

A BRIEFING FOR MEDICAL PROFESSIONALS ON THE POTENTIALLY HARMFUL EFFECTS OF HYDRAULIC FRACTURING (“FRACKING”)

This briefing aims to raise the awareness of medical professionals living/working in Fermanagh about the potential harmful effects of fracking.

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1. INTRODUCTION

On 1st April 2011, the Department of Enterprise, Trade and Investment (DETI) granted a Petroleum license (PL2/10)¹ to Tamboran Resources Pty² Limited to explore for, drill for and extract natural gas from shale in the Lough Allen Basin (North). This area includes most of Fermanagh to the west of Lough Erne, but stretches right across a large area of the lower lough taking in part of the east of the county. The license fee was £1,000. See map in [Appendix A](#) for coverage.

Licenses have also been granted in the Republic of Ireland for areas of Roscommon, Leitrim, Cavan, Sligo and Donegal.

No health impact assessments, no environmental impact assessments and no meaningful public consultations were carried out prior to the granting of this license.

Tamboran propose to use unconventional methods of gas extraction. They will drill first and then use a method called hydraulic fracturing, also known as 'fracking' or 'fraccing' to unlock the gas. The practice has come under scrutiny internationally due to concerns about the environment, health and safety. Fracking has been banned in France³ and moratoriums have placed on the method in other places including South Africa⁴ and New Jersey⁵. A social and environmental debate is currently raging about fracking in Ireland, USA, Australia and New Zealand all of which are being affected by this technology.

2. WHAT IS INVOLVED IN THE EXTRACTION PROCESS?

During drilling, which takes place first, 'drilling mud' or 'drilling fluid' is used to cool and power the drill and this drilling mud is recycled. At a public information meeting in Carrick On Shannon in September 2011, Tamboran's CEO, Mr. Richard Moorman stated "we will be using chemicals in the drilling process".⁶

After drilling, the fracking process begins. Fracking involves injecting millions of gallons of water, chemicals and sand, at high pressure, into shale rock formations deep below the earth's surface. This breaks open the rock and allows the gas to flow out to the head of the well. According to The Endocrine Disruption Exchange (TEDX)^a, an estimated 30% to 70% of the fracking fluid will resurface⁷, bringing back with it toxic substances naturally present in underground oil and gas deposits, as well as the chemicals used in the fracking fluid.

This fracking fluid slurry is generally stored in open pits on the surface. The slurry continues to surface for the life of the well, up to 30 years.

3. WHAT SHOULD WE BE CONCERNED ABOUT?

a) LACK OF ADEQUATE REGULATION

The EU (and UK) has yet to establish effective regulations and safety standards that would protect people and drinking water sources.

The EU conducted a study "Impacts of shale gas and shale oil extraction on the environment and on human health"⁸(June 2011):

^a TEDX is non-profit organization that focuses primarily on the human health and environmental problems caused by low-dose and/or ambient exposure to chemicals that interfere with development and function, called endocrine disruptors.

- It noted that **“There is no comprehensive directive providing for a European mining law.”** It recommended that **“A publicly available, comprehensive and detailed analysis of the European regulatory framework concerning shale gas and tight oil extraction is not available and should be developed.”**
- The Water Framework Directive (WFD) establishes a system for the protection and improvement of all aspects of the water environment including rivers, lakes, estuaries, coastal waters and groundwater. The study recommended that **“The coverage of the Water Framework Directive should be re-assessed with special focus on fracturing activities and their possible impacts on surface water.”**
- The study identified a **“number of gaps”** in the current EU regulatory framework concerning hydraulic fracturing and recommended that **“the threshold for Environmental Impact Assessments to be carried out on hydraulic fracturing activities in hydrocarbon extraction is set far above any potential industrial activities of this kind, and thus should be lowered substantially.”**
- The study recommended that **“It should be assessed whether the use of toxic chemicals for injection should be banned in general.”**

The complete list of [Recommendations](#) and [Conclusions](#) of the study can be found in [Appendix B](#).

In Northern Ireland, drinking water quality is regulated by The Drinking Water Inspectorate (DWI). Given that the Water Framework Directive does not appear to adequately address fracking activities, it is difficult to see how the DWI could carry out its role effectively.

Along with the DWI, NI Water has responsibilities for the safety of drinking water in Northern Ireland. We believe its lack of experience in possible fracking related contamination makes it ill-suited to guarantee us a safe water supply.

Jo Leinen (MEP) chairs the EU parliament's main body overseeing environmental regulation, an influential committee on the environment, public health and food safety (ENVI). He told the Guardian that he wanted a new **“energy quality directive”** that would mean fuels with **adverse environmental impacts - such as shale gas** and oil from tar sands - were stringently regulated within the EU.⁹ According to the Guardian, Mr Leinen has the power to bring forward proposals that could make it into law within a few years.

While these proposals are very welcome, they will come too late for the people of Fermanagh as Tamboran propose to start fracking in Q4 of 2012, less than a year from now.¹⁰

b) USE OF CHEMICALS DURING DRILLING AND FRACKING

Richard Moorman, Tamboran CEO, acknowledged that the company will use chemicals while drilling but said they will not use them while fracking.⁶

However, this ‘no-chemical’ approach appears to be unfeasible for the following reasons:

- It need not be honoured over the *lifetime* of the project as Tamboran is permitted by DETI to ‘farm-out’ a part-interest in their license to other companies. Refer to [Appendix C](#) for DETI advice on ‘farming-out’. Refer to [Appendix D](#) for an example of where farming-out has already occurred in Ireland in 2004.
- It may not be legally binding – as it is a voluntary undertaking on Tamboran’s part.
- It is untried and untested – fracking has never been carried out anywhere in the world without chemicals. Dr. Anthony R. Ingrao, a Professor of Engineering at Cornell University in New York has rejected Mr. Moorman’s claim stating **“It is highly unlikely that there could be an economically produced shale gas well, of the scale that is commonly being used in the US, using only water and sand.”**
- It is economically unfeasible. See section [3d Concerns over Tamboran’s inexperience](#).

Recovered drilling and fracking chemicals have been shown to be toxic. See sections [3c Drilling Chemicals](#) and [3c Fracking Chemicals](#). We believe that that the toxicity of these chemicals represents an unacceptable risk to human health and the surrounding environment.

Further to these concerns, fracking has also been implicated in local earthquake activity. Earthquakes have been linked to fracking operations near Blackpool¹¹ and in Oklahoma.¹²

c) CONTAMINATION OF DRINKING WATER/GROUNDWATER BY CHEMICALS AND METHANE GAS

World-wide, one of the major concerns with shale gas drilling is the toxicity of chemicals used throughout.

Drilling Chemicals

Following the blowout of a natural gas well Crosby 25.3 in Wyoming in 2009, TEDX compiled a list of 32 chemicals from the material safety data sheets for the drilling fluids used at the time of the blowout. 10 of the chemicals had no chemical risk assessment. Therefore no peer-reviewed investigation into their reactivity, toxicity and long term health effects has been undertaken. The 22 chemicals that did possess CAS numbers^b could be assessed and were associated with a variety of health effects ranging from the immediate or soon after the exposure, to long term chronic effects which could appear years later.

For example, 100% were associated with respiratory effect, > 90% cause skin eye and sensory problems, 77% GIT or liver damage, 55% immune system damage, 50% ecological damage, > 30% cancer and >10% reproductive or developmental damage.

12 chemicals were water soluble which meant that they had a similar profile of health problems but with higher percentages in each category except cancer mutagen and endocrine disruption. Water soluble chemicals are also easily absorbed by the body.

7 chemicals were volatile and had an even higher risk of adverse effects in all the categories because they could readily become airborne and could be inhaled, swallowed and reach the skin.

Fracking Chemicals

According to the US Environmental Protection Agency(EPA)^c following tests on recovered fluids, toxic chemicals in fracking fluids include substances such as polycyclic aromatic hydrocarbons; methanol; formaldehyde; ethylene glycol; glycol ethers; hydrochloric acid; sodium hydroxide; and diesel fuel, which contains benzene; ethylbenzene; toluene; xylene; naphthalene and other chemicals. It should be noted that the compounds benzene, toluene, ethyl benzene and xylene (abbreviated BTEX) are native constituents of the extracted natural gas seam and therefore potentially present in waste water regardless of whether they were originally added to drilling or fracking fluids. BTEX chemicals are known carcinogens, having a well-established toxicity profile in the human body and acknowledged health risks. For an overview of the use and effects of fracking chemicals we urge you to watch the lecture given by Dr. Helen Redmond of the Australian organization **Doctors for the Environment**¹³.

FracFocus^d lists the chemicals most often used in the fracking process. See <http://fracfocus.org/chemical-use/what-chemicals-are-used>. These chemicals were present in concentrations which could be detrimental to human health.

According to TEDX, 16 of the known chemicals used in fracking have health effects in at least 10 categories. The top four health effects for chemicals in these products include: skin, eye and sensory organ effects, respiratory effects, gastrointestinal effects, and brain and nervous system effects. Some of these chemicals are carcinogenic. The water supply can potentially be contaminated by both the fracking chemicals and by the extracted gas. See [Appendix E](#) for details of how chemical contamination occurs. Real examples are also given.

Methane gas

^b CAS Registry Numbers are unique numerical identifiers assigned by the "Chemical Abstracts Service" to every chemical described in the open scientific literature and including elements, isotopes, organic and inorganic compounds, organometallics, metals, alloys, coordination compounds, minerals, and salts; as well as standard mixtures, compounds, polymers; biological sequences including proteins & nucleic acids; nuclear particles, and nonstructurable materials.

^cThe EPA is a government agency set up to protect health and the environment.

^dFracFocus is the hydraulic fracturing chemical registry website. This website is a joint project of the US Ground Water Protection Council and the US Interstate Oil and Gas Compact Commission.

There are documented cases where homeowners living near a fracked well can literally “ignite” their water because of methane gas bubbles in the pipes. The Newsnight documentary “Is extraction of shale gas by fracking safe?”¹⁴ includes scenes showing householders setting tap water and well water on fire.

A peer-reviewed study¹⁵ by four scientists from Duke University titled “Methane Contamination of Drinking Water Accompanying Gas-Well Drilling and Hydraulic Fracturing” was published in the Proceedings of the National Academy of Sciences in May 2011. The study covered areas of New York state and Pennsylvania. It states, **“Our results show evidence for methane contamination of shallow drinking water systems in at least three areas of the region and suggest important environmental risks accompanying shale gas exploration worldwide.”**

According to the Cornell University study ‘Should fracking stop? Extracting gas from shale increases the availability of this resource, but the health and environmental risks may be too high’¹⁶, water sources can be contaminated with methane from deep shale formations: **“Another peer-reviewed study looked at private water wells near fracking sites. It found that about 75% of wells sampled within 1 kilometre of gas drilling in the Marcellus shale in Pennsylvania were contaminated with methane from the deep shale formations.....However, methane poses a high risk of explosion at the levels found, and it suggests a potential for other gaseous substances in the shale to migrate with the methane and contaminate water wells over time.”**

The study additionally discovered that **“Fracking also extracts natural salts, heavy metals, hydrocarbons and radioactive materials from the shale, posing risks to ecosystems and public health when these return to the surface.”**

In improperly operated, poorly constructed or deteriorated wells, natural gas may move from the wellbore. This is called gas migration. Migrating gas can affect water supplies, as well as potentially accumulate inside or next to structures such as residences, businesses and farming operations. This could create a risk of a fire or explosion. Gas migration may become a threat to the health, safety and welfare of the public.

Contamination Incidents in the USA

The environmental group Riverkeeper^e, has compiled a report titled ‘Fractured Communities’¹⁷ (Sep 2010) detailing more than 100 instances of environmental contamination linked to gas drilling and fracking operations around the USA. These include:

- more than 50 cases of drinking water or ground water contamination
- 10 cases of surface water spills of drilling fluid
- more than 30 investigations of stray gas migration¹⁸ from new and abandoned wells in Pennsylvania
- illegal operations and permit violations by gas drilling companies
- five blowouts/explosions that occurred between 2006 and 2010 that contaminated groundwater and/or surface water

These numbers have increased since the report was written in 2010.

^eRiverkeeper is a member-supported watchdog organization dedicated to defending the Hudson River and its tributaries and protecting the drinking water supply of nine million New York City and Hudson Valley residents.

Contamination in Dimock, Pennsylvania

The highest profile and perhaps the most disturbing case of alleged contamination caused by fracking, occurred in Dimock in Pennsylvania, USA where 64 gas wells were drilled in a nine-square-mile area, by Cabot Oil & Gas. Cabot allegedly contaminated 14 water wells with methane and the water supply was also allegedly contaminated by fracking fluids; the residents claimed that they were unable to drink the water or shower in it; a water well belonging to a resident blew up and Pennsylvania Department of Environmental Protection (DEP) permanently shut down three wells and ordered Cabot to install treatment systems in residents' homes.

Agency inspectors from the DEP took punitive action against Cabot on several occasions and in September 2010, Cabot CEO accused the DEP of waging "a public war against us."¹⁹ See [Appendix F](#) for detail on the case.

Contamination in Pavillion, Wyoming

In 2004, the EPA released a report stating that hydraulic fracturing in coal seams "poses minimal threat" to underground drinking water and that the practice required no further study.²⁰ Yet, in November 2011, the EPA disclosed that it had found high levels of cancer-causing compounds and at least one chemical commonly used in hydraulic fracturing in an aquifer in Pavillion, Wyoming. This testing had been carried out after the EPA had warned "residents not to drink or cook with the water and to ventilate their homes when they showered".²¹

On November 18th 2011, it was reported that 'The head of the Environmental Protection Agency says high levels of methane, benzene and chemicals found in two Wyoming water-monitoring wells are "of concern" and said hydraulic fracturing may be responsible'.²²

Contamination in Wyoming County, Pennsylvania

The following report appeared in The Times Tribune on July 11th 2011²³.

"A stray gas case in Wyoming County was discovered in late 2010, when DEP tested the headspace above a Washington Twp. water well and found methane at explosive levels. The department found methane leaking from the space between casing strings in a nearby Chesapeake Energy well then determined an "extremely close" match between the leaking gas and the gas found in the affected water well. In emails to the department, Chesapeake argued that it had done everything right."

d) CONCERNS OVER TAMBORAN CEO'S LINK TO SOUTHWESTERN ENERGY

Prior to his appointment as CEO of Tamboran, Richard Moorman worked for Southwestern Energy from May 2008 until March 2011 in a senior capacity as their Manager, Strategic Analysis, Economic Planning and Acquisitions.

In September 2010, 13 Pennsylvania families filed a lawsuit against Southwestern Energy alleging their drinking-water wells had been contaminated due to gas drilling (fracking) conducted by the company, and as a result the families had to pay for alternative sources of water. The lawsuit further alleges at least one of the plaintiffs became physically ill, exhibiting neurological symptoms consistent with toxic exposure to heavy metals.²⁴

In May 2011, a class-action lawsuit was filed in Arkansas against Southwestern Energy alleging the company was responsible for both methane and chemical contamination of their water.²⁵ Tim Holton, the lead lawyer on the case said the case started when one family's water well was turned into a gas well allegedly because of nearby fracking. **"The water well next door to their house began to spew methane. So much so that they ended up putting a flare in the person's backyard."**

In a letter dated 11th September 2011, some Fermanagh residents wrote to the Minister of Enterprise, Trade and Investment Mrs Arlene Foster. They expressed concerns about the granting of the gas exploration license in Fermanagh. In their letter they raised the following issue:

They wrote, ***“in his presentation^f Richard Moorman is boasting to be ‘active in natural gas projects for most of his career, especially at Leor Energy LLc and SouthWestern Energy Ltd.’ This company has presently a lawsuit against them for extensive water pollution and contamination in Pennsylvania.”***

The residents received a response from John White, Head of Minerals & Petroleum Branch (DETI) in a letter dated 26th October 2011. See [Appendix C](#) for relevant extract.

“The Department acknowledges Mr. Moorman’s previous experience in the US unconventional gas industry. It knows of no reason to associate Mr. Moorman with any ongoing litigation involving a previous US employer.”

Mr. Moorman was active in gas projects at SouthWestern Energy and held a senior managerial role in the company. The incidents of alleged contamination occurred on his watch and one would have expected the DETI to have taken these contamination lawsuits into consideration before granting the license. As a fledgling company (Tamboran was established in 2009), Tamboran has no previous history with which to establish its ability to mediate and resolve community and environmental matters. It is therefore imperative to consider Mr Moorman’s Curriculum Vitae in the context of his previous employer, Southwestern Energy.

We have no confidence in Mr. Moorman’s or Tamboran’s ability to safeguard our health and safety. In light of his previous employment history, his stated commitment to public health and the environment appears dubious.

We are concerned that the DETI has overlooked significant evidence relating to Mr. Moorman’s employment history when granting the exploration license to Tamboran. Self-evidently, the contamination lawsuits should have impacted greatly on the decision.

In a television interview on 24th November 2011, the BBC quoted Mrs Foster as saying:²⁶

***“The exploration licences were granted by my department officials,”
“I have had no input into any of the discussions or granting of licences, ...”***

For the people of Fermanagh, who may be harmed by the granting of the license, it is shocking that the decision was taken without input from the Minister.

e) CONCERNS OVER TAMBORAN’S INEXPERIENCE

Although Richard Moorman, Chief Executive of Tamboran, has stated that no chemicals will be used in the fracking process in Ireland, fracking has never been carried out anywhere in the world without chemicals.

Dr. Anthony R. Ingraffea is Professor of Engineering at Cornell University in New York. He is a fracking expert with 30 years experience in rock fracture mechanics and has worked directly for the world’s leading oil and gas completion company Schlumberger. Professor Ingraffea has rejected Mr. Moorman’s claim and has stated ***“It is highly unlikely that there could be an economically produced shale gas well, of the scale that is commonly being used in the US, using only water and sand.”***²⁷

We are concerned that our community is being treated as “a test case”. Although the granting of the license to Tamboran by the DETI, was based in part on *‘the technical capability of the applicant’*²⁸, the applicant (Tamboran) would appear to have no proven technical capability or experience in shale gas extraction, never mind chemical-free fracking.

f) TOO MANY UNKNOWNNS

The truth is that there are too many unknowns about the long term dangers and effects of fracking. Prof. Ignaffea believes drilling for oil and gas is always a risky business, and that energy companies are effectively experimenting in people’s backyards. In the Newsnight documentary “Is extraction of shale gas by fracking safe?”²⁹, he told Susan Watts, ***“I don’t accept the notion that the industry can come in and***

^fCommunity Information Evening, Enniskillen 6th September 2011

say we're safe – Oops, wait a minute, we've found another situation we hadn't anticipated. We're learning from what we're doing".

4. CALL FOR REVOCATION OF LICENSE AND MORATORIUM ON FRACKING

The previously mentioned EU study⁸ concluded that ***“the present privileges of oil and gas exploration and extraction should be reassessed in view of the fact that the environmental risks and burdens are not compensated for by a corresponding potential benefit as the specific gas production is very low.”***

While fracking for natural gas is seen as a short-term solution to our energy needs, any energy resource that sacrifices water protection and potentially threatens people's health and environmental safety in such significant ways should be halted. We are asking for medical professionals to support the call for the revocation of Tamboran's license and a moratorium on fracking until enough scientific evidence is gathered to fully assess the environmental and human health impact of the technology.

If we fail to register our concerns, we may well be leaving a toxic legacy for our children and grandchildren.

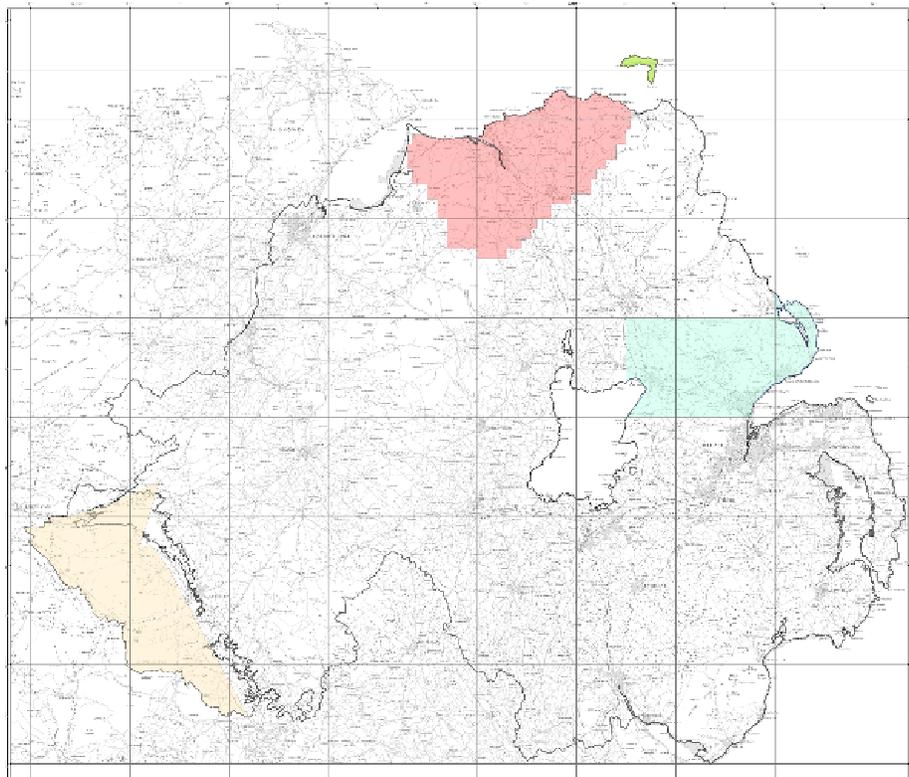
WHAT YOU CAN DO

If, having read this briefing and having done your own research, you feel there is cause for concern or the need for more information, then as the advocates of public health we urge you to write to our politicians. You have a very powerful voice in representing the health concerns of your patients. The suggested politicians to be contacted are (i) the local MP (ii) Minister of Enterprise, Trade and Investment (iii) First Minister (iv) Deputy First Minister (v) Environment Minister for Northern Ireland (vi) Minister of Health, Social Services and Public Safety (vii) Minister for Agriculture and Rural Development (viii) local MLAs (ix) NI MEPs (x) Chair of Fermanagh District Council (xi) leaders of all the political parties (xii) Members of NI Assembly Enterprise, Trade and Investment Committee (xiii) copies to the newspapers.

We have included a suggested template letter in [Appendix G](#) and email contact details for politicians/newspapers in [Appendix H](#).

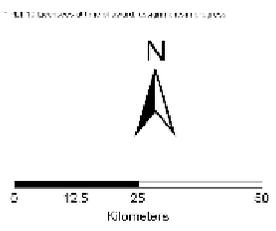
APPENDIX A – PETROLEUM LICENSES IN NI

Petroleum licences in Northern Ireland - June 2011

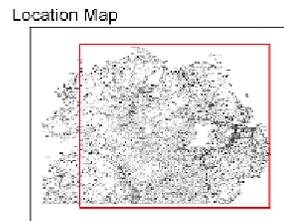


Petroleum licences awarded in 2011

- PL1-10 Infrastructure Petroleum Oil & Gas (UK) Limited
- PL3-10 Tamboran Resources Pty Limited
- PL5-10 Petlib Energy Limited
- PL5-10 P R Singleton Limited



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Taken from screenshot at http://www.detini.gov.uk/ni_petroleum_licence_map_june_2011_72dpi.jpg

APPENDIX B -EU RECOMMENDATIONS & CONCLUSIONS

Extracts from the study “Impacts of shale gas and shale oil extraction on the environment and on human health” prepared by DIRECTORATE GENERAL FOR INTERNAL POLICIES, POLICY DEPARTMENT A: ECONOMIC AND SCIENTIFIC

RECOMMENDATIONS

- There is no comprehensive directive providing for a European mining law. A publicly available, comprehensive and detailed analysis of the European regulatory framework concerning shale gas and tight oil extraction is not available and should be developed.
- The current EU regulatory framework concerning hydraulic fracturing, which is the core element in shale gas and tight oil extraction, has a number of gaps. Most importantly, the threshold for Environmental Impact Assessments to be carried out on hydraulic fracturing activities in hydrocarbon extraction is set far above any potential industrial activities of this kind, and thus should be lowered substantially.
- The coverage of the water framework Directive should be re-assessed with special focus on fracturing activities and their possible impacts on surface water.
- In the framework of a Life Cycle Analysis (LCA), a thorough cost/benefit analysis could be a tool to assess the overall benefits for society and its citizens. A harmonized approach to be applied throughout EU27 should be developed, based on which responsible authorities can perform their LCA assessments and discuss them with the public.
- It should be assessed whether the use of toxic chemicals for injection should be banned in general. At least, all chemicals to be used should be disclosed publicly, the number of allowed chemicals should be restricted and its use should be monitored. Statistics about the injected quantities and number of projects should be collected at European level.
- Regional authorities should be strengthened to take decisions on the permission of projects which involve hydraulic fracturing. Public participation and LCA- assessments should be mandatory in finding these decisions.
- Where project permits are granted, the monitoring of surface water flows and air emissions should be mandatory.
- Statistics on accidents and complaints should be collected and analysed at European level. Where projects are permitted, an independent authority should collect and review complaints.
- Because of the complex nature of possible impacts and risks to the environment and to human health of hydraulic fracturing consideration should be given to developing a new directive at European level regulating all issues in this area comprehensively.

CONCLUSIONS

At a time when sustainability is key to future operations it can be questioned whether the injection of toxic chemicals in the underground should be allowed, or whether it should be banned as such a practice would restrict or exclude any later use of the contaminated layer(e.g. for geothermal purposes) and as long-term effects are not investigated. In an active shale gas extraction area, about 0.1-0.5 litres of chemicals are injected per square metre.

This holds even more as the potential shale gas plays are too small to have a substantial impact on the European gas supply situation. The present privileges of oil and gas exploration and extraction should be reassessed in view of the fact that the environmental risks and burdens are not compensated for by a corresponding potential benefit as the specific gas production is very low.

APPENDIX C—EXTRACT FROM DETI LETTER TO FERMANAGH RESIDENTS

Background

On 11th September 2011, some Fermanagh residents sent a letter to the Minister of Enterprise, Trade and Investment Mrs. Arlene Foster expressing concerns about the granting of the gas exploration license in Fermanagh. They received a response from Mr. John White, Head of Minerals & Petroleum Branch, on 26th October 2011.

The following is an extract from John White's response.

Credibility of gas companies

It is Tamboran's stated intention not to use chemicals in the fracking fluids. However, it is commonplace in many types of deep drilling to add small amounts of additives to water-based drilling muds to control the density and viscosity. The drilling mud is recycled in the drilling process and the eventual disposal of the rock cuttings and excess drilling mud is subject to regulatory control.

Regarding to the experience of Tamboran Resources, it is not uncommon for small companies to take the lead in the early stages of oil or gas exploration projects, particularly in countries that do not have existing production such as Northern Ireland. The Department recognises this in its licensing regime, particularly in requiring information in respect of the use of drill-or-drop work programmes in license applications. Applicants for petroleum licenses are statutorily required to have the technical and financial capability to undertake pre-drilling exploration. However, small companies almost invariably need to obtain additional funding and technical capacity to progress to exploration drilling. They may do so by 'farming out' a part-interest in their license to one or more companies with greater resources, or by augmenting their own capability. The NI licensing regime allows for this by requiring such licenses to nominate an Operator – that company must have the necessary technical expertise and experience, and be approved by the Department, when it submits an application to drill. It must also demonstrate, to the satisfaction of the Department, that it has the necessary capability to carry out the proposed operations.

The Department acknowledges Mr Moorman's previous experience in the US unconventional gas industry. It knows of no reason to associate Mr. Moorman with any ongoing litigation involving a previous US employer.

APPENDIX D – EXTRACT FROM ‘QUEST FOR OIL IN NORTHERN IRELAND HAS ITS COST’

<http://digitalhen.co.uk/news/uk-northern-ireland-15132225>

“A licence secured in 2004 for the Porcupine basin off the south west coast of Ireland by Providence is now operated by the world's largest energy company.

A licence like this is granted for a nominal fee.

When Providence managed to attract Exxon Mobile onto its permit, the company's share price rocketed.

Eighty per cent of the licence was handed to the multi-national. What was previously an Irish license granted to an Irish owned company, is now under the control of a cluster of big businesses.”

APPENDIX E—HOW CHEMICAL CONTAMINATION OCCURS WITH EXAMPLES

This contamination can result from:

- **Well blowout**

On 19th April 2011 there was a blowout from a Chesapeake Energy well in Bradford County. WNEP (a Pennsylvania TV station) reported that ***“The well blew near the surface, spilling thousands and thousands of gallons of frack fluid over containment walls, through fields, personal property and farms, even where cattle continue to graze.”***

- **Spill from gas well pipes**

Gas well pipes can become fractured, resulting in leakage of contaminants into the surrounding ground.

Three spills¹⁷ were reported to have occurred in Dimock PA in September 2009 where Cabot Oil & Gas were drilling. The first two spills totalled more than 8,000 gallons of a lubricant gel used in the fracking process. The spills polluted a wetland and caused a fish kill in Stevens Creek. The PA DEP issued a notice of violation to Cabot for the spills. PA DEP cited Cabot for violations of the Pennsylvania Clean Streams Law, Pennsylvania Solid Waste Management Act, the Dam Safety and Encroachments Act, and the Oil and Gas Act, as a result of: an unpermitted discharge of polluting substances, an unpermitted discharge of residual waste, two unpermitted encroachments on Stevens Creek, not containing polluting substances at the well site, and an unpermitted discharge of industrial waste. According to Cabot, the releases were caused by failed pipe connections. In addition, a third spill of 420 gallons of the same lubricant gel occurred on September 22, 2009 at the same site.

- **Improper disposal or careless handling of toxic wastewater from fracking**

In 2011, for example, The New York Times reported that some Pennsylvania Marcellus shale natural gas drillers were shipping potentially toxic and radioactive hydraulic fracking wastewater to sewage treatment plants not equipped to treat it. This fracking wastewater, which has only been partially treated, is later released into rivers and streams used as sources of drinking water by millions of Pennsylvanians.³⁰

- **Surface spills from storage facilities**

In August 2009, PA DEP fined Atlas Resources \$97,350 for allowing hydraulic fracturing fluids to overflow from a wastewater pit and contaminating a high quality watershed in Washington County.¹⁷

According to the EPA, the toxic fluids can become trapped in rock formations for generations, making it difficult at present to measure the extent of the contamination.

APPENDIX F-EXTRACT FROM 'FRACTURED COMMUNITIES'

An extract from a report by the environmental group Riverkeeper, 'Fractured Communities', Sep 2010. The full report can be found at

<http://www.riverkeeper.org/wp-content/uploads/2010/09/Fractured-Communities-FINAL-September-2010.pdf>

A. Cabot Oil & Gas, Dimock, PA.

COMMUNITIES PA DEP stated that agency inspectors "discovered that the well casings on some of Cabot's natural gas wells were cemented improperly or insufficiently, allowing natural gas to migrate to groundwater."⁵¹

On September 16, 2009, additional incidents in Dimock were linked to Cabot when two liquid gel spills occurred at the company's Heitsman natural gas well pad.⁵² The spills polluted a wetland and caused a fish kill in Stevens Creek.⁵³ The PA DEP issued a notice of violation to Cabot for the spills.⁵⁴ PA DEP cited Cabot for violations of the Pennsylvania Clean Streams Law, Pennsylvania Solid Waste Management Act, the Dam Safety and Encroachments Act, and the Oil and Gas Act, as a result of: an unpermitted discharge of polluting substances, an unpermitted discharge of residual waste, two unpermitted encroachments on Stevens Creek, not containing polluting substances at the well site, and an unpermitted discharge of industrial waste.⁵⁵

The two spills involved a lubricant gel used in the high-volume hydraulic fracturing process and totaled over 8,000 gallons.⁵⁶ According to Cabot, the releases were caused by failed pipe connections.⁵⁷ In addition, a third spill occurred on September 22, 2009 at the same site.⁵⁸ This subsequent spill involved 420 gallons of the same lubricant gel.⁵⁹

Following these three spills, on September 25, 2009, PA DEP fined Cabot \$56,650 and ordered the company to cease all high-volume hydraulic fracturing activities until it completed a number of engineering and safety improvements.⁶⁰ On October 16, 2009, PA DEP allowed Cabot to resume high-volume hydraulic fracturing activities after it submitted the required documents.⁶¹

On November 4, 2009, PA DEP and Cabot entered into a Consent Order and Agreement in settlement of violations regarding: excessive pressure/improper or insufficient cementing (casings) on certain wells; pollution of private water supplies within Dimock and Springville Townships in Susquehanna County; discharge of natural gas into ground water; discharge of industrial waste and/or residual waste onto the ground and/or into state waters, failure to submit well records, and failure to maintain a Driller's log.⁶² PA DEP also found elevated levels of methane gas in wells that provide drinking water to 13 area homes and identified combustible gas in the headspaces of seven of the wells.⁶³

PA DEP found that Cabot's unpermitted discharges polluted groundwater and contravened the state's Clean Streams Law and Solid Waste Management Act,⁶⁴ and ordered the company to immediately implement a number of corrective actions, including providing potable water and/or gas mitigation devices to affected residences.⁶⁵ PA DEP assessed a penalty of \$120,000 as well as stipulated penalties for any future violations.⁶⁶

After failing to comply with all of its obligations under the original Consent Order, PA DEP and Cabot modified the original Consent Order on April 15, 2010.

Under this Modification, PA DEP suspended all of Cabot's permit applications and fined the company an additional \$240,000 dollars and the company agreed to pay an additional \$30,000 dollars per month until PA DEP determined that Cabot had complied with all of its obligations under both the original Consent Order and the Modification.⁶⁷

PA DEP had also collected samples from another drinking water well in the affected area and found the company responsible for elevated levels of dissolved methane gas.⁶⁸ In addition, the agency noted gas bubbling was continuing in cellars of certain wells and noted bubbling in five additional wells, indicating possible problems with insufficient or improperly cemented casings.⁶⁹ As part of the April 2010 Modification, PA DEP ordered Cabot to plug within 40 days three gas wells thought to be responsible for drinking water contamination and ordered Cabot to install treatment systems in affected homes within 30 days.⁷⁰ PA DEP found that Cabot had failed to comply with a 2009 Consent Order and PA DEP's chief stated in no uncertain terms that "[g]as migration is a serious issue that can have dire consequences to affected communities."⁷¹

In late July 2010, PA DEP gave Cabot Oil & Gas an additional 60 days to permanently fix the contaminated water supplies in Dimock.⁷²

APPENDIX G - SUGGESTED TEMPLATE LETTER

For your convenience, this template letter along with the pre-prepared email list is available from <http://ourgoodhealth.info/> If you encounter any difficulties please contact majella.mccarron@gmail.com. Please feel free to modify this letter as you see fit.

[Sender Address etc]

[Date]

To: *Arlene Foster (Minister of Enterprise, Trade and Investment); Peter Robinson (First Minister); Martin McGuinness (Deputy First Minister); Alex Attwood (Environment Minister for Northern Ireland); Edwin Poots (Minister of Health, Social Services and Public Safety); Michelle O'Neill (Minister for Agriculture and Rural Development); Michelle Gildernew (MP Fermanagh and South Tyrone); Bairbre De BRÚN (MEP); Jim Nicholson (MEP); Diane Dodds (MEP); Tom Elliott (MLA); Phil Flanagan (MLA); Sean Lynch (MLA); Maurice Morrow (MLA); Gerry Adams (Leader Sinn Féin); David Forde (Leader Alliance Party); Jim Allister (Leader TUV); Thomas O'Reilly (Chair of Fermanagh District Council); Members of Enterprise, Trade and Investment Committee - Gordon Dunne; Stephen Moutray; Paul Frew; Robin Newton; Steven Agnew; Daithí McKay; Phil Flanagan; Sue Ramsey; Alban Maginness; Alasdair McDonnell; Mike Nesbitt*

Cc: *Impartial Reporter, Fermanagh Herald, Belfast Telegraph, Irish News, Newsletter*

Dear Sir/ Madam,

I am a general practitioner in County Fermanagh with my patient base in [location a/ location b] and surrounding areas.

On 1st April 2011 the Department of Enterprise, Trade and Investment granted a Petroleum license to Tamboran Resources Pty Ltd to explore, drill for and extract shale gas in the Lough Allen Basin.

This was done without a health impact assessment, an environmental assessment or any meaningful public consultation.

My private research into the technology to be used, hydraulic fracturing or 'fracking' leads me to have very serious concerns regarding its safety and implications for the community. As an advocate for the health of the patients in my care, I support the call for the revocation of Tamboran's license and an immediate moratorium on fracking.

Yours sincerely

[Firstname Surname] MB BCH MRCPG [other qualifications]

APPENDIX H – EMAIL CONTACT LIST

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Cc: editorial@impartialreporter.com; m.kennedy@fermanaghherald.com ; writeback@belfasttelegraph.co.uk ;
newsdesk@irishnews.com;newsdesk@newsletter.co.uk;

For your convenience, this email contact list is available from <http://ourgoodhealth.info/> If you encounter any difficulties please contact majella.mccarron@gmail.com. Please feel free to modify this list as you see fit.

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First Minister	Peter Robinson	peter.robinson@MLA.niassembly.gov.uk
Deputy First Minister	Martin McGuinness	Martin.McGuinness@mla.niassembly.gov.uk
Environment Minister for Northern Ireland	Alex Attwood	Private.Office@doeni.gov.uk
Minister of Health, Social Services and Public Safety	Edwin Poots	private.office@dhsspsni.gov.uk
Minister for Agriculture and Rural Development	Michelle O'Neill	private.office@dardni.gov.uk
Fermanagh and South Tyrone MLAs		
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	Michelle Gildernew	As above
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	Jim Nicholson	james.nicholson@europarl.europa.eu
	Diane Dodds	diane.dodds@europarl.europa.eu
Leaders of NI Political Parties with representation in the NI Assembly		
Democratic Unionist Party	Peter Robinson	As above
Sinn Féin	Gerry Adams	gerry.adams@oir.ie
Ulster Unionist Party	Tom Elliott	As above
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Alliance Party	David Forde	alliance@allianceparty.org
Green Party	Steven Agnew	steven.agnew@mla.niassembly.gov.uk
Traditional Unionist Voice	Jim Allister	info@jimallister.org
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1 Tamboran license www.detini.gov.uk/deti-energy-index/minerals-and-petroleum/petroleum_licensing_2.htm (Refer to license PL2/10)

2 Tamboran web site <http://www.tamboran.com/>

3 France becomes first country to ban extraction of natural gas by fracking <http://blogs.scientificamerican.com/observations/2011/06/30/france-becomes-first-country-to-ban-extraction-of-natural-gas-by-fracking/>

4 S.Africa imposes "fracking" moratorium in Karoo <http://www.reuters.com/article/2011/04/21/us-safrica-fracking-idUSTRE73K45620110421>

5 New Jersey issues one-year moratorium on fracking <http://www.reuters.com/article/2011/08/25/us-shale-newjersey-idUSTRE7706VN20110825>

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- 6 At a public information meeting in Carrick On Shannon on September 2011 Tamboran CEO Richard Moorman said "We will not use chemicals for Hydraulic Fracturing, but we will be using chemicals in the drilling process". <http://what-the-frack.org/2011/09/08/chemicals-will-be-used-tamboran/>
- 7 <http://www.endocrinedisruption.com/chemicals.introduction.php>
- 8 Impacts of shale gas and shale oil extraction on the environment and on human health (June 2011) <http://europeecologie.eu/IMG/pdf/shale-gas-pe-464-425-final.pdf>
- ⁹ Influential MEP calls for shale gas regulation <http://www.guardian.co.uk/environment/2011/jun/30/shale-gas-europe-leinen>
- ¹⁰ Slide 27 - <http://nofrackingireland.files.wordpress.com/2011/07/tamboranresources-presentation-22042011-1.pdf>
- 11 Gas Fracking Probably Caused Blackpool Earthquakes in U.K. <http://www.businessweek.com/news/2011-11-03/gas-fracking-probably-caused-blackpool-earthquakes-in-u-k-.html>
- 12 Oklahoma earthquake possibly caused by controversial energy drilling process. <http://www.dailymail.co.uk/news/article-2060798/Oklahoma-earthquake-possibly-caused-controversial-energy.html>
- ¹³ Dr Helen Redmond - Doctors for the Environment <http://lockthegate.org.au/health-forum/dr-helen-redmond.cfm>
- 14 <http://news.bbc.co.uk/1/hi/programmes/newsnight/9255520.stm>
- 15 Methane Contamination of Drinking Water Accompanying Gas-Well Drilling and Hydraulic Fracturing <http://www.propublica.org/documents/item/methane-contamination-of-drinking-water-accompanying-gas-well-drilling>
- 16 Should fracking stop? Extracting gas from shale increases the availability of this resource, but the health and environmental risks may be too high' (Sep 2011) http://www.geog.psu.edu/sites/default/files/Fieldtrip_Howarth&Ingraffea_vs_Engelder_2011.pdf
- 17 Fractured Communities (Sep 2010) <http://www.riverkeeper.org/wp-content/uploads/2010/09/Fractured-Communities-FINAL-September-2010.pdf>
- 18 Stray gas migration: In improperly operated, poorly constructed or deteriorated wells, natural gas may move from the wellbore. This is called gas migration. Migrating gas can affect water supplies, as well as potentially accumulate inside or next to structures such as residences, businesses and farming operations. This could create a risk of a fire or explosion. Gas migration may become a threat to the health, safety and welfare of the public.
- 19 http://www.pennlive.com/midstate/index.ssf/2010/09/marcellus_drilling_company_fro.html
- 20 http://www.epa.gov/ogwdw/uic/pdfs/cbmstudy_attach_uic_final_fact_sheet.pdf
- 21 <http://www.propublica.org/article/epa-finds-fracking-compound-in-wyoming-aquifer/single>
- 22 EPA chief: Wyoming water well results 'of concern' (Nov 2011) http://trib.com/news/state-and-regional/epa-chief-wyoming-water-well-results-of-concern/article_0aacd635-c62a-5eae-9f79-e6ae14eb1906.html
- ²³ Stray gas plagues NEPA Marcellus wells <http://thetimes-tribune.com/news/stray-gas-plagues-nepa-marcellus-wells-1.1173187#ixzz1ezdYrW6D>
- 24 <http://www.americas-watchdog.com/class-action-lawsuit-claims-fracking-polluted-arkansas-wells/>
- 25 <http://www.cbc.ca/news/canada/new-brunswick/story/2011/05/24/nb-southwestern-lawsuit-hydro-fracking-551.html>
- 26 <http://www.bbc.co.uk/news/uk-northern-ireland-15873655>
- 27 <http://www.anglocelt.ie/news/roundup/articles/2011/08/10/4005993-tamborans-claims-of-chemical-free-frack-fluid-challenged-by-expert/>
- 28 THE HYDROCARBONS LICENSING DIRECTIVE REGULATIONS (NORTHERN IRELAND) 2010,
Provision : Determination of applications, 4(1)(a) <http://www.legislation.gov.uk/nisr/2010/170/regulation/4/made>
- 29 Is extraction of shale gas by fracking safe? <http://news.bbc.co.uk/1/hi/programmes/newsnight/9255520.stm>
- ³⁰ Report from <http://www.water-contamination-shale.com/>