest in using the same practice on coal resources in Southland and Canterbury.

Hydraulic fracturing involves pumping, under extremely high pressure, fracture fluids through into subsurface formations to cause small fissures in rock formations to enhance hydrocarbon recovery. The fractures are very small, in the order of millimetres, and the extent of the fractures is a function of the formation and fracture operation.

Access to the formation is via a well drilled and lined with steel casing. The steel casing is held in place with cement and is installed as a succession of tubular sections, each section screwed into the next. The casing assembly is designed to separate the well stream products from the immediate environment and protect potable groundwater resources.

The hydraulic fracture fluids are dominated by water and proppant (i.e. the sand, small ceramic pellets or other inert particulates) which comprise more than 97% by volume, with the remainder chemicals / additives. Hydrocarbon based fracture fluids have been used but are being replaced with lower environmental impact water based systems.

Large volumes of high quality water may be required for hydraulic fracturing activities. This water may be sourced from municipal supplies, if available.

Once a fracture has been initiated, fracture fluid and proppant are carried into the fracture. The proppant keeps the fracture open when the pumping is stopped. The placement of proppant in the fractures is assisted by the use of cross-linked gels. These are solutions that are liquid at the surface but, with time and temperature, form long-chain polymer bonds and thus become like gels that transport the proppant into the formation. Once in the formation these gels 'break' back with time and temperature to a liquid state and flow back to the surface without disturbing the proppant wedge trapped in the hydraulic fracture. With continued flow, formation hydrocarbon fluids and residual fracture fluids should be drawn into the fracture, through the well perforations into the well bore and to the surface.

When the pressure of the fluid injection is released, some of the fracture fluid, called return flow, is driven by high pressure in the formation, up the well bore and is collected at the surface for storage and licensed disposal. The return flow will contain contaminants from the fracture fluids and the formation, including hydrocarbons (which may contain low levels of naturally of occurring contaminants benzene, ethylbenzene, toluene, and xylene). Overseas, Naturally Occurring Radioactive Material (NORMS) may be brought to the surface in return flows from deep formations but given New Zealand geological conditions this is unlikely. The

National Radiation Laboratory in Christchurch is able to provide advice to councils about the likelihood of NORMS being present and any risks they might pose.

In terms of section 15 of the RMA, hydraulic fracturing involves a discharge of contaminants (energy, chemicals, water and proppants) to an underground reservoir formation in a manner that can cause changes to the physical and chemical condition of that formation. The nature and duration of these changes depend on the formation characteristics. For example, in certain Taranaki gas reservoir formations, only a very small amount of the fracture fluids is totally unrecovered. The residual fracture fluids that are not collected in return flows will be "leached" out of the formation and brought to the surface with hydrocarbon production. Such produced water is separated from the hydrocarbons at treatment facilities and disposed of at licensed facilities.

Overseas literature notes the percentage of fracture fluids that are immediately discharged in the return flow can vary between about 20% and 80% of the fracture fluids and this is dependent on the fracture formation properties and the fracture operation.

Some of the chemicals / additives used in hydraulic fracture fluids are extremely toxic (e.g. biocides) and are used elsewhere in society. However, they are present in very low concentrations in the fracture fluids, but still need careful environmental management to avoid adverse environmental effects. Other chemicals / additives used are not considered harmful and are found in food products. ERMA has approved use of the fracture fluid chemicals under the Hazardous Substances and New Organisms Act 1996 (HSNO). HSNO approval and Material Safety Data Sheets are available for the chemicals/ additives used in hydraulic fracturing in New Zealand.

3.0 Regulatory requirements

In August 2011 the Taranaki Regional Council sought legal advice on whether the activity of hydraulic fracturing should be addressed under the Resource Management Act 2001 or Crown Minerals Act 1991. The two pieces of legislation are separate, and

require consideration of different matters. However, Crown Minerals Act decisions may have flow-on environmental benefits in practice.

Under the Crown Minerals Act, the Minister of Energy gives approval for hydrocarbon exploration and production work programmes. Such approval can be withheld if it is considered contrary to recognised good exploration or mining practice. 'Good practice' is not defined in the Act, but Ministry of Economic Development (MED) documents indicate that it relates to efficient use of the mineral resource to avoid wastage or contamination of the mineral resource, rather than relating to environmental considerations. MED leaves consideration of environmental matters to local authorities under the RMA, although some MED requirements may have flow-on environmental benefits in practice.

The legal advice noted that the RMA is the appropriate legislation under which regional councils could consider the environmental effects of hydraulic fracturing discharges. The discharge of fracture fluid into land would be covered by section 15 of the Act and each case needs to be assessed on its particular circumstances to determine which subsection applied. If the ground level operation or the source of the fracture fluid (or both) qualified as an industrial or trade premise, it follows that section 15 (1) (d) of the RMA would probably be the best fit and could be used to require a resource consents for the discharge. If there was potential for the fracture fluid to enter water, section 15(1)(b) would be relevant.

As noted above, the discharge of fracture fluids is via a well. Under the RMA, the construction and drilling of a well is addressed under section 9. Under this section, a resource consent is required if the activity contravenes a regional rule, for example if it does not comply with the environmental standards/ terms/ conditions in a permitted activity rule.

The RMA can address activities many kilometres beneath the land surface. The moratoriums put in place banning hydraulic fracturing in some parts of the world partly arise because of a lack of a suitable environmental regulatory framework to assess and manage the environmental effects of the activity.

4.0 Actual or potential environmental effects and their management

The actual or potential environmental effects of high pressure hydraulic fracture discharge will depend on the nature of the subsurface discharge and local environment and may include and relate to:

a) the well location and depth;
b) the integrity of the well delivery system, and the potential for leakage through the casing or up the outside of the casing at the base of the well, causing contamination of potable aquifers;
c) the integrity of the formation receiving and surrounding the subsurface discharge, particularly the geological seal that confines the formation itself, and those seals above, and the potential for a breach of these seals, causing contamination of potable aquifers above;
d) the potential for increased seismic vibrations locally during the fracturing process;
e) the management of the type of contaminants used in the fracture fluids including site management measures to avoid or contain contaminant spills; and
f) the discharge of return fluids, containing the degraded fracture fluid and contaminants from the formation being fractured.

To address the actual and potential environmental effects there needs to be considerable planning, design and monitoring of the fracture process. The activity itself needs to be continuously overseen by operators and service companies to evaluate and document the events of the fracture process. Every aspect of the process needs to be carefully monitored, from the wellhead and down-well pressure to pumping rates and density of fracture fluids. The monitors can also track the volumes of each additive, water used and return fluids, and ensure the equipment is functioning properly. The monitoring information can be used to model the effects of the subsurface fracture discharge, and the likely extent of the fractures can be determined and illustrated in a proppant concentration diagram.

Such monitoring occurs in hydraulic fracturing activities in mainly gas reservoirs in the Taranaki region.

5.0 Regional council position for regulating hydraulic fracturing

In order to give the community confidence that the actual and potential effects of hydraulic fracturing are being managed appropriately, the following regional council sector position is proposed for the regulation of hydraulic fracturing activities.

Each regional council will have an operative regional plan with policies and rules covering activities such as taking water, discharging contaminants to air, to water, and to land, and probably land use rules around well/bore authorisations. Depending on how the policies and rules are written, they may condition how each council evaluates an application. However, it is likely that most regional plans would treat activities associated with hydraulic fracturing as at least full discretionary.

Resource consents will be required for hydraulic fracture activities under the RMA. Each regional council will consider and determine such applications under the RMA including as follows:

a) the well delivery system under section 9;
b) the taking and use of water for the hydraulic fracturing activities under section 14;
c) the subsurface discharge under section 15, particularly section 15 (1) (d);
d) the discharge of return fluids under section 15.

For unitary councils, there will also be further land use considerations under section 9 of the RMA.

The design of the wells and the high pressure subsurface discharge of fracture fluids are probably the only new considerations under the RMA for most councils.

The Resource Managers Group (RMG) should instruct the Consent Managers Special Interest Group to develop a standard regional council approach to consent processing, including with suitable guidance for consent applicants and processing officers, minimum requirements for Assessment of Environmental Effects reports and template resource consent conditions for the consideration and assessment of the

above applications, particularly for the well design and subsurface discharge components. This could include the employment of appropriate expertise and assessment of overseas regulatory regimes, to build on the expertise that already exists. A review of overseas literature on the actual environmental effects of the activity could also be undertaken and made available to councils to assess whether these effects were relevant under New Zealand conditions.

The RMG should also instruct the Policy Managers Special Interest Group look at drafting a regional plan rule or rules to specifically deal with the activity, particularly for the well design and subsurface discharge components, in the event existing rules are not suitable.