



# Scientific Facts on Risks of Shale Gas exploitation in Europe

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GreenFacts

## Level 2 - Details on Risks of Shale Gas exploitation in Europe

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This is a faithful summary of the leading report produced in 2012 by the Environment DG (DG Environment):  
*"AEA Technology"*

The full Digest is available at: <https://www.greenfacts.org/en/shale-gas/>

**i** This PDF Document is the Level 2 of a GreenFacts Digest. GreenFacts Digests are published in several languages as questions and answers, in a copyrighted user-friendly Three-Level Structure of increasing detail:

- Each question is answered in Level 1 with a short summary.
- These answers are developed in more detail in Level 2.
- Level 3 consists of the Source document, the internationally recognised scientific consensus report which is faithfully summarised in Level 2 and further in Level 1.

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## 1. Why are unconventional natural gas resources in Europe likely to be exploited?

This report sets out the key environmental and health risks associated with the potential development of high volume hydraulic fracturing in Europe. It addresses the impacts and risks that differ from conventional gas exploration and extraction which are already addressed in regulations.

The study reviewed available information on a range of potential risks and impacts of high volume hydraulic fracturing, and concentrated on both the direct impacts of hydraulic fracturing as well as the associated activities such as transportation and waste water management. The study did not address secondary or indirect impacts such as those associated with materials extraction (stone, gravel etc.) and energy use related to road, infrastructure and well pad construction.

## 2. What potential risks were identified?

This analysis has drawn mainly on experience from North America, where hydraulic fracturing has been increasingly practised since early in the 2000s. The views of regulators, geological surveys and academics in Europe and North America were sought. Where possible, the results have been set in the European regulatory and technical context.

The study includes a review of the efficiency and effectiveness of current EU legislation related to shale gas exploration and production and the degree to which it adequately covers the impacts and risks identified. It also includes a review of risk management measures.

The study adopted a risk prioritisation approach to enable objective evaluation. The magnitude of potential hazards and the expected frequency or probability of the hazards were categorised on the basis of expert judgement and from analysis of hydraulic fracturing in the field where this evidence was available to allow risks to be evaluated. Where the uncertainty associated with the lack of information about environmental risks was significant, this was duly acknowledged. This approach enabled a prioritisation of overall risks.

The study examined the stages in development of a hydraulic fracturing project, which included:

1. Well pad site identification and preparation;
2. Well design, drilling, casing and cementing;
3. Technical hydraulic fracturing stage;
4. Well completion;
5. Well production;
6. Well abandonment.

The preliminary risk assessment covered potential risks for the environment and human health arising from hydrocarbons operations involving hydraulic fracturing in Europe in these various situations. The report identified a high risk for most of the environmental aspects examined in the case of the cumulative impact of multiple installations: Groundwater contamination, Surface water contamination, Water resources, Release to air, land take, Risk to biodiversity, Noise impacts, Traffic. The risk was classified moderate for the Visual impact and low for Seismicity.

### 3. What is recommended to manage those risks?

Three main causes of risks and impacts from high-volume hydraulic fracturing identified were mainly related to the following challenges :

1. The use of more significant volumes of water and chemicals and the lower yield of unconventional gas wells compared to conventional gas extraction;
2. Ensuring the integrity of wells and other equipment throughout and after the lifetime of the plant;
3. The potential toxicity of chemical additives and the challenge to develop greener alternatives; ensuring that spillages of chemicals and waste waters with potential environmental consequences are avoided ;
4. Ensuring a correct identification and selection of geological sites;
5. The potential uncertainties associated with the long-term presence of hydraulic fracturing fluid in the underground;
6. The unavoidable traffic impacts that cannot be entirely avoided;
7. The potential for development over a wider area than is typical of conventional gas fields;
8. The unavoidable emissions to air and noise impacts related to plant and equipment during well construction and use.

Measures for mitigation of these risks were identified from existing and proposed legislation in the US and Canada where shale gas extraction is currently carried out. A number of the recommendations made by the US Department of Energy are relevant for regulatory authorities in Europe. In particular, it is recommended that the European Commission should take a strategic overview of potential risks.

### 4.

This study has also identified and made recommendations for the management of the specific risks related to hydrocarbon extraction involving high volume hydraulic fracturation techniques.

These include:

- The development of less environmentally hazardous drilling and fracturing fluids;
- Methods to improve well integrity through development of better casing and cementing methods and practices;
- The development of a searchable European database of hydraulic fracturing fluid composition;
- Research into the risks and causes of methane migration to groundwater from shale gas extraction;
- The development of a system of voluntary ecological initiatives within sensitive habitats to generate mitigation credits which could be used for offsetting future development.

Regarding the development of these extractions, the study also revealed a number of gaps or possible inadequacies in the EU legislation : some that that could lead to risks to the environment or human health not being sufficiently addressed others where uncertainty arises because a lack of information regarding the characteristics of high volume hydraulic fracturing (HVHF) projects or aspects for which it is not possible to conclude under this study whether or not at EU level the risks are adequately addressed.

## 5.

Exploration and production of natural gas and oil within Europe has in the past been mainly focused on conventional resources that are readily available and relatively easy to develop. This type of fuel is typically found in sandstone, siltstone and limestone reservoirs. Conventional extraction enables oil or gas to flow readily into boreholes. As opportunities for this type of domestic extraction are becoming increasingly limited to meet demand, EU countries are now turning to exploring unconventional natural gas resources, such as coalbed methane, tight gas and in particular shale gas. These are termed 'unconventional' resources because the porosity, permeability, fluid trapping mechanism, or other characteristics of the reservoir or rock formation from which the gas is extracted differ greatly from conventional sandstone and carbonate reservoirs.

Preliminary indications are that extensive shale gas resources are present in Europe (although this would need to be confirmed by exploratory drilling). To date, it appears that only Poland and the UK have performed high-volume hydraulic fracturing for shale gas extraction (at one well in the UK and six wells in Poland);

## 6.

In order to extract these unconventional gases, the characteristics of the reservoir need to be altered using techniques such as hydraulic fracturing. In particular high volume hydraulic fracturing has not been used to any great extent within Europe for hydrocarbon extraction. Its use has been limited to lower volume fracturing of some tight gas and conventional reservoirs in the southern part of the North Sea and in onshore Germany, the Netherlands, Denmark and the UK.

## 7.

In February 2011, the European Council concluded that Europe should assess its potential for sustainable extraction and use of both conventional and unconventional fossil fuel resources. A 2011 report commissioned by the European Parliament drew attention to the potential health and environmental risks associated with shale gas extraction. At present, close to half of all EU Member States are interested in developing shale gas resources, if possible.

However, in response to concerns raised by the general public and stakeholders, several European Member States have prohibited, or are considering the possibility to prohibit the use of hydraulic fracturing. Concurrently, several EU Member States are about to initiate discussions on the appropriateness of their national legislation, and contemplate the possibility to introduce specific national requirements for hydraulic fracturing.

The recent evolution of the European context suggests a growing need for a clear, predictable and coherent approach to unconventional fossil fuels and in particular shale gas developments to allow optimal decisions to be made in an area where economics, finances, environment and in particular public trust are essential. Against this background, the Commission is investigating the impact of unconventional gas, primarily shale gas, on EU energy markets and has requested this initial, specific assessment of the environmental and health risks and impacts associated with the use of hydraulic fracturing, in particular for shale gas.

## 8.

Technological advancements and the integration of horizontal wells with hydraulic fracturing practices have enabled the rapid development of shale gas resources in the United States— at present the only country globally with significant commercial shale gas extraction. In 2012, the US Environmental Protection Agency (EPA) has issued Final Oil and Natural Gas Air Pollution Standards including for natural gas wells that are hydraulically fractured as well as Draft Permitting Guidance for Oil and Gas Hydraulic Fracturing Activities Using Diesel Fuels. The EPA is also developing standards for waste water discharges and is updating chloride water quality criteria, with a draft document expected in 2012. In addition, it is implementing an Energy Extraction Enforcement Initiative, and is involved in voluntary partnerships, such as the Natural Gas STAR program. The US Department of the Interior proposed in April 2012 a rule to require companies to publicly disclose the chemicals used in hydraulic fracturing operations, to make sure that wells used in fracturing operations meet appropriate construction standards, and to ensure that operators put in place appropriate plans for managing flowback waters from fracturing operations.

Reference : ***Support to the identification of potential risks for the environment and human health arising from hydrocarbons operations involving hydraulic fracturing in Europe. Report for the European Commission. Ref: AEA/ED57281/Issue Number 17 iv European Commission DG Environment Dr Mark Broomfield AEA Technology plc Gemini Building, Harwell, Didcot, OX11 0QR t: 0870 190 6389 mark.broomfield@aeat.co.uk.***

<http://ec.europa.eu/environment/integration/energy/pdf/fracking%20study.pdf> [see <http://ec.europa.eu/environment/integration/energy/pdf/fracking%20study.pdf>]

*(\*) the content of these "highlights" has been peer reviewed by AEA (English version). The structure of the content does not correspond to the one of the original summary of the original study as the purpose of GreenFacts is to "highlight" in its "news" section the main elements of the reports .*