

UK shale gas: mapping the current regulation and legal landscape

Doug Bryden, James Nierinck and Romola Parish

Travers Smith LLP London¹

Introduction

The names ‘Barton Moss’, ‘Preese Hall’ and ‘Balcombe’ strike an almost immediate association with the process of hydraulic fracturing or ‘fracking’.² The recognition of these exploratory wells and of the operators involved such as Cuadrilla, Igas and Dart Energy, reflects the widespread industrial, governmental and public interest in this emerging energy source.

At the heart of the debates on fracking is regulatory balance: that is, treading the optimum regulatory path between encouraging development and ensuring protection of the environment and the local community.

Unconventional onshore gas production has the potential to expand into a large industry in the UK. In June 2013, the British Geological Survey estimated that the Bowland-Hodder shales (located largely in and around Lancashire) contained approximately 1,329 trillion cubic feet (tcf) of gas in place.³ Set against the UK’s annual consumption of approximately 3.5tcf, it is clear that shale gas could make a sizeable contribution to the UK’s energy mix. This is especially the case as the EU and UK continue their transition to a low-carbon economy in line with the EU’s recently published 2030 climate framework.⁴

This article seeks to explore some of the key environmental concerns and the proposed UK regulatory response. Part 1 sets out the context for shale gas

development, focusing on processes and the scale of financial investment to date. Part 2 considers key environmental concerns, followed in Part 3 by an analysis of the present tapestry of regulatory licences, consents, permits and notifications developed to control these identified risks as well as some of the other pressing legal concerns.

1. Stages of fracking development and investment in UK shale gas to date

Before embarking on a discussion of the environmental issues and corresponding regulatory challenges arising out of shale gas development in the UK, it is useful to have a sound understanding of the context in which these issues arise. For the purposes of this article, the relevant context involves both knowledge of the phases of shale gas development, as well as an understanding of the investment climate, specifically the notable transactions that have occurred in the embryonic UK shale gas sector over the past few years.

Shale gas development

Shale gas development can be broken down into four distinct stages. An understanding of these stages, and the techniques and technologies deployed during these stages is required as regulation often seeks to target specific stages of development.

The four stages of shale gas development are as follows.

1. *Exploration*

The aim of the exploration phase is to identify whether there are any shale gas deposits within a given geographical area. On site, operators will construct a ‘pad’ and a drilling rig approximately 30m tall will be installed. Operators will often undertake seismic surveys, sample the shale rock and conduct one or more ‘fracks’ at a site. The exploration stage typically lasts 2–6 months.

1 Doug Bryden is a Partner at Travers Smith LLP and Head of the Environment and Operational Regulatory Group, James Nierinck is an Associate in the Environment and Operational Regulatory Group and Romola Parish is a Senior Associate in the Planning Group.

2 Indeed sometimes incorrectly, for the geology of the Balcombe site is such that Cuadrilla does not in fact intend to frack the exploration well at Lower Stumble. Cuadrilla news: ‘Cuadrilla submits new planning application to West Sussex County Council’ 23 January 2014.

3 I J Andrews, British Geological Survey for Department of Energy and Climate Change, London ‘The Carboniferous Bowland Shale gas study: geology and resource estimation’ 2013.

4 European Commission ‘A 2030 framework for climate and energy policies’ Green Paper <http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52013DC0169&from=EN>. Reviewed 11 April 2014.

2. *Appraisal/moving into production*

During this phase, further information as to the extent of the deposit and its production characteristics is gathered to confirm whether it can be exploited economically. This may include additional fracking tests and flow testing. The appraisal stage typically lasts 6–24 months.

3. *Production*

The production phase is the longest stage in shale gas development and will generally last for around 10–25 years, depending on the nature and extent of the gas deposits. It is during this stage when the site is operating at full capacity, that fracking activities may be conducted and shale gas is extracted from underground deposits. During this period, a number of wells may be dug, pipelines and process facilities installed and temporary storage facilities established.

4. *Decommissioning and restoration*

At the end of its working life, be it following the exploration stage (should the site be considered not to be worth developing) or following a lengthy spell of production, a site should be restored to its original ‘pre-fracking’ condition. Processes include making wells safe for abandonment, and the removal of surface installations.

Investment in UK shale gas to date

To date, there have been only three significant investments into the UK shale gas industry. The first of these was in Centrica plc’s acquisition of a 25 per cent interest in Petroleum Exploration Development Licence (PEDL) 16 – the Bowland exploration licence in Lancashire – from Cuadrilla Resources Ltd and AJ Lucas for £40 million.

This type of deal, whereby an investing party acquires an interest from an existing PEDL licensee is known in the oil and gas sector as a ‘farm-in’. As part of this deal, Centrica committed to injecting up to £60 million exploration and appraisal costs. At the time of the deal in June 2013, Centrica commented that it presented an ‘attractive opportunity.....to explore the potential and commercial viability of natural gas from shale in the UK’.⁵

Later in 2013, GDF Suez entered the UK shale market by striking an agreement with Dart Energy to acquire a 25 per cent share in 13 PEDLs located in Cheshire and the

East Midlands, overlying the Bowland Shale.⁶ According to GDF Suez’s press release, its UK exploration and production entity paid Dart Energy upfront cash consideration of US\$12 million at closing and will contribute US\$27 million exploration and appraisal costs.

Most recently, oil major Total struck a deal with UK energy firm IGas Energy to acquire a 40 per cent interest in two PEDLs in Lincolnshire. As part of this deal, it was reported that Total will pay \$1.6m in back costs and fund a work programme of up to \$46.5m, with a \$19.5m minimum commitment.⁷

Although common in the oil and gas sector, these ‘farm-in’ type investments pose interesting challenges for both lawyers and operators’ commercial teams alike. Typically investments are structured around well-recognised contractual agreements, including Joint Operating Agreements (JOAs) which are fairly standard for offshore oil and gas exploration and development. JOAs are a good starting point; however, given the range of new challenges and issues associated with onshore operations (not least the complexity added by land access and planning issues, and the additional regulatory issues discussed in more detail below), care needs to be taken so as to ensure such JOAs are fit for (onshore) purpose. By way of example, certain lead investors may wish to ring-fence step-in rights in certain situations to ensure that they can influence key decisions (especially where reputational concerns might arise).

Given the rapid injection of capital into exploration and production activities in 2013 and 2014 by some of the world’s largest oil and gas companies, field appraisal is set to continue in earnest.

2. Environmental concerns

The high level of political and regulatory engagement in developing a workable legislative and fiscal landscape to support the shale industry has been one of the most telling developments of 2013; all the more so, given that we are, as at the time of writing, some way off full-scale shale gas exploration and exploitation in the UK. But is such a proactive political and regulatory approach that surprising? The tensions between promoting economic growth, managing the perceived development, and environmental and safety concerns are polarised and proving increasingly divisive. One overwhelming conclusion, be it at an EU or UK level, is that, for the onshore unconventional oil and gas sector to fulfil its potential, strong regulation is needed to control and mitigate both the actual and perceived environmental impacts of fracking.

⁵ Centrica news ‘Centrica acquires a 25% interest in UK shale exploration licence’ 13 June 2013
<http://www.centrica.com/index.asp?pageid=29&newsid=2778>. Reviewed 23 March 2014.

⁶ UK GDF Suez Press release ‘GDF SUEZ enters onshore exploration licences with shale gas potential for the first time’ 22 October 2013.

⁷ BBC News ‘French oil giant Total to invest in UK shale gas’ 13 January 2014. <http://www.bbc.co.uk/news/uk-25695813>.
Reviewed 23 March 2014.

The benefits to the UK economy of a fully developed shale industry have been positively articulated by many.⁸ The UK Government, through its various fiscal incentives⁹ or lobbying at an EU-level,¹⁰ is clearly a strong supporter of the shale industry.

There remains, however, widespread resistance to onshore unconventional oil and gas developments and we briefly consider the environmental concerns driving this opposition. The regulatory response to these drivers is considered in Part 3 below. As always, to perceive the benefits of any new industry in full (such as shale, nanotechnology, genetically modified crops, etc), one must consider the risks (be they probable but of little impact, or remote but potentially material). Indeed, only by appreciating and understanding these risks can the current and proposed regulatory frameworks be adequately assessed.

Contamination and safety risks

As with any industrial or extractive industry, there are some inherent pollution and contamination risks associated with onshore unconventional oil and gas: for example, the production of methane and the handling and transportation of significant quantities of potentially dangerous chemicals and wastes. The fracking activities themselves also present some unique challenges – the potential loss of fracking fluids during the extraction process being most commonly cited.

A more immediate challenge (and one which is well documented from experiences in the United States) is how to deal with the high levels of salt, heavy metals and naturally occurring radioactive materials (NORM) that may be present in the fracking flowback fluids. Given the nature of these

flowback fluids, the UK's Environment Agency (EA) considers them to be 'waste' under the EU Mining Waste Directive 2006. Although industry has sought to challenge this position for the current exploration works by claiming such fluids benefit from specific 'prospecting' exemptions under the Directive, the Agency has, to date, rejected such arguments. To avoid or limit potential environmental impacts, these wastes will need to be appropriately handled, stored, transported and treated. Again, this is not unlike any manufacturing or extractive industry where the UK's environmental permitting regime is now well developed. The presence of elevated levels of NORM, however, does pose an additional challenge as the specific chemistry of these contaminants typically means they are likely to accumulate in sewage solids. That said, these NORM risks are not unique to fracking and under the current permitting regime waste containing excessive levels of NORM is already required to have a separate permit for its handling and disposal.

The debate on how best to deal with flowback fluids poses an interesting example of the unique problems posed by onshore fracking (both for operators and regulators). On-site treatment and re-use of flowback fluids may be, for many reasons, a good thing (not least to reduce the water burden on the local environment); however, such on-site treatment and reuse may intensify levels of NORM or other contaminants present in the fracking fluid and eventual wastewater. As always, a balance between these risks will need to be struck.

Separate to these wastewater issues and the obvious need to avoid surface contamination through storing and handling chemicals and other dangerous substances in an appropriate manner, an area of particular concern (and emotive debate) is the potential for loss of fracking fluid (including its chemical additives and any other natural contaminants picked up during the fracking process) to subsurface soil and groundwater. Although industry is keen to stress that there have been only limited experiences of potential groundwater contamination in the US,¹¹ this is undoubtedly an issue that requires careful consideration.

To help manage this contamination risk, the EA is seeking to control what goes into the ground in the first place. The Agency must be told of the fracking chemicals to be used and only those substances permitted under the

⁸ For example, the Institute of Directors' Report 'Getting Shale Gas Working' (22 May 2013) estimated the industry could generate £3.7 billion in annual investment, as well as giving rise to 74,000 jobs.

⁹ The UK Government formally announced in its 2013 Autumn Statement a new tax allowance for companies incurring capital expenditure on onshore oil and gas projects. As Chancellor George Osborne pledged earlier in 2013: 'I want Britain to be a leader of the shale gas revolution [...] this new tax regime, which I want to make the most generous for shale in the world, will contribute to that'.

¹⁰ One of the most significant pro-fracking developments to date has been the watering down of attempts by the European Union legislators to introduce a new EU-wide regulation on fracking. In January 2014, the Commission's memo outlining its 'Shale Gas Initiative' may not have been to everyone's liking, but it was certainly welcome news for industry. At its heart, a number of Shale Gas Recommendations were made which set out *voluntary* minimum principles for Member States to apply when permitting exploration and production of conventional oil and gas using high volume fracking. Such *voluntary* standards and recommendations are a far cry from the wide-ranging regulatory framework originally proposed by the European Commission in October 2012. Although the EU's current position is undoubtedly helpful, the Commission will, within the next 18 months, seek to review how effective this voluntary approach has been, following which it will consider whether there is a need for more comprehensive legislative proposals controlling the exploration and production of hydrocarbons using fracking. See L Reins below pp 16-27.

¹¹ The Royal Society and The Royal Academy of Engineering's 'Shale gas extraction in the UK: a review of hydraulic fracturing' (June 2012) is often cited as providing a balanced account of these risks. The report highlights that known groundwater contamination from hydraulic fracturing in the US typically relates to inappropriate operational practices and, in particular, issues around poorly constructed well casings and shallow fracking. Further, the report notes that in relation to these US groundwater cases 'none has shown evidence of chemicals found in hydraulic fracturing fluids'; rather the contaminant of concern was methane, which the report notes was historically naturally present in high levels.

EU Groundwater Directive 2006 are allowed. It is also clear that the EA intends to make the details of what chemicals are being used publicly available. This move for greater transparency is echoed by the EU which has stressed on a number of occasions, and has clearly stated in its recent recommendations, that manufacturers, importers and downstream users will be required to refer to fracking when complying with their obligations under the EU's REACH chemicals regulation. The EU Commission has also asked the European Chemicals Agency (ECHA) to make changes in the REACH database of registered chemicals, so that it will be easier to search for information on substances used in fracking operations. This transparency may not appear at first to be a powerful regulatory control, but given the anticipated level of scrutiny from sophisticated NGOs and some Member States, as well as other industries, all of which may from time to time oppose fracking, it is likely to present a number of future challenges for the industry (just as the reporting and communication obligations under REACH have been challenging for both the petrochemical and consumer goods industries).

The Royal Society and Royal Academy of Engineering's report of June 2012 notes that one of the key factors for mitigating these contamination risks will be to focus on well integrity, including subsequent inspection and management. The Environment Agency is aware of the issue and will require, as part of an operator's notification of its intention to drill under the Water Resources Act 1991, well and case designs to be submitted. The various environmental permits will also contain conditions expressly dealing with environmental monitoring.

Ensuring adequate well design and casing will also be important in controlling the release of methane and other gases to the atmosphere. The release of methane is another of the principal concerns associated with fracking, both from an environmental as well as a health perspective. Additionally, where the fracking site is close to air quality management areas, nitrogen oxides from flaring, lorry movements and on-site equipment should also be monitored. Given industry's desire to make a success of UK fracking and in order to alleviate public health concerns, it is anticipated that operators may voluntarily set baselines and then monitor against these a range of additional ground gasses such as nitrogen dioxide, sulphur dioxide, hydrogen sulphide, volatile organic compounds (VOCs) and other chemicals such as benzene, toluene and xylenes.

The general consensus remains that should these potentially higher-risk aspects of fracking be adequately regulated then they should pose only a relatively low risk. As The Royal Society and Royal Academy of Engineering

concluded in June 2012, these risks 'can be managed effectively ... as long as operational best practices are implemented and enforced through regulation'.

Resources – water demand

Increased industrial activities will put varying degrees of pressure on resources (both locally and nationally). One particular area of concern, especially for more water stressed areas of the UK such as East Anglia, will be how to manage the high water demands of a full-scale fracking operation. Although on-site recycling and reuse of flowback fluids should substantially reduce this demand (as well as the need to tanker off wastewater) fracking may potentially, as discussed above, give rise to increased concentrations of contaminants in the fracking fluid.

Impact to local amenity

Unlike offshore oil or gas exploration or indeed US shale developments, fracking activities in the UK will, in certain cases, take place close to residential areas. Some sites may also impact important habitats and designated nature areas.

Increased levels of noise, light, dust and vibrations are probable together with the visual impacts of having industrial scale equipment and infrastructure. Although the views of local residents will be of less relevance in relation to the granting of the majority of operational permits and licences, these neighbouring landowners will, as discussed below, be key stakeholders in relation to the planning process. Local communities and councils will be vigilant monitors of such negative impacts and industry will need to work hard to convince them otherwise.

In addition to objecting to and challenging planning applications, nuisance claims may also arise. Activities at and around the sites (such as drilling, truck movements, generators and even protests) may result in disruptions to neighbouring landowners and residents (both day and night). As recently confirmed by the Supreme Court in the *Coventry v Lawrence* case,¹² the fact that a site may have the benefit of planning permission is normally of no assistance to an operator seeking to defend a nuisance case (para 94 per Lord Neuberger). Further, operating within a site's environmental permits similarly does not act as a defence to an action in nuisance.¹³ Whilst we are not presently aware of any nuisance actions in the UK in respect of fracking (unsurprising given that development is in its infancy), there are reports from the US of what is believed to be the first successful action against a fracking operator by a landowner in respect of alleged air contamination and

¹² *Coventry v Lawrence* [2014] UKSC 13. See D Hart in this issue pp 57-63.

¹³ *Barr v Biffa Waste Services Ltd* [2013] QB 455.

health claims.¹⁴

Accordingly, operators will need to remain aware that, notwithstanding any planning permissions and environmental permits that they may hold, they must conduct their activities in a manner so as not to interfere unduly with the use or enjoyment of neighbouring land.

Climate change

Reconciling the development of unconventional oil and gas with the UK Government's current low-carbon policies is a challenge. Gas is not a renewable energy nor a low carbon fuel source. Policymakers do, however, see it as a lower-carbon or, as it is sometimes referred to, a 'bridging' fuel.

In addition, it is argued by many that the climate change impact of fracking operations is greater than that of conventional oil and gas extraction. This is attributed to the more intensive nature of the extraction process as well as the possibility of greater fugitive methane releases. These issues have been strongly advocated by industry objectors and it is, therefore, unsurprising that both the regulators and industry appreciate the need to mitigate emissions (fugitive or otherwise). For example, the latest DECC guidance seeks to persuade operators to avoid venting as far as is technically possible. Flaring is also to be tightly controlled.

How unconventional oil and gas fits into wider climate change debates also needs careful consideration. For example, the availability of cheap shale gas has boomed in the US, where as a result there has been a fuel switch from coal to gas. Whilst lowering greenhouse gas emissions domestically, the use of cheap US coal elsewhere (in the EU, for example) has risen as have associated emissions (*Financial Times* 3 February 2013).

As many climate change commentators rightly point out, a switch to shale gas simply does not fit within the UK's current carbon budget and ambitious carbon reduction commitments. That said, as has been articulated by the UK Government, shale gas will prove a useful transition fuel towards a lower carbon economy. If the UK shale gas industry takes off as the Government hopes, it will be interesting to see if the UK will need to modify its decarbonisation timetable.

3. Overview of operational regulatory and legal issues

In this last part we will consider how the policy makers and legislature are meeting the challenges, risk and

concerns posed by onshore unconventional oil and gas operations. A notable feature of the extant and emerging regulatory regime is the diversity of regulators. Operational fracking activities are controlled and overseen by a variety of bodies including the Department for Energy and Climate Change (DECC), the EA¹⁵ Health and Safety Executive (HSE) and local Minerals Planning Authorities (MPAs).

Further, the operational consents, permits, licences and notifications required reflect an interesting mix of public (for example, planning consents and EA environmental permits) and private law matters (for example, licences and leases of private land).

A final theme running through the regulatory regime is its dynamic and evolving nature; with the failure to bring forth binding legislation at EU level, Member States, including the UK, have been given a higher level of discretion as to their national regulation of shale gas. Given the widespread interest in fracking as a technique to extract shale gas, the UK Government has been particularly proactive in establishing a regulatory roadmap to encourage a harmonised and balanced regulatory approach. We now explore the suite of interlocking petroleum, planning, environmental and health and safety regulatory and wider operational regulatory regimes.

Petroleum Exploration Development Licences

Petroleum Exploration Development Licences, commonly referred to as PEDLs, are landward licences granted by DECC to operators under section 3 of the Petroleum Act 1998. PEDLs grant the holder the exclusive right to 'search and bore for petroleum' within a defined onshore 'field' or licence area.

Operators need to hold a PEDL due to the nature of petroleum ownership in the UK. Ever since the Petroleum (Production) Act 1934, the exclusive right to search and drill for and extract 'petroleum' (that is, oil and gas) vests in the Crown. Accordingly, operators require a licence from central government which is empowered by statute to grant such licences.¹⁶

According to government data,¹⁷ there are presently around 176 PEDLs for onshore oil and gas in the UK. PEDLs granted to date are mostly located in the following areas: the Weald and Wessex Basins south of London, Cheshire, Lancashire and the Midlands, the Cleveland Basin (Yorkshire),

¹⁴ *Los Angeles Times* 'Jury awards Texas family nearly \$3 million in fracking case' 23 April 2014 reviewed 28 April 2014 <http://www.latimes.com/nation/la-na-fracking-lawsuit-20140424,0,508199.story#axzz2zzvmkOQc>.

¹⁵ In respect of onshore operations conducted in England.

¹⁶ This system of licences can be contrasted to the position in the US, where, by virtue of differing land laws, either the right to get petroleum or the petroleum itself usually vests in the owner of the land.

¹⁷ DECC Petroleum Act 1998 Onshore Licensing map 1 March 2014 https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/286129/20140227_landfields_lics.pdf. Reviewed 23 March 2014.

Northumberland and the Midland Valley in Scotland (running roughly between Edinburgh and Glasgow).

Each PEDL takes the form of a deed, and obliges the relevant licensee to follow its terms. The terms of PEDLs are prescribed in a set of 'model clauses' set out in regulations under the Petroleum Act 1998.¹⁸ Key PEDL terms include the conferral of the right to get petroleum, the payment of fees in return, the parameters of the field licensed to the operator, the obligation to obtain written consent prior to drilling, the term of the licence, the operator's obligation to work the licensed area in accordance with 'good oilfield practice' and termination and surrender provisions.

Further, and in line with the UK Government's policy to ensure maximum exploitation of petroleum, PEDLs contain specific 'working obligations' or 'work commitments'. These are obligations to conduct certain specified activities within the licensed area during the 'initial term' (the first six years) of the PEDL. Work commitments often include the obligation to obtain and process seismic data relating to the licensed area (to identify prospective geological structures) and to drill a certain number of wells to a specified depth. For example, a PEDL may have an obligation to drill one well to 800m during the initial term. Provided an operator meets its obligations in the initial term, the PEDL extends to a 'second term' of five years, and thereafter to a 'production period' of twenty years.¹⁹ If, however, an operator does not meet its work commitments or other relevant terms under the PEDL, DECC may elect to revoke the licence and re-issue it during the next licensing round. In this way, operators are obliged to increase development within their PEDL so as to find out whether exploiting petroleum is commercially viable.

PEDLs are issued through a competitive bidding system of licensing rounds. As part of the licensing process, and prior to any grant of a PEDL, DECC will assess operator competency. This involves a consideration of, *inter alia*, the operator's financial capability, technical experience and ability to supervise, manage and undertake the proposed operation (including well abandonment activity) assessment of the scope of relevant insurance coverage for operations, the hierarchy of decision-making, the risk-assessment and plans for public engagement.

DECC has recently announced its intention to conduct a further onshore oil and gas licensing round (the 14th round) for unlicensed areas in parts of England, Scotland

and Wales in 2014. This announcement accompanied the launch of the consultation on the UK's Strategic Environmental Assessment for Further Onshore Oil and Gas Licensing, which seeks to identify, describe and evaluate the likely significant effects of further onshore development in accordance with the SEA Directive.²⁰ This further licensing round will grant operators the right to exploit shale gas reserves in areas of the UK which have, to date, been untouched by onshore development.

The exact role of a PEDL, and its relationship with other permits, consents, licences and authorisations should be understood. PEDLs merely allocate the oil and gas resource in a specific area to a particular company: they do not include any of the other rights required to conduct fracking operations, including rights of access, drilling consents, planning permissions and environmental consents. These issues are discussed in greater detail below.

Environmental Risk Assessment

DECC has confirmed²¹ that operators will be required to compile an Environmental Risk Assessment (ERA) for all shale gas operations involving hydraulic fracturing as early as possible in the development of their proposals, and in any event prior to application for planning consent. ERAs are high-level preliminary risk assessments and should include an overview assessment of the environmental risks, including risks to human health. ERAs should cover the full life-cycle of the proposed operations and should encompass the views of stakeholders, including local communities. It is intended that the ERA should inform other assessments, including the Environmental Impact Assessment where required under planning legislation.

DECC is currently consulting with other regulators to compile a form of agreed guidance for operators on the preparation of ERAs. Whilst this requirement is not a statutory requirement, failure to undertake an ERA or completion of an inadequate ERA may leave an operator at risk of challenge under other legislation, such as health and safety regulations. As the regulatory framework for onshore oil and gas exploration and exploitation is still developing, this may become a statutory requirement in due course. The best practice proposals put forward by DECC in December 2013 reflect guidelines currently

18 Presently contained in Schedule 6 to The Petroleum Licensing (Exploration and Production) (Seaward and Landward Areas) Regulations 2004/352 (as amended).

19 It will be noted that the PEDL's three terms follow the three stages of field development outlined in Part 1 above.

20 Required under the EU's Strategic Environmental Assessment Directive (2001/42/EC) as transposed by the Environmental Assessment of Plans and Programmes Regulations 2004/1633 https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/273997/DECC_SEA_Environmental_Report.pdf.

21 DECC 'Onshore oil and gas exploration in the UK: regulation and best practice' December 2013.

under consideration within the international context, for example by the International Risk Governance Council.²²

Planning permission

In addition to obtaining a PEDL, operators require site specific planning permissions to conduct operations within their licensed area. Shale gas operations involve, for planning purposes, the extraction of ‘minerals’,²³ and applications should be submitted to the local MPAs. MPAs are the County Council (in two-tier parts of the country), the Unitary Authority, or the National Park Authority.

National planning policy on hydrocarbons is laid out in paragraphs 142–49 of the National Planning Policy Framework. In summary, UK national policy is to facilitate the sustainable use of minerals (including conventional and unconventional hydrocarbons). This involves balancing the need for minerals extraction and the benefit to the economy against impacts on the natural and historical environment and human health. In the recently updated Online Planning Practice Guidance on Minerals (the Planning Guidance)²⁴ the Department for Communities and Local Government (DCLG)²⁵ states that:

...there is a pressing need to establish – through exploratory drilling – whether or not there are sufficient recoverable quantities of unconventional hydrocarbons such as shale gas and coalbed methane present to facilitate economically viable full scale production.²⁶

Planning applications require the submission of a standard application form, supported by plans and drawings,²⁷ certificates of ownership relating to the application site and design and access statements (where required).²⁸ Of particular note is the importance of the red-line boundary delimiting the area to which the application relates. Best practice is for this to include the area under which sub-surface fracking activities are likely to take place. However, the government has recently stated that it will amend the requirement to notify all owners and occupiers of land within a red line boundary in the case of shale gas applications. This requirement will be limited to that part of the application site where any surface workings or

development take place.²⁹ As a general rule, all potential impacts of the exploratory or production process will need to be considered, including transport and access, archaeological or heritage potential of the site as well as visual, noise and other amenity impacts.

A further contentious issue is whether operators are obliged to conduct an Environmental Impact Assessment (EIA) and submit an ‘environmental statement’ under the EU’s Environmental Impact Assessment Directive (EIA Directive) to accompany their application.³⁰ Environmental statements draw together, in a systematic way, the assessment of the likely significant environmental effects of the proposed development.

Under EU law, all projects listed in Annex I to the EIA Directive require an environmental statement. In particular, this includes projects for the extraction of natural gas for commercial purposes where the amount extracted exceeds 500,000 cubic meters per day.³¹ In addition, projects listed in Annex II to the EIA Directive (generally, less environmentally impacting projects) require an environmental statement where, following case-by-case examination, and taking account of certain criteria including the characteristics and location of the project, it is determined that such a project is likely to have significant effects on the environment.³² MPAs generally conduct a ‘screening’ exercise to determine whether any proposal for onshore gas extraction requires an EIA. In the Planning Guidance, DCLG states ‘that it is unlikely that an environmental impact assessment will be required for exploratory drilling operations which do not involve hydraulic fracturing’.³³ This implies that an EIA would be likely to be required for exploratory fracking wells, and will be required for the production stage. In all circumstances, early dialogue and consultation with the relevant MPA would appear to be advisable.

In determining the application, the MPA will consider the advice of a variety of statutory consultees, including English Heritage, Natural England, the Highways Agency and the EA in respect of matters including the protection of the environment and the public.³⁴

Any planning consent is subject to a variety of conditions. Several will need to be discharged before any

22 International Risk Governance Council ‘Risk governance guidelines for unconventional gas development’ 2013.

23 See NPPF Annex II definition of minerals.

24 New Online Planning Practice Guidance – Minerals 6 March 2014 <http://planningguidance.planningportal.gov.uk/blog/guidance/minerals/>.

25 The government department charged with responsibility for planning and development matters.

26 Note 24 para 091.

27 Town and Country Planning (Development Management Procedure) (England) Order 2010/2184 art 6.

28 *ibid* art 8.

29 DCLG ‘Revised requirements relating to planning applications for onshore oil and gas: proposals paper. Summary of responses and government response’ January 2014.

30 Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment, as transposed in the UK (in part) by the Town and Country Planning (Environmental Impact Assessment) Regulations 2011/1824.

31 Directive 2011/92/EU Annex I para 14.

32 *ibid* art 4(2), (3) and art 2(1).

33 New Online Planning Practice Guidance – Minerals (n 24) para 119.

34 Note 27 art 10, sched 5.

works can commence at the site, for example any contamination, archaeological or ecological surveys and implementation of mitigation works. Other conditions may regulate how the development is carried out (routing of HGVs, control of noise and dust, permitted hours of work etc) and the on-going use of the site throughout its lifecycle (for example, the number of vehicle movements, noise and dust, air quality and visual issues including site screening). Finally, there will be conditions requiring the removal of equipment, sealing of the well heads, decontamination works and site restoration.

Once PEDLs have been granted at the strategic national level, it is likely that planning consents will become a major battleground for onshore shale gas operations. Public consultation is a key element in the consideration of planning applications,³⁵ and as shale gas exploration falls under the local jurisdiction of MPAs (rather than under the National Significant Infrastructure Projects regime where applications are considered by the Planning Inspectorate), each application that is granted can be individually challenged in the High Court by interested third parties. Such third parties need not necessarily live locally or be directly affected by the proposals but the grounds of such challenges are limited to legal or procedural matters and not the planning merits of the case. The government is introducing reforms to the judicial review of planning decisions in the Criminal Justice and Courts Bill in order to limit the use of ill-founded judicial review claims as a deliberate delaying tactic to resist development, and to speed up the process of dealing with meretricious claims.³⁶

Furthermore, all documents submitted are publicly available, thus enabling review and public participation in planning decisions. MPAs are public bodies and decisions are made by locally elected councillors whose actions may be challenged by judicial review in the High Court. Any planning application refused by MPAs can also be appealed by operators to the Planning Inspectorate. Operator applicants should therefore be prepared for legal challenges to MPA's planning decisions, and the inevitable costs and delays that are likely to ensue.

The government is keen to encourage fracking but has recognised its unpopularity with local residents. It has therefore sought to compensate for actual or perceived disruption, both through public participation in the planning system and through application of business rates receipts to local communities. In a recent statement, the Prime Minister announced that all the business rates

revenue from shale gas sites is to be retained by councils (double the current figure of 50 per cent) which may amount to £1.7m for a typical site. In addition, operators have committed around £100,000 to be given to local communities for each test well, and 1 per cent of revenues if it is exploited.³⁷ This could be £5m to £10m over the lifetime of a site. How this is to be spent for the local communities' benefit is yet to be determined, but should reflect local needs and concerns.³⁸ The UK Onshore Operators Group has also created a Community Engagement Charter which sets out what local communities can expect from shale gas developments and how they can engage with operators and the commitments that operators will make to local communities.³⁹ Whilst this is a voluntary commitment rather than statutory obligation, reputational pressure, commercial competition and real concern about disruption through public protest are likely to encourage its implementation.

Landowner access

The grant of a PEDL and planning consent do not alone entitle operators to conduct exploratory and development operations: access to a drill site on private land must also be secured by an operator. It is standard, from our experience, for licences or lease options to be taken which are conditional on the grant of a satisfactory planning consent. Lease options enable operators to exercise their option to take a lease of land following the grant of development consent and when it is ready to commence exploratory drilling operations. Once the option is exercised, the lease runs for the defined term (which may be set to coincide with the potential production phase). Alternatively, operators may take short term leases or licences of land during exploratory work, prior to securing longer term leases for the production phase.

A key factor in deciding whether to choose a lease or a licence lies in the degree of control over the land that each gives. A lease gives the operator exclusive possession of the land, and subject to the terms of the lease, he can deal with it as if it were his own. A licence is generally for a much shorter term and is only a right (so far as it is drafted) to occupy to undertake certain activities or as otherwise

37 DECC 'Providing regulation and licensing of energy industries and infrastructure' updated 26 March 2014 <https://www.gov.uk/government/policies/providing-regulation-and-licensing-of-energy-industries-and-infrastructure/supporting-pages/developing-shale-gas-and-oil-in-the-uk>. Reviewed 11 April 2014.

38 Prime Minister's Office 'Local councils to receive millions in business rates from shale gas developments' 13 January 2014. See also D Hart below pp 57–63.

39 United Kingdom Onshore Operators Group: 'Shale Community Engagement Charter' June 2013 <http://www.ukoog.org.uk/images/ukoog/pdfs/communityengagementcharterversion6.pdf>.

35 As required under the UNECE's Aarhus Convention.

36 Commons Library 'Judicial Review: Government reforms – Commons Library Standard Note' 17 February 2014 <http://www.parliament.uk/business/publications/research/briefing-papers/SN06616/judicial-review-government-reforms>.

defined, but without exclusive possession of the land. This is a potentially critical distinction where there is a threat of trespassers and disruption. Under a lease, the operator has full control over security issues, but under a licence operators may need to rely on the landlord taking effective action, unless provision is made for the operator to deal with such matters. There are also other issues such as control over equipment and land-related tax issues to consider.

Land access rights should be negotiated at an early stage, and typically in advance of an operator's planning application. Consideration should be had for, amongst other things, the term of the lease, the size of the area required, the willingness of landowners to permit shale gas operations on their land,⁴⁰ access to and from the site (in light of the plant and equipment that may need to be delivered), and the landowner's rights (if any) to prevent the option being exercised. Overall, from an operator's perspective, due to the uncertain nature of site development, flexible land access rights are considered essential.

Access to 'frack' under neighbouring land

Whilst the above-ground drilling site for fracking activities will impact a relatively small area of land, fracking operations will spread out laterally from the drilling site, often under adjoining land owned by third parties. In addition to obtaining land access rights to the drill site, operators need to consider how to approach the issue of fracking under neighbouring land.

In the 2010 case of *Star Energy v Bocardo*,⁴¹ the Supreme Court held that *prima facie* 'the owner of the surface is the owner of the strata beneath it',⁴² until 'one reaches the point at which physical features such as pressure and temperature render the concept of the strata belonging to anybody so absurd as to be not worth arguing about'.⁴³

Campaigners such as Greenpeace have seized on the Supreme Court's *ratio* in *Star Energy* to argue that any unauthorised incursion by operators during fracking operations on the strata below land constitutes a common law trespass against that landowner.⁴⁴ Greenpeace has encouraged landowners to sign up to a 'legal block',

indicating that their consent is not given to the conducting of fracking operations under their land.

It is presently unclear how this 'land rights' issue will play out. Clearly, operators could approach neighbouring landowners at an early stage and seek their consent to conduct fracking activities. This may be easily achievable should several large landowners be willing to consent to operations under their land. However, should fracking occur in the vicinity of residential areas, or simply an area of small holdings, then obtaining this consent could become an administrative nightmare. Indeed, the very process of obtaining consent landowner-by-landowner could itself generate opposition to fracking activities. Operators who do not seek the consent of landowners may be faced with legal action by landowners to prevent or be compensated for fracking operations under their land. One point which remains uncertain is whether a court would grant an injunction against an operator conducting drilling operations under neighbouring land, or whether the court would consider damages to constitute sufficient remedy. Assuming the law remains as it is, a 'test case' on this point would appear likely. From a planning perspective, as mentioned above, the government has decided that notification is not required for all owners of land above subsurface fracking but that it should be contained within the red-line boundary of the application.

In light of the issues surrounding traditional methods of consent, operators may seek to acquire the necessary ancillary minerals rights through a rarely used statutory route, the Mines (Facilities and Support) Act 1966. Under this Act, operators may apply to the Secretary of State setting out why they should be granted ancillary mineral rights. Reasons which operators may put forward include: (a) that there are too many landowners with the power to grant the rights; (b) that those landowners cannot be ascertained or found; and, of particular note, (c) that the landowner with the power to grant the right unreasonably refuses to grant it or demands unreasonable terms.⁴⁵ If the Secretary of State, following consideration of the application, considers that the operator has made out his case, then he shall refer the application to the High Court which may vest the ancillary rights in the operator by way of an order. Whilst this process may appear straightforward, it has been estimated that this process could take between 18 and 24 months.

Given the threat of 'ransom strips' surrounding drilling sites and the cumbersome statutory route, we would anticipate that steps will be taken to clarify how operators are expected to obtain the necessary ancillary rights to

40 See eg Lord Cowdray's objection to fracking on or under his land in the South Downs National Park. BBC News 'Lord Cowdray in Fernhurst anti-fracking legal bid.' 25 November 2013. Reviewed 26 March 2014.

41 *Star Energy Weald Basin Limited v Bocardo SA* [2010] UKSC 35.

42 Unless there has been an alienation of them by a conveyance, at common law or by statute to someone else.

43 *Bocardo* (n 41) para 28 per Lord Hope.

44 Greenpeace UK press release 'Greenpeace launches nationwide legal block to fracking' 14 October 2013 <http://www.greenpeace.org.uk/media/press-releases/greenpeace-launches-nationwide-legal-block-fracking-20131010>.

45 Mines (Facilities and Support) Act 1966 ss 3, 4.

conduct fracking operations. Although not publicly articulated by the government at the time of writing, the *Financial Times* (22 April 2014) reports that under new proposals included in an Infrastructure Bill to be introduced in the Queen's Speech, companies will be allowed to run pipelines under privately owned land without fear of breaching trespass laws. This is expected to be a particularly divisive issue, and one which will no doubt be followed closely by both industry and opponents of fracking.

Environmental permits

Operators will probably require a number of environmental permits issued by the EA⁴⁶ under the Environmental Permitting (England and Wales) Regulations 2010 to conduct onshore activities. The EA takes a risk-based approach to regulating shale gas development, taking into account local site characteristics and site specific environmental risks.

The scope of the permitted activities will depend on the exact methods used and the geology of the site, however the environmental permitting regime seeks to cover a wide variety of issues, including:

- (i) the protection of water resources, including groundwater aquifers, water discharge activity (applicable where surface water runoff may become polluted) as well as assessing and approving the use of chemicals which form part of the hydraulic fracturing fluid;
- (ii) appropriate storage, treatment and disposal of mining waste produced during the borehole drilling and hydraulic fracturing process. All onshore gas exploration which involves drilling a borehole will require a mining waste permit covering the management of mining wastes (eg drill cuttings, spent drill muds and drill fluids, flowback fluids and waste gases);
- (iii) industrial emissions activity, when the operator intends to flare more than 10 tonnes of gas per day; and
- (iv) suitable treatment and management of any naturally occurring radioactive materials (NORM), in the form of flowback water and sediments, for example.

In June 2013, the EA made a commitment to streamline and simplify environmental regulation of onshore oil and gas exploratory activities. As part of this commitment, the EA issued technical guidance for onshore oil and gas exploratory operations to assist industry in understanding

the permissions that may be required to conduct exploratory operations.⁴⁷ At the time of writing, this technical guidance remains in draft form. In addition to this guidance, the EA committed to providing a more streamlined application for operators and to significantly reducing the time taken to obtain the necessary permits for exploration.⁴⁸ Further, DECC's recent onshore oil and gas regulatory roadmap⁴⁹ encourages pre-application consultations between operators and the EA and suggests that operators 'twin-track' planning and environmental applications to ensure that operational regulatory matters are progressed as smoothly as possible.

Water abstraction licences

If operators wish to abstract more than 20 cubic meters per day of water for operational purposes (rather than purchasing water from a public water supply utility company) then they will need to obtain a water abstraction licence under section 24/24A of the Water Resources Act 1991. Of note, the EA states that there is 'no guarantee that directly abstracted surface water or groundwater will be available' and that water abstraction licences for shale gas operations will be assessed like any other.⁵⁰ Given the high volume of water which may be required for fracking operations, access to water by operators may be an essential requirement before they can move into the production stage. Accordingly, it is likely that access to water arrangements will be closely monitored by operators and opponents alike.

Involvement of the Health and Safety Executive

A further element to the patchwork of regulators and regulations is that of health and safety law, which is closely intertwined with the management of environmental risks. In November 2012, the HSE and EA issued a 'working together agreement' which explains the joint approach to the regulation of unconventional oil and gas developments.⁵¹ A coordinated regulatory effort is required to ensure that shale gas wells are designed, constructed and operated to standards that protect both people and the environment.

47 Environment Agency 'Onshore oil and gas exploratory operations: technical guidance' Consultation Draft August 2013.

48 Environment Agency 'Commitment to streamline and simplify environmental regulation of onshore oil and gas exploratory activities' 27 June 2013.

49 DECC (n 21).

50 Environment Agency 'Guidance Note: Regulation of exploratory shale gas operations' November 2012. http://www.groundwateruk.org/downloads/EA_ShaleGasRegulation.pdf.

51 Health and Safety Executive and the Environment Agency 'Working together to regulate unconventional oil and gas developments' November 2012 http://cdn.environment-agency.gov.uk/LIT_7317_e1b401.pdf.

46 In respect of onshore operations conducted in England.

The UK's Health and Safety Executive (HSE) is engaged with shale gas operations from the perspective of well integrity and site safety. There are two key pieces of health and safety legislation which impose sector-specific obligations on onshore gas operators in addition to obligations on operators contained in general health and safety legislation, including the Health and Safety at Work etc. Act 1974. These are: the Borehole Sites and Operations Regulations 1995 (BSOR) and (despite their misleading title) the Offshore Installations and Wells (Design and Construction, etc) Regulations 1996 (DCR). The BSOR and DCR are made under and are additional to obligations on operators contained in general health and safety legislation, including the Health and Safety at Work etc Act 1974. In addition operators may, depending on the nature of their operations, need to consider obligations under the Control of Substances Hazardous to Health (COSHH) and Control of Major Accident Hazards (COMAH) regimes.

The BSOR apply to all onshore sites at which borehole operations occur,⁵² and are primarily concerned with health and safety management at the borehole site. Under BSOR, operators are obliged to give the HSE at least 21 days' advance notice⁵³ of drilling and abandonment operations. The notice must include a series of information on matters such as the type of the well, the particulars of the rig and a description of operations.⁵⁴ Further, drilling operations must not be commenced unless a health and safety policy is prepared which demonstrates that adequate measures will be taken to safeguard the health and safety of persons working at the site.⁵⁵

The DCR apply to both onshore and offshore installations and wells. The DCR are primarily concerned with well integrity and impose a set of obligations on operators to achieve this aim, including pre-drilling assessment of below-ground conditions, the preparation of a well examination scheme (to ensure that the well is designed and constructed to prevent unplanned escape of fluids) and certain reporting obligations. One notable safeguard contained within the DCR is the requirement for the design and construction of a well to be examined by an independent and competent specialist such that, so far as it is reasonably practical, there can be no unplanned escape of fluids from the well.⁵⁶

Additional consents, permits and notifications

In addition to the PEDLs, planning consents and principal environmental permits discussed above, operators may, depending on their activities, require a suite of additional permits and consents, or may be obliged to notify research and regulatory bodies of certain specified activities. This section will briefly touch upon a variety of these matters.

Notification of intention to drill: section 199 of the Water Resources Act 1991 places a statutory obligation upon operators to notify the appropriate agency (in England, the EA) of its intention to drill. This notification should be made on the prescribed form which is, at the time of writing, Form WR-11.⁵⁷ The EA will ask for a method statement, providing information as to the well being drilled, the well casing applied, details of any chemicals proposed to be used by the operator to stimulate the well, the storage of substances on site and a proposed drilling mud management plan.⁵⁸ From this information, the EA will decide whether the proposed borehole construction, casing and completion are adequate to prevent unacceptable risks to the environment. If necessary, the EA has broad additional statutory powers to request additional disclosure of information to conduct its analysis.⁵⁹ Following its review of an operator's drilling and water conservation strategy, the EA can serve a conservation notice requiring an operator to make amendments to its proposal to safeguard water resources.⁶⁰

British Geological Survey obligations: under section 23 of the Mining Industry Act 1926 (as amended), operators sinking boreholes greater than 100ft (30m) deep must give written notification to the Natural Environmental Research Council (through the British Geological Survey). Following notification, operators are under several other continuing obligations, including to keep records of the operations and retain specimen cores. The intention of these provisions is to ensure that all information obtained from the sinking of boreholes is made available to the British Geological Survey.

Flaring and venting consent: when gas cannot be economically used, gas is 'flared' to reduce its global warming potential. Gas may also, in certain circumstances, be 'vented' (released) for safety reasons. Flaring and venting have the potential to lead to localised environmental concerns surrounding local air quality issues, visual impacts

52 Borehole Sites and Operations Regulations 1995/2038 reg 2(1), 3(1).

53 *ibid* reg 6(1). The HSE can agree a shorter notice period.

54 *ibid* reg 6(1), sched I pt I.

55 *ibid* reg 7.

56 Offshore Installations and Wells (Design and Construction etc) Regulations 1996/913 reg 18.

57 Notice to the Environment Agency of intention to construct or extend a boring for the purpose of searching for or extracting minerals.

58 Environment Agency (n 47).

59 Water Resources Act 1991 s 201.

60 *ibid* s 199(2).

and noise. Depending on the nature of their operations, operators may need to apply for venting consents under the Energy Act 1976 and flaring consents under the Petroleum Act 1998.

Coal Authority authorisation: any shale gas activity which intersects, disturbs or enters any of the Coal Authority's coal interests requires prior written authorisation of the authority. This authorisation can take the form of either a licence, an agreement, or a permit, depending upon the activity to be carried out. Early consultation with the Coal Authority to obtain the necessary rights at each specific site would be advisable.

DECC consent to drill: under the terms of its PEDL, operators are obliged to seek DECCs written consent prior to the commencement of drilling operations. DECC consent is one of the final, and coordinating consents in the shale gas process. In considering whether to issue consent to drill, DECC will have regard to the suite of regulatory controls discussed above, including ensuring that planning permission is in place, environmental permits and consents have been obtained, and that the HSE has received notice of intention to drill. Upon receipt of DECC's consent to drill, and subject to the finalisation of a hydraulic fracturing plan and agreed method for monitoring induced seismicity (where fracking is going to be conducted), an operator has in place the requisite consents and may continue its operations.

Decommissioning and restoration

Decommissioning may be viewed as a latecomer to the table. Of note, the Onshore Planning Practice Guidance issued in July 2013⁶¹ referred to three phases of hydrocarbon extraction, however by December 2013, the UK Government had introduced a fourth stage of 'decommissioning and restoration'.⁶²

Under the Planning Guidance,⁶³ responsibility (including ultimate financial responsibility) for the restoration and aftercare of fracking sites lies with the operator and, in the case of default, with the landowner. As part of an operator's planning application, proposals for high quality restoration and aftercare of the site should be submitted. Examples of restoration include the prior stripping of soils from the site and their ultimate replacement during the decommissioning phase to enable the intended after-use.

Depending on the circumstances of each site, it is likely that planning conditions will be imposed on operators addressing site restoration and aftercare. The type of conditions laid down will depend on a variety of factors, including the intended after-use, the method of working at the site, the length of site occupation and the general character of, and planning policies for, the area.⁶⁴

The need for a form of financial guarantee to ensure site restoration has, as with other environmentally impacting industries such as open-cast coal mining, received particular focus. The UK Government's approach is that a financial guarantee to cover restoration and aftercare costs will only be justified in exceptional cases, including very long-term projects, the application of novel techniques, or where there is evidence of the likelihood of financial or technical failure.⁶⁵

Planning Guidance states that MPAs should seek to meet concerns about financial liabilities relating to site restoration either through planning obligations or voluntary agreements when development consent is given. Operators can also contribute to established mutual funding schemes to ensure the proper restoration of sites in the event of their financial failure.⁶⁶

This issue is similarly addressed in the EU Commission's non-binding Recommendation⁶⁷ to Member States to ensure that the operator provides a financial guarantee or equivalent covering the permit provisions and potential liabilities for environmental damage prior to the start of operations involving high-volume hydraulic fracturing.⁶⁸

Conclusion

Finding the correct balance between resource extraction and regulation is an objective which the UK has managed through both the common law and statute ever since the industrial revolution. The UK has a proud heritage of extractive industries and benefits from an established set of experienced environmental and health and safety regulatory bodies. That said, fracking poses a range of public regulatory and private law challenges which operators should prepare for. This is even more so given the heightened NGO and public scrutiny of the potential environmental and social impacts.

⁶⁴ *ibid* para 43.

⁶⁵ *ibid* para 49.

⁶⁶ Such as the Mineral Products Association Restoration Guarantee Fund or the British Aggregates Association Restoration Guarantee Fund.

⁶⁷ Commission Recommendation 2014/70/EU of 22 January 2014 on minimum principles for the exploration and production of hydrocarbons (such as shale gas) using high-volume hydraulic fracturing.

⁶⁸ *ibid* para 12.2.

⁶¹ DCLG 'Planning practice guidance for onshore oil and gas' July 2013.

⁶² DECC 'Developing Onshore Shale Gas and Oil – Facts about "Fracking" 'December 2013'.

⁶³ Note 24.

This article has sought to highlight key potential environmental risks, including contamination and safety concerns, water resources pressures, impact to local amenity and climate change and then analyse the present regulatory and legal landscape for onshore operators.

As noted at the beginning of this article, onshore operations have to date only reached the exploration phase. The present legal and regulatory system is, without doubt, advanced and seeks adequately to mitigate potential

material environmental and social risks. One of the most striking elements of UK shale gas regulation is the clear ‘frontloading’ of the work on creating a robust regulatory regime. The UK’s approach has been marked by a commendable joint commitment from government and industry, strengthened by public participation, to ensure that the emerging shale gas industry is appropriately regulated against known risks from the outset. Only time will tell as to the adequacy of these measures.