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**NOTE FOR THE ATTENTION OF MR MATTHIAS GROOTE, CHAIR OF THE ENVI COMMITTEE, EUROPEAN PARLIAMENT**

**Subject:** **Transmission Note on the EU environmental legal framework applicable to shale gas projects**

The exploration and exploitation of unconventional hydrocarbons, notably shale gas, is an emerging topical issue for Europe. These projects use advanced technologies such as horizontal drilling and high volume hydraulic fracturing.

Although such projects are still at the phase of exploration and some years away from commercial production, hydraulic fracturing is taking place at present, attracting increasing attention from media and stakeholders. In this context, several Members of the European Parliament have addressed questions to the European Commission concerning the applicable EU environmental legislation in this field.

To this end, the present note aims to inform you as well as the members of your committee about the EU environmental legal framework applicable to the above projects, and to provide the European Commission's views regarding the correct interpretation of that legal framework. The enclosed technical and legal papers serve only for clarification purposes and do not create any new rules of law.

Enclosures: Technical annex
Legal annex

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ANNEX I

**Subject Technical summary**

## 1. Context

Rapid advancements in technologies for the exploration and extraction of hydrocarbons make it increasingly possible to extract *unconventional* hydrocarbons from geological formations with low hydrocarbons content, low porosity and low, or very low permeability. As such, exploration and production of unconventional fossil fuels increasingly take place around the world.

In Europe, the exploration and extraction of unconventional fossil fuels, and in particular shale gas, has recently become a topical issue. EU Heads of States or Government concluded in February 2011 that there is a need to assess Europe's potential for *sustainable* extraction and use of unconventional fossil fuel resources, including shale gas. Several Member States have given out licenses for the exploration of such resources on their territory. To our knowledge, a few exploration wells (including horizontal wells) have been drilled and some hydraulic fracturing has already been carried out or will be performed in the near future.

As illustrative example, this annex summarises the advanced technological processes used for the extraction of shale gas and highlights potential environmental impacts and risks related to such processes.

Shale gas is natural gas extracted from shales, a rather common type of organic-rich sedimentary rock formed from deposits of mud, silt, clay and organic matter. The low permeability of the shales leads to considerable quantities of natural gas being trapped within their pores.

The reference to 'shale gas projects' in the context of this letter and its annexes is to be understood generically, as designating *any* 'unconventional hydrocarbon project using horizontal drilling and high volume hydraulic fracturing'.

## 2. The use of advanced technological processes in shale gas projects

Horizontal drilling techniques and high volume hydraulic fracturing techniques, two advanced technological processes deployed at commercial scale in the USA, are combined and applied notably in the context of shale gas projects to enable the gas to be extracted from the shale formations. Europe's current experience concerning the widespread use of these two advanced technologies is limited.

'Directional/horizontal drilling' designates the drilling of wells at depths usually greater than 2 kilometres, whereby the horizontal leg of the well follows the contour of a given geological formation for up to 3 kilometres or more.

'Hydraulic fracturing' or 'fracking', involves the high-pressure injection of fracturing fluids – a mixture of water (98%-99.5%), a proppant (such as sand, bauxite or ceramic beads) and chemicals (generally from 0.5%-2%) – into the shale formation to break the shale rock and connect the pores that trap the natural gas. As the injection pressure exceeds the rock strength, the process results in the opening or enlargement of fractures that can extend several tens of meters into the geological formation, away from the well. The injected propping agent prevents the fractures from closing after the pumping pressure is released. In turn, the open fractures allow natural gas and oil to flow from the formation into the well. Once the hydraulic fracturing process is completed, some 25 percent to 70-75 percent of the initial fracturing fluid, now mixed with produced water, rises to the surface where it can be collected[1]. This recovered fluid is referred to as 'flowback' or 'waste water'.

One shale gas well consumes typically 1,500 $m^3$ of water during the drilling process and a further 11,000 $m^3$, in the form of fracturing fluids, during the hydraulic fracturing process. Typically, chemical additives make up some 57 $m^3$ to 227 $m^3$ of that fracturing fluid. In general, a 2-hectare site (called also 'pad') accommodates 6-8 wells, extracting from areas of 1-2 square kilometres. Water requirements for hydraulic fracturing can thus be substantial in a local context.

## 3. Potential environmental impacts and risks

The European Commission's preliminary analysis, based on the available technical information, suggests that interactions of the above processes with environmental media are likely to be complex and cross-cutting in nature. Of concern are potential risks related notably to surface and groundwater, the use of chemicals, waste management practices, as well as impacts to land, biodiversity and air quality.

(1) **<u>Shale gas activities may affect water in three main ways</u>**:

(a) The *abstraction/consumption-use of large amounts of water resources* (water as the main component of the fracturing fluid injected into the ground): the ecological and quantitative status of surface water and groundwater bodies from which the water is abstracted can be affected. More generally, reduction in water quantity and flow may impact water quality and associated ecosystems.

(b) The *chemical pollution of groundwater bodies*. Although some technical uncertainties remain on the exact composition of fluids used in the process, it is assumed that the fracturing fluids typically contain hazardous substances. Technically, the amount of fracturing fluid recovered by the operator as flowback water may then be re-used for a new fracturing operation or re-injected into a given geological formation for final disposal. Thus, there may be a risk of contamination of a groundwater body in case (unlikely in deep shale formations and well-performed fracture jobs) where chemical additives mixed with unrecovered water would migrate into nearby aquifers. The pollution may even

[1] Estimates concerning the recovery rate of fracturing fluids vary to a considerable degree. Some estimates specifically for the Marcellus shale in the USA project a fracture fluid recovery rate of 10 to 30 percent.

be more serious if the groundwater body concerned is a drinking water supply. Another risk may be posed by failure of the cement or casting surrounding the wellbore, as the well must often penetrate several groundwater bodies to reach the shale gas site. In case where the ring is not properly sealed, fracturing fluids may impact directly a groundwater body or may be discharged among layers of rocks situated between the surface and an aquifer.

(c) The *treatment of waste water* (i.e. brine from the geological formation and flowback water) of the fracturing fluid that is recovered. Flowback water and water produced during a well's lifetime can contain high concentrations of salts, heavy metals and radionuclides, mobilised from the shale formation, in addition to the initial chemical substances contained in the fracturing fluid. US literature suggests that municipal waste water treatment facilities that accept such waste streams can encounter serious problems due to the significant volumes of fluids produced by the industry and their specific chemical composition.

(d) *Risks to surface waters*, resulting for instance from spills or leakages, are further mentioned under site specific cumulative impacts.

(2) **Waste drill cuttings**

Drilling of the wells gives rise to substantial quantities of drill cuttings. Where mud-drilling is used, the quantity of solid waste is further increased. Cuttings may be contaminated with naturally occurring radioactive materials and brines. Uncontrolled, temporary storage of the cuttings on site may result in pollution of surface and ground waters as the result of surface run-off, particularly as the result of flooding or during storms.

(3) **Site specific cumulative impacts**

The exploration and extraction of shale gas may give rise to a variety of site specific impacts that change, depending on the phase of the project. Typical for the early phases of operation are diesel or natural gas fuelled engines, used to power drilling equipment and pumps for hydraulic fracturing processes. During the extraction phase, pumps and compressors may be needed to render the produced gas up to the surface or up to pipeline pressure. These may provide potential sources of air emissions of volatile organic compounds, oxides of nitrogen and particulate matter, as well as noise.

Trucks are typically used to transport construction materials, water supplies, fracturing additives and fuels to the site, and to remove resulting waste from the site. In general, an 8-well pad may require some 5 to over 7 thousand truck-trips over its lifetime. This traffic may provide additional sources of air pollution and noise. Where transport is along unpaved roads, it may provide additional sources of particulate matter emissions. The well completion process may involve the venting or flaring of some natural gas. Fugitive emissions such as leaks from pipe connections and associated equipment may also occur. The preparation of individual well-pads may result in the disturbance of areas of a few hectares together with associated haul roads and pipeline corridors.

Key environmental concerns in relation to impacts on **Natura 2000 sites** designated under the Habitats (92/43/EEC) and Wild Birds (2009/147/EC) Directives:

(a) Damages may be direct in case where outdoor shale gas installations are located within the perimeter of a Natura 2000 site. Drilling operations require several acres of land for significant above-ground development (drilling wells, well-pads, roads, pipelines, infrastructures to bring the shale gas from the wellhead to the pipeline etc.) Such installations may well affect a protected natural habitat, breeding sites or species of Community interest.

(b) Damages may also be indirect if a protected natural habitat (e.g. a wetland), directly dependent on a groundwater body, is affected by chemical additives used in the fracturing fluids, which would have first contaminated and migrated through the groundwater body.

The above analysis, based on available technical information, does not exclude further net incremental risks or impacts that are specific to these types of projects. The Commission will therefore keep monitoring closely scientific and project developments within Europe and globally, in order to obtain a comprehensive picture of this topical issue.

## ANNEX II

**Subject:** **EU environmental legislation applicable to unconventional hydrocarbon projects involving the use of advanced technologies such as horizontal drilling and high volume hydraulic fracturing**

Based on the available technical information, the European Commission considers that unconventional hydrocarbon projects involving the combined use of advanced technological processes such as horizontal drilling and high volume hydraulic fracturing,[2] notably shale gas exploration and exploitation activities, are covered by EU environmental legislation from the planning until the cessation.

Among the main pieces of EU environment legislation covering shale gas projects are featured:

- Directive on the assessment of the effects of certain public and private projects on the environment (EIA) (85/337/EC)
- Directive on the management of waste from extractive industries (Mining Waste Directive) (2006/21/EC)
- Directive establishing a framework for Community action in the field of water policy (Water Framework Directive) (2000/60/EC)
- Regulation on the registration, evaluation and authorisation of chemicals (REACH) (1907/2006/EC)
- Directive on the placing of biocidal products on the market (Biocidal Products Directive) (98/8/EC)
- Directive on the control of major-accident hazards involving dangerous substances (Seveso II) (96/82/EC)
- Directive on the conservation of natural habitats and of wild fauna and flora (Habitats) (92/43/EC)
- Directive on environmental liability with regard to the prevention and remedying of environmental damage (Environmental Liability Directive) (2004/35/EC)

Please find below a short explanation on how the above mentioned pieces of legislation apply for instance to shale gas operations. More detailed information on the applicability of individual Directives or Regulations may follow, as deemed necessary.

### 1. Pre-development phase

Shale gas exploration and exploitation projects fall under the **EIA Directive**. It implies that, before a shale gas exploration or exploitation project comes to life, the operator (developer) has to assess the likely significant environmental impacts (e.g. upon nature,

[2] Please refer to Annex I for information on the hydraulic fracturing practice.

water resources, landscape) of the project. It also implies that the operator (developer) can not start a project without obtaining a permit. In the framework of the development consent procedure, the public and environmental authorities must be given the right to express opinions on the permit request and to get access to the decision to grant or not a permit. Those opinions should be taken into account by the competent authority. In case where a permit is granted to an operator (developer) for a shale gas exploration or exploitation project, members of the "public concerned", including NGOs, will be entitled to challenge at the national level the legality of the decision.

Alongside the EIA Directive, a prior assessment of the impacts, including cumulative ones, of a foreseen shale gas project is needed under the **Habitats Directive** if the project could affect in a significant manner Natura 2000 sites (Article 6). Outside Natura 2000 sites, the Habitats Directive foresees a specific authorisation regime for projects likely to affect the breeding sites or resting places of protected species (Articles 12 and 16).

Before a shale gas project may start, the operator must also meet obligations under the **Mining Waste Directive**. In particular, given that used fracturing fluid is to be considered as 'extractive waste', and given that any area designated for the accumulation or deposit of extractive waste should be considered as a 'waste facility', the operator must obtain a permit under that Directive which will have to be based on the "Best Available Techniques". The Commission will develop a reference document (BREF) covering the management of waste from shale gas activities. Like the EIA Directive, the Mining Waste Directive requires the operator who requests the authorisation to give information on his project and its impacts and provides the public with a right to be consulted and to express an opinion. The operator has also to draw up a waste management plan and a major-accident prevention policy if the facility is classified as 'Category A' according to the Directive. In addition, the operator has to give, before the start of the operation, a financial guarantee to show that he is able to implement all his obligations under the permit (including after-closure duties).

**2. Hydraulic fracturing and management of flowback water**

The Commission considers that Article 11(3)(j) of the Water Framework Directive does not allow the injection of flow back water (containing hazardous chemicals) for disposal into geological formations. As such, Article 11(3)(j) does not apply to shale gas activities. This is consistent with the objective of the Water Framework Directive (ensuring good status of water resources) and is supported by the negotiation history of this Directive since the exception clause in question was devised for conventional hydrocarbon operations. Consequently, the **Mining Waste Directive** applies and requires the treatment of flow back water.

In addition, the operator of a shale gas extraction project might also have to obtain an authorisation under the **Water Framework Directive**, if the project would require the abstraction of large amounts of water from a surface or a groundwater body. Discharge of pollutants (waste water with hazardous chemicals) into groundwater bodies is prohibited. If the shale gas extraction installation falls under the **SEVESO II Directive** (depending on the thresholds related to storage of gas or of dangerous substances listed under the Directive, or subject to the mixture of chemicals on site), the operator has to fulfil several obligations before starting his project, such as informing the competent authority on the nature and the quantity of dangerous substances that would be stored within his

establishment. In case the operator does not meet his duties, the Member State should prohibit the start of the activity.

Under the **REACH Regulation**, manufacturers and importers of substances used for shale gas operations were obliged to register the substance by December 2010 if produced/imported above 1000 t/y or with a lower tonnage for specific hazardous substances. In the registration, they must provide information about conditions for its safe use for this purpose. If an operator of a shale gas project uses hazardous registered substances, his suppliers have to provide him with an extended safety data sheet that includes exposure scenarios. Should the operator identify that the exposure scenarios submitted do not cover his specific use, he must notify the European Chemicals Agency (ECHA) and provide relevant information in accordance with Article 38. Alternatively, he may ask his supplier to develop an exposure scenario covering his use or find an alternative substance or process that fulfils the REACH requirements. Until the above conditions are met, the substances concerned cannot legally be used in shale gas operations.

Moreover, any biocidal products used in the operations will have to comply with the **Biocidal Products Directive.**

### 3. Permit, review and monitoring requirements

Once an operator of a shale gas extraction project is granted a permit / an authorisation, he is entitled to start his activity. He will then have to fulfil all the conditions set out in his permit, provided that those conditions ensure compliance with EU environmental law. Relevant EU instruments may provide themselves for a review and, if needed, a revision of the authorisation and relevant conditions. For instance, the **Water Framework Directive** foresees that the authorisation for water abstraction must be periodically reviewed while the **Mining Waste Directive** specifies that competent authorities must periodically reconsider and, where necessary, update permit conditions. Such revision usually takes place on the basis of information provided by the permit holder on the implementation of his project and on the fulfilment of the conditions set out in his permit and by the competent monitoring bodies.

Competent authorities have also monitoring obligations. For instance, under the **Water Framework Directive** according to which, among others, the chemical quality of groundwater bodies must be regularly checked and action must be taken in case of significant chemical pollution, including by revising the authorisation conditions. Under the **Mining Waste Directive,** not only must the operator of a waste management facility notify the competent authority of any significant adverse environmental effects identified, but the competent authority itself must inspect the facility before any deposit operations and at regular intervals. Regarding the **SEVESO II Directive**, Member States must organise a system of inspections / controls of the establishment so as to ensure that the operator has taken all appropriate measures to prevent major accidents. Should the inspection reveal that those measures are seriously deficient, the Member State would then have to prohibit the use of the installation.

### 4. Environmental liability

If a shale gas project leads to significant environmental damage due, for instance, to over-abstraction of water in a small surface water body (affecting the status of the water body)

or to intended or unintended spills of fracturing fluids, chemicals or waste water into the environment, the operator will be held liable in accordance with the **Environmental Liability Directive**, and will be asked to bear the remediation costs. It would in particular be the case where the operator would have not complied with the conditions and limits set out in his permit.

The environmental liability of the operator of a shale gas project could also be engaged in case of significant damage caused to a Natura 2000 site. One may as well refer to the closure and after-closure obligations imposed upon operators of mining waste management facilities. Indeed, as specified in the **Mining Waste Directive,** the operator remains responsible for the maintenance, monitoring and corrective measures in the after-closure phase as long as it is required by the competent authority. Also, in case where a major-accident occurs in a shale gas installation that qualifies as a SEVESO installation, the **SEVESO II Directive** requires that the operator provides the competent authority with all relevant information on the event, including on the steps envisaged to reduce the medium- and long-term adverse effects of the accident.