

Are we fit to frack?

Policy recommendations
for a robust regulatory
framework for the shale
gas industry in the UK



Working in partnership





Introduction

Over the coming years, major decisions will be made that will determine whether commercial extraction of shale gas will take place in the UK, how and on what scale.

These decisions could have significant impacts on our countryside, wildlife and the climate. As a partnership of leading conservation charities*, we have come together to reach an evidence-based understanding of these environmental impacts and to make recommendations for how negative impacts can be avoided or at least minimised.

The first part of this report summarises the environmental risks posed by the shale gas industry in the UK, based on the evidence review entitled *Hydraulic Fracturing for Shale Gas in the UK: Examining the Evidence for Potential Environmental Impacts*, which has been written by the project partners named below and peer-reviewed by the Centre for Ecology and Hydrology (CEH).

The second part of this report proposes 10 recommendations to address these risks and to ensure that regulation for the shale gas industry is fit for purpose.

You can view both reports online at **rspb.org.uk/fracking**

*A partnership of the Angling Trust, the National Trust, the Royal Society for the Protection of Birds (RSPB), the Salmon & Trout Association, The Wildlife Trusts and the Wildfowl & Wetlands Trust (WWT).

Our approach

We believe commercial shale gas extraction should only go ahead in the UK if it can be objectively demonstrated that the regulatory framework for the industry is fit for purpose, and offers sufficient protection to the natural and historic environment.

The government is keen to see shale gas extraction rolled out quickly, but more needs to be done to satisfy these conditions and ensure that the UK's climate change commitments are met.

As conservation organisations, we are calling for urgent improvements to be made to the regulatory framework for shale gas extraction. The 10 recommendations set out on the opposite page and discussed on pages 16–23, map out how we believe this can be achieved.

Further independent evidence is also needed to help understand and address the impacts of commercial shale gas exploitation – in the absence of carbon capture and storage – on climate change.

Summary of recommendations

1. Avoid sensitive areas for wildlife and water resources by creating shale gas extraction exclusion zones.
2. Make Environmental Impact Assessments (EIA) mandatory for shale gas extraction proposals.
3. Require shale gas operators to pay for a world-class regulatory regime.
4. Prevent taxpayers from bearing the costs of accidental pollution.
5. Make water companies statutory consultees in the planning process.
6. Require all hydraulic fracturing operations to operate under a Groundwater Permit.
7. Make sure Best Available Techniques (BAT) for mine waste management are rigorously defined and regularly reviewed.
8. Ensure full transparency of the shale gas industry and its environmental impact.
9. Ensure monitoring and testing of shale gas operations is rigorous and independent.
10. Minimise and monitor methane emissions.

Further explanation of these recommendations can be found on pages 16–23 of this report.

Climate change

The UK has committed to reducing greenhouse gas emissions to keep the global average temperature rise below two degrees Celsius.

Critical to meeting this objective will be abiding by the legally binding framework, established by the 2008 Climate Change Act, for reducing UK greenhouse gas emissions by at least 80% (over 1990 levels) by 2050.

This will require a step change in the way we source, manage and use energy. The Committee on Climate Change, for example, has recommended that UK electricity emissions should be reduced from the current level of 531 grams of carbon dioxide per kilowatt hour (531 g CO₂/kWh) to 50 by 2030.

Our review of the current evidence base suggests that shale gas exploitation is not compatible with these goals for the following reasons:

1. The carbon intensity of electricity from shale gas is higher than electricity from renewable alternatives.

Recent work by the Department of Energy and Climate Change (DECC) estimates that the overall carbon footprint of shale gas is comparable to that of conventional gas. When used for generating electricity, its carbon footprint is about half that of coal, but 16 times higher than wind power. Carbon capture and storage could considerably reduce these emissions; however the technology for this remains unproven on a mass, commercial scale.

If growth in shale gas takes UK investment and support away from lower carbon alternatives available, such as wind, wave and solar power, there would be a decrease in emissions savings.



A gas-fired power station, Teesside

Investment in shale gas risks locking the UK into high carbon infrastructure

2. Methane leaked during shale gas extraction could increase emissions further.

Methane is a potent greenhouse gas: already 30% of global methane emissions originate from leaks in the fossil fuel industry and natural geological processes. The International Panel on Climate Change (IPCC) notes that reducing these leaked emissions by a quarter by 2030 would alone reduce global warming by about 0.2°C.

A number of studies have found that shale gas exploitation has led to significant, additional methane leakage in the USA.

Shifting to natural gas from coal can have climate benefits only if the cumulative leakage rate from natural gas production is below 3.2%. Whilst some estimates suggest leakage rates from shale gas extraction can be below this level, there remains considerable

uncertainty. For example, a recent study estimated that the total methane emissions in the Uinta Basin in Utah amounted to 6.2–11.7% of the average hourly gas production in the region.

3. Avoiding dangerous levels of climate change requires fossil fuels to remain unexploited.

In 2012, the International Energy Agency warned that, without carbon capture and storage, if we are to avoid dangerous levels of climate change, no more than one third of the world's proven fossil fuel resources could be consumed. This estimate excludes much of the world's shale gas resources.

In this context, and given the UK's historical emissions and consequent responsibility to lead the low carbon transition, it is hard to justify large-scale investment in extracting UK shale gas – particularly if it's at the expense of lower carbon alternatives.

Habitat loss and fragmentation

The shale gas industry will require land for the construction of well pads and associated infrastructure, which could cause the loss or fragmentation of important habitats for wildlife.

Estimates vary but hundreds or even thousands of well pads could be required in the Bowland shale region alone. Each will require 2–3 hectares (ha) of land, as well as land for a storm water system, new roads, compressor stations and pipelines. If sited incorrectly, this level of development could lead to significant habitat loss and fragmentation at the landscape level.

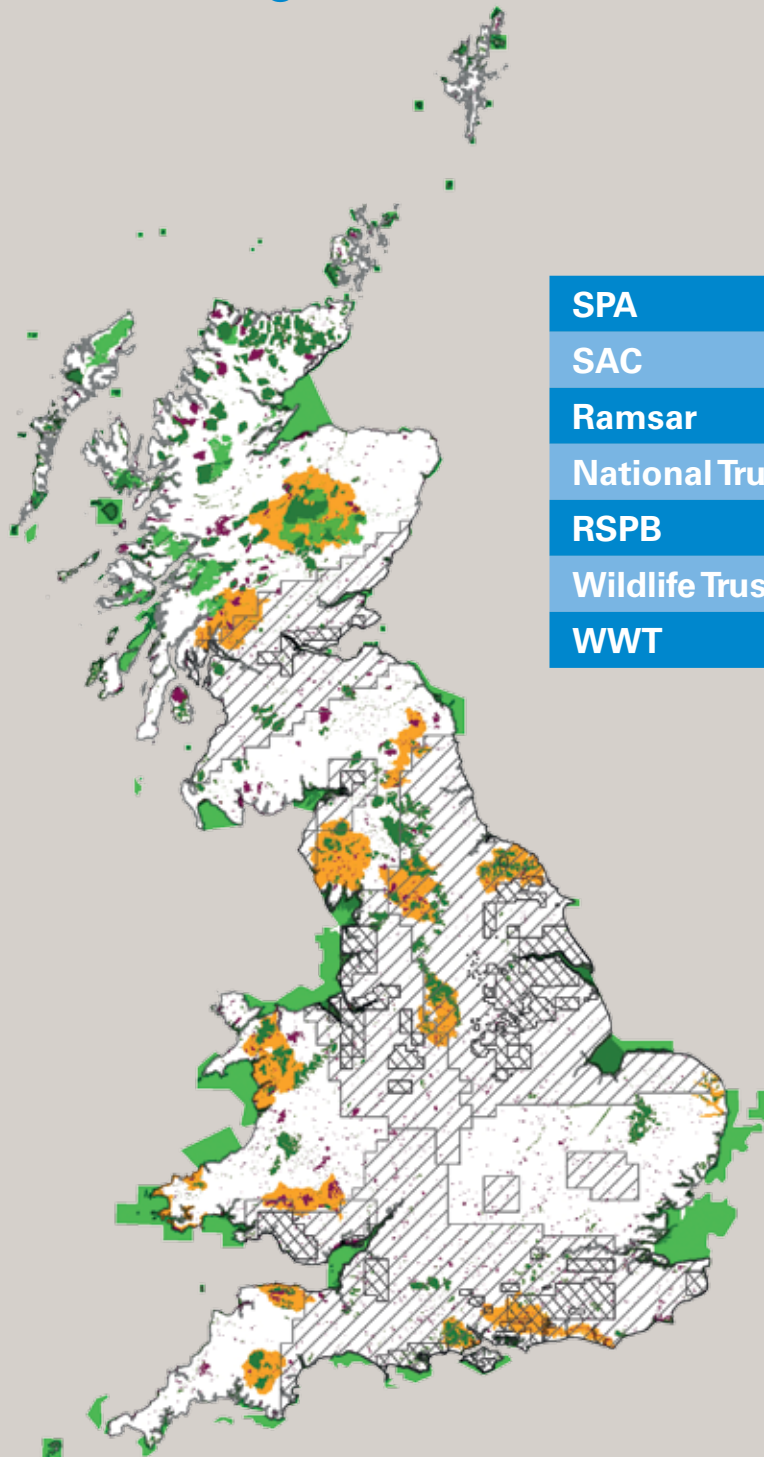
In the US, 695 ha of core Pennsylvanian forest have been lost to shale gas infrastructure. The additional 403 miles of new roads built to service the industry have also caused significant fragmentation of habitats, which is known to have a serious impact on a range of forest species.

Special places for nature under threat

Areas that are designated for their importance to wildlife in the UK that may be affected by the shale gas industry are shown on the map opposite. They include sites as diverse and special as Morecambe Bay – one of the most important wildlife sites in Europe, which hosts hundreds of thousands of wintering birds, the North York Moors and the Thames Estuary.

Potential licence areas for shale gas extraction also cover some of our most sensitive river systems, including globally important chalk streams like the Hampshire Avon, habitats that host spawning salmon and sea trout, unique plant life and a rich diversity of invertebrates.

Areas designated for their importance to wildlife in the UK that may be affected by the shale gas industry.



	No. of sites within areas currently under licence	No. of sites within areas being considered in the 14th licensing round
SPA	34	83
SAC	65	251
Ramsar	25	62
National Trust	120	634
RSPB	24	89
Wildlife Trusts	280	1,551
WWT	1	6

The first step for a developer wanting to drill for shale gas in Great Britain is to apply for a licence from the Department of Energy and Climate Change (DECC). These are usually offered in rounds.

A separate licensing system applies in Northern Ireland.

Key

	Areas currently under licence		Sites of Special Scientific Interest (SSSI)
	14th round licences under consultation by the Department of Energy and Climate Change (DECC) GB		National Parks
	Special Protection Areas (SPA), Special Areas of Conservation (SAC) and Ramsar sites		

Wildlife disturbance

Shale gas drilling activity, construction noise and the increased movements of vehicles and people are all likely to have adverse impacts on our wildlife.

There are still considerable uncertainties about the potential disturbance levels, but evidence suggests it could be significant.

For example, in the Mesa Verde National Park in Colorado, 64 compressors (associated with shale gas extraction) outside the protected area, resulted in an average 34.8 decibel (dBA) rise above typical ambient sound within the park. Along the eastern border of the park, nearest to the highest density of compressors, sound levels increased by a mean of 56.8 dBA above ambient conditions. This compares to the US Environmental Protection Agency recommended "safe noise level" of 55 dBA.

The projected growth rate of the shale gas industry in the UK, and its associated infrastructure, could result in a significant level of disturbance for sensitive species.

Heavy goods vehicle movements associated with the gas extraction work

can cause further disturbance to wildlife in certain areas. The transportation of equipment, fluid, sand and other materials during the drilling, completion and hydraulic fracturing stages equates to between 4,300 and 6,600 truck trips per well pad.

"The projected growth rate of the shale gas industry in the UK could result in a significant level of disturbance for sensitive species."

Finally, extraction sites cause light pollution. For example, a proposal for exploratory drilling for shale gas in the Weald Basin in southern England included installing a 45-metre tower, lit up 24 hours a day. This could have an adverse effect on vulnerable species, such as barbastelle bats (see opposite).

Case studies

Pink-footed geese

Andy Hay (rspb-images.com)



The UK is internationally important for pink-footed geese, with 85% of the global population spending the winter here.

The geese are particularly vulnerable to human disturbance and prefer large, open

areas to feed in; areas that are not protected.

Two of the four main over-wintering sites for pink-footed geese in the UK lie within possible shale gas extraction zones.

Barbastelle bats

Eric Medard (naturepl.com)



The Low Weald of Sussex and Surrey is particularly important for bats, including the rare, protected barbastelle bat.

Barbastelles roost in dense woodlands and fly out nightly along regular flight lines to

their feeding areas. If these flight lines are disrupted by prominent artificial lighting, it could make it harder for them to hunt and survive.

Water resources

Water is vital for wildlife and humans, and UK water resources are under constant demand. The shale gas industry could add even more pressure.

Overall, rainfall per person in the UK is on a par with that of Spain and significantly less than Greece or Portugal, with the east of England receiving, on average, as little as 700 mm of rain a year – about the same as Ethiopia. Even where rainfall is considerably higher, the water is subject to competing demands from power generation, industry and public water supply.

Parts of the UK that are water-stressed have rivers with low flows, which in turn puts pressure on fish and other wildlife that depend on healthy rivers. There are 1,826 areas or catchments across England and Wales (out of a total of 6,688) where water is available for new abstractions less than 30% of the time. These catchments are more vulnerable to water-stress. Of these, 15% overlap with areas already licensed for onshore oil and gas development, and 53% overlap with areas that are under consideration for the 14th licensing round (see opposite page).

A recent AMEC report for the UK government estimated that the UK shale gas industry could require up to 25,000 cubic metres of water per well,

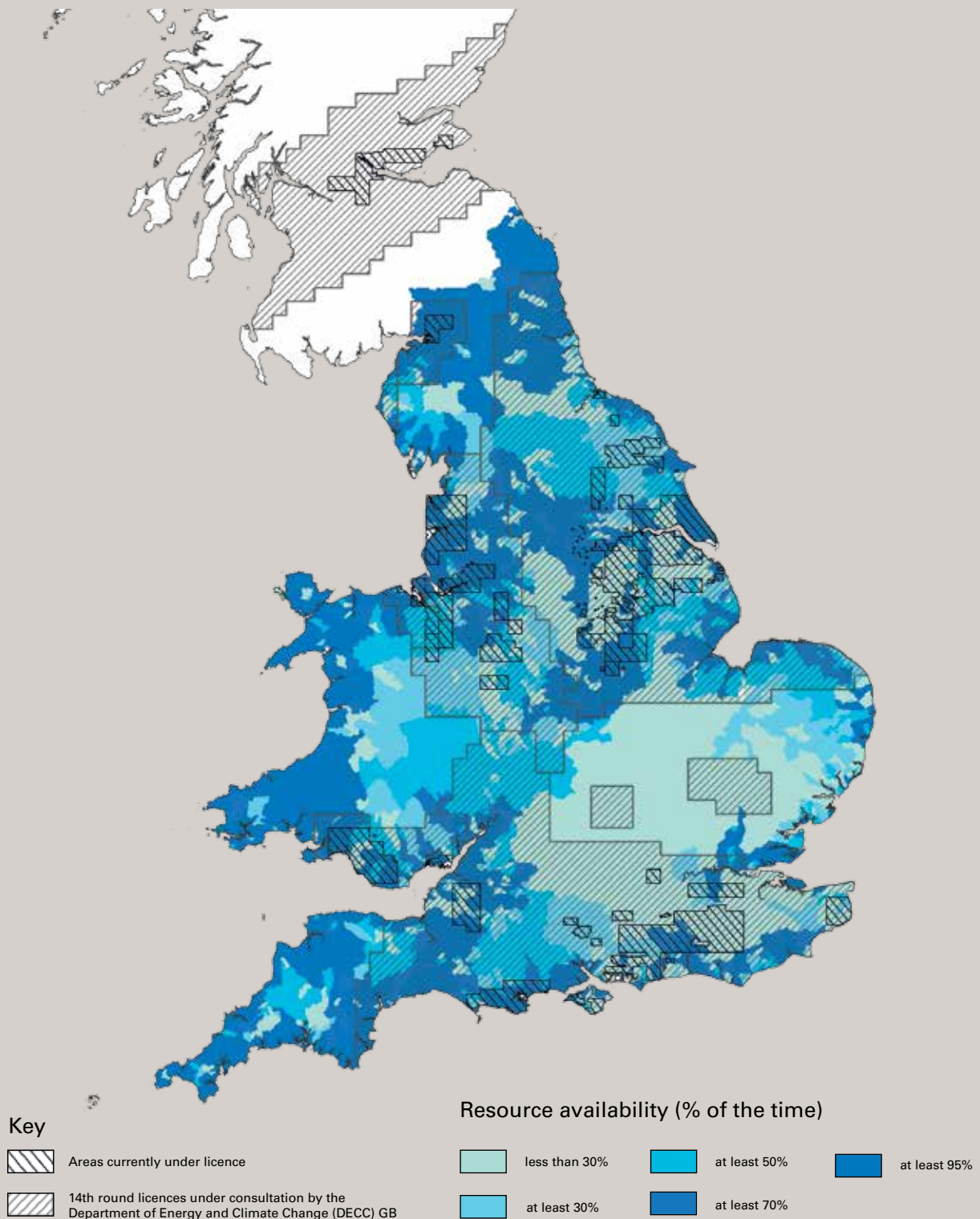
which would translate to as much as 108 million cubic metres of wastewater requiring treatment over a 20-year period. This would place significant burden on our existing wastewater treatment infrastructure.

“There may not be enough water available to meet the requirements for hydraulic fracturing in water-stressed areas.”

The location and timing of water demand will be critical. A large concentration of extraction activities in areas already under water stress could place unsustainable pressure on the environment.

This view is supported by the water industry trade association, Water UK, who highlight: “...where water is in short supply, there may not be enough available from public water supplies, or the environment, to meet the requirements for hydraulic fracturing.”

Water resource availability areas that may be affected by the shale gas industry.



Data © Environment Agency (EA), Centre for Ecology and Hydrology (CEH).
Data for England and Wales only.

Water pollution

There are many sources of water pollution in the UK that are detrimental to wildlife and people. Shale gas extraction is likely to add to the problem.

Contamination of ground and surface water, in relation to shale gas extraction, can occur as a result of:

- contaminants percolating up from the fractured shale seam into an aquifer;
- leakages of methane and/or fracturing fluid as a result of well failure;
- accidental surface spillages of fracturing fluid or waste water.

In the USA, methane contamination linked to shale gas extraction has been found in aquifers overlying the Marcellus and Utica shales in Pennsylvania and New York.

These contamination incidents can be minimised if best practice – facilitated by a strong regulatory regime – is adopted and rigorously followed by the industry. However, the risk cannot be reduced to zero, and once contamination of groundwater has occurred, the clean-up is difficult and may take many years.

Waste

Waste is also an issue. Upon the completion of fracturing a well, the well is de-pressurised and 10-40% of the “fracking fluid” used in the process

returns to the surface within the first few weeks of the well’s flow, at an approximate rate of 1,000 m³ a day. These fluids tend to be highly saline and contaminated with natural radioactive isotopes. The safe management of this flowback and the produced waters is critical if contamination, resulting from accidents, run-off or surface spillages, is to be avoided.

“Once contamination of groundwater has occurred, the clean-up is difficult and may take many years.”

Even after treatment, the waste water is saline and can find its way into water bodies via the effluent discharge from a wastewater treatment works. For example, recent studies have found that the disposal of shale gas waste waters to waterways in western Pennsylvania have led to a highly saline environment and increased radioactivity in surface waters. High salinity can be detrimental to the aquatic environment.

Case study

Chalk streams and their wildlife



Vicki Wagner (Alamy)

Chalk streams are home to wildlife such as salmon and sea trout that are very vulnerable to pollution

England is home to 85% of the world's chalk streams. Known as England's coral reefs, they are highly prized fisheries that are home to protected species such as salmon and sea trout, as well as grayling and bullhead, which require high water quality to thrive.

In the USA, adverse impacts of commercial shale gas extraction on aquatic fauna have been documented. English chalk streams would be extremely vulnerable to such pollution incidents, as well as to further demands for water.

In the Chilterns, for example, there are nine chalk streams, all suffering from low flows as a result of over-abstraction. The Chilterns Conservation Board has raised serious concerns over the compatibility of commercial shale gas extraction in the area with conserving these special places.



Salmon & Trout Association

Atlantic salmon

10 ways to improve regulation for the shale gas industry

1 Avoid sensitive areas by creating shale gas extraction exclusion zones.

From the wild expanses of the North York Moors to the internationally important wetlands of Morecambe Bay, parts of our countryside are particularly special for wildlife and water resources.

Given the risks associated with shale gas development, and the high level of uncertainty about them, national and local government should ensure that sensitive areas such as these are protected from development. This would best be achieved by not licensing or permitting shale gas extraction, or exploration activity in these areas in the first place.

Removing these sensitive areas from the 14th licensing round would reduce the total area being offered for licence by just 12%.

This is not a new concept: the Environment Agency has already ruled out drilling wells in areas known as "Source Protection Zone 1". Our proposed shale gas exclusion zones are shown on the map opposite. They include nationally and internationally

protected areas, nature reserves for which we have spatial data, land owned by the National Trust, and national parks. Other areas may also be appropriate for exclusion and public consultation would ensure these are identified.

Even avoiding these proposed shale gas exclusion zones will not be enough to protect the sites, as areas around them are often ecologically linked. For example, important species might use the farmland and forestry around a protected area for feeding. Given that each species behaves differently and each site is different, it is not possible to define an exact "buffer zone" around the proposed exclusion zones. Any application for shale gas extraction would therefore need to be carefully scrutinised for impacts on local wildlife as well as any nearby special sites.

Some areas of the country will be particularly vulnerable to groundwater contamination. We recommend that the Environment Agency, the Scottish Environment Protection Agency, Natural Resources Wales and the Northern Ireland Environment Agency identify these areas and consider adding them to these exclusion zones.

Proposed shale gas exclusion zones

Key



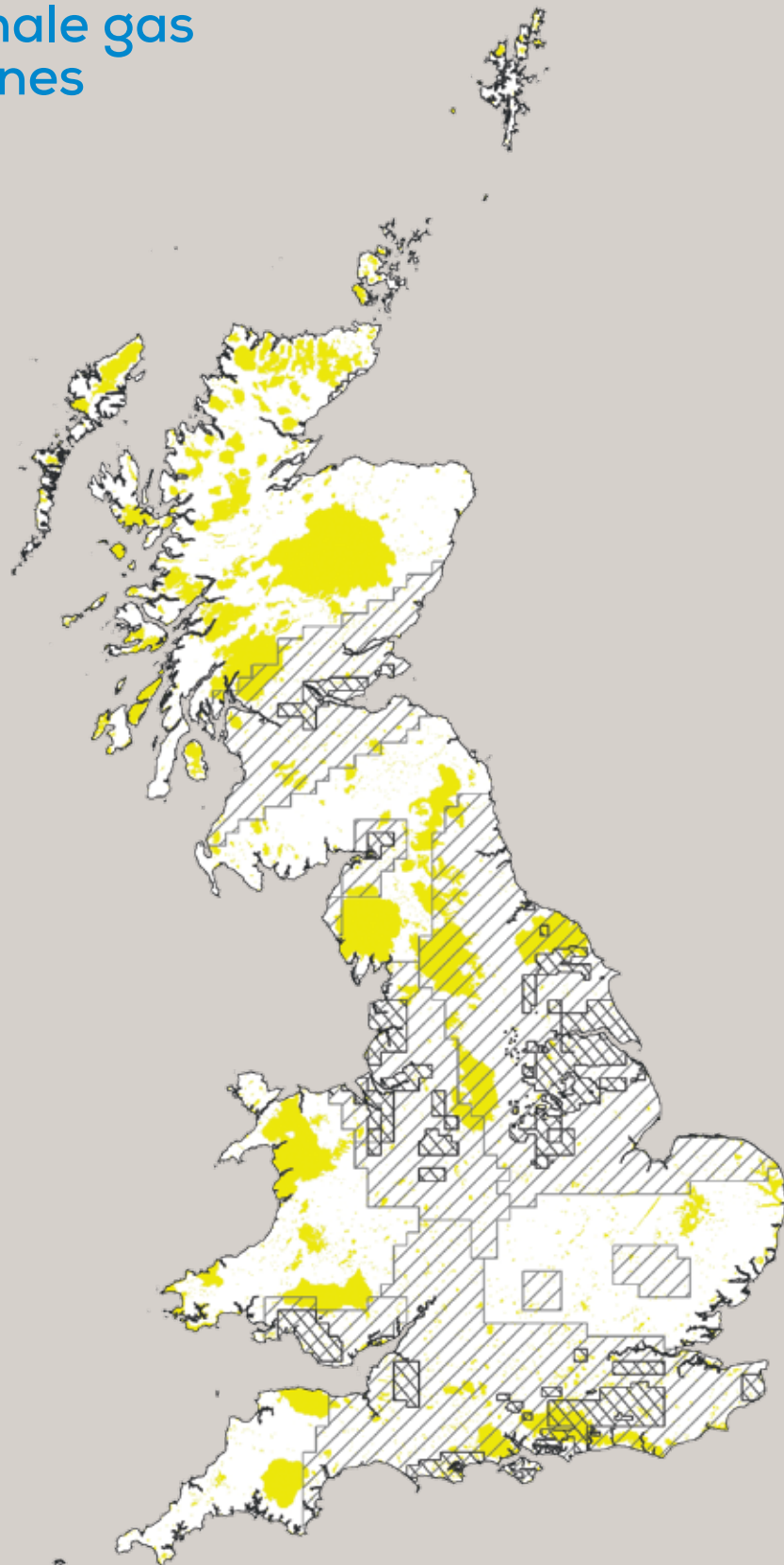
Areas currently under licence



14th round licences under consultation by the Department of Energy and Climate Change (DECC) GB



Exclusion areas





2 Make Environmental Impact Assessments (EIA) mandatory for shale gas extraction proposals.

Environmental Impact Assessment is a process for assessing the likely environmental impacts of a development and addressing them.

Public consultation is a key requirement of the EIA process, ensuring transparency. Because EIAs are a formal part of the planning process, they must also meet certain standards and be fully considered by councils when determining planning applications. On the other hand, voluntary impact assessments vary in quality and have no formal standing in the decision-making process.

The circumstances under which an EIA is required vary depending on the scale and type of development proposed. Currently, shale gas extraction operations are being permitted without an EIA.

The Secretary of State has the power to require an EIA for certain operations if they are considered likely to have significant environmental effects. Based on our review of the potential impacts of shale gas extraction and the immature status of the industry in the UK, we recommend that government should require an EIA for all forthcoming proposals. This will ensure that any environmental impacts are understood and incorporated into planning and decision-making. It will also help build public confidence that environmental concerns are being treated objectively in the planning process.

3 Require shale gas operators to pay for a world-class regulatory regime.

The Prime Minister has sought to address concerns about shale gas extraction by stating that the UK has one of the most stringent regulatory systems in the world. We agree that European and domestic legislation should put many vital controls in place. However, it will take significant investment to equip planning and regulatory authorities, including the Environment Agency, Natural England and their equivalents in Scotland, Wales and Northern Ireland, with the skills and resources needed to apply the regulatory systems to this new and inherently complex industry. This investment is needed, but currently these bodies are under severe budgetary pressure.

We therefore believe that the regulation of the shale gas industry should be based on the principle of “full cost recovery” – where the full cost of providing regulation is recovered from the industry. This can be achieved by permitting the regulatory agencies to charge for permissions and authorisations at a rate that reflects the true costs of planning, administration, monitoring and enforcement. To demonstrate this goal has been met, the UK Administrations and their agencies should publish accounts relating to the costs of regulating the shale gas industry, and these costs should then be recovered from the sector’s income.



Expensive restoration of some open-cast coal sites is likely to fall to the taxpayer

4 Prevent taxpayers from bearing the costs of accidental pollution.

Even the best regulation can only partly mitigate risk. If things go wrong it is important that fracking companies will cover the costs of clean-up.

Existing legislation requires regulators to check fracking companies are financially viable before issuing certain permits, but there is no way of knowing what will happen over the 25-year lifetime of a well. As a result, if a company goes into administration it will be the taxpayer that bears the cost of cleaning up after an accident and/or for decommissioning a site. This is currently a major issue with the open-cast coal industry in Scotland, for example, where failure to monitor the value of restoration bonds, combined with the collapse of two major operators, have left an estimated £200 million funding shortfall for restoration.

We recommend that the government introduces requirements for fracking companies to provide an upfront financial guarantee, sufficient to cover clean-up costs for the lifetime of the well and its decommissioning. These guarantees should be in place before permits are granted, and only be rescinded once the regulatory authority is satisfied that a well has been properly decommissioned and the site restored.

5 Make water companies statutory consultees in the planning process.

Shale gas extraction may place significant stress on the water environment and/or public water supplies, depending on the local context. Moreover, the saline and radioactive liquid waste produced by shale gas extraction poses significant risks of pollution and it can only be disposed of at specially licensed wastewater treatment facilities.

For this reason, we believe it should be a legal requirement that the water industry is consulted in the planning process. This will help ensure that demands on public water supply and wastewater treatment can be met without compromising the natural environment, and before planning permissions are granted.



Much of our native wildlife, like kingfishers, need clean, pollution-free water to survive

6 Require all hydraulic fracturing operations to operate under a Groundwater Permit.

Shale gas extraction activities pose a risk of accidental groundwater pollution, even if the gas resource itself occurs at a greater depth in impermeable strata. The current approach in England is to exclude these activities from a Groundwater Permit unless the regulator believes the risk of contamination is significant – a test that remains undefined.

As an example, the high volume hydraulic fracturing undertaken at the Preese Hall site in Lancashire was considered exempt from groundwater controls on the basis that the target strata did not contain groundwater.

We believe this is unacceptable. A Groundwater Permit should be required for all shale extraction operations. Such permits should require a detailed hydro-geological assessment of the site. They should also set out how all pollution risks will be mitigated, including through the design, construction and testing of well casings.

7 Make sure Best Available Techniques (BAT) for mine waste management are rigorously defined and regularly reviewed.

The Mining Waste Directive requires shale gas extraction operators to set out a Waste Management Plan as part of their permit application. These plans should outline how BAT will be used to manage waste, including flowback water, fugitive emissions, waste gas, drill cuttings and drilling slurries.

We recommend that the definition of BAT and design of monitoring protocols for the shale gas industry should be subject to rigorous, independent scrutiny to ensure the public have confidence in the controls in place. Definitions of BAT should be reviewed frequently to ensure they reflect developments in our understanding of risks and the latest technical developments in this new industry.



Alan Curtis (Alamy)

The regulatory regime for the shale gas industry must protect our natural and cultural heritage

8 Ensure full transparency of the industry and its environmental impact.

A complex web of state legislation and non-disclosure agreements negotiated between fracking operators and landowners has resulted in a paucity of data emerging from the shale gas industry in the USA.

While a lot has been written about the impact of the shale gas extraction process on water quality or resources in the USA, much of this is in the form of industry or advocacy reports that have not been peer-reviewed. This lack of transparency has fuelled the debate around environmental risks and economic benefits, and has undermined public confidence.

We recommend that all regulatory conditions and monitoring data for the industry in the UK are made publicly available. This should include, but not be restricted to, the chemicals authorised for use in hydraulic fracturing, the volumes of fracking fluids used, the composition of the drilling muds, geophysical logs of casings and boreholes, well productivity, and the analysis of flowback fluids.

9 Ensure monitoring and testing is rigorous and independent.

Hydraulic fracturing is an emerging technology in the UK. Careful design, testing and monitoring are vital to establish an environmental baseline; ensure that mitigation measures are properly installed; demonstrate that operators are complying with permits; and detect any pollution incidents quickly.

We recommend that regulatory authorities, including the Environment Agency, Scottish Environmental Protection Agency, Natural Resources Wales, the Northern Ireland Environment Agency and the Health and Safety Executive, take the lead in monitoring shale gas operations until the industry can prove it has the correct systems and culture in place, and before any elements of operator self-monitoring are introduced. The resources needed for this baseline and regulatory monitoring will require significant new investment in the responsible bodies. The money for this should be recovered from the shale gas industry itself.



Mark Godfrey

Methane leakage should be monitored across the whole site

10 Minimise and monitor methane emissions.

Fugitive methane emissions escaping from shale gas operations are a major threat to the climate and to rivers and groundwater. Recent independent studies of mature shale gas extraction areas in the USA have shown higher methane concentrations in the air than expected, and have linked methane contamination of water resources with extraction operations. This is a serious risk in the UK.

To ensure these leaked emissions are minimised and monitored, we recommend that the environmental regulator should monitor and regulate the greenhouse gas emissions from individual shale gas extraction sites. This work should be paid for in full by the shale gas industry, and include:

(i) measuring the methane emissions on a representative sample of extraction sites, using direct measurements that allow the accurate quantification of all emissions from the sites. This will help to establish baseline data and to validate ambient monitoring.

(ii) Establishing monitoring around each extraction site.

To ensure independent and objective assessment, this should be carried out by the appropriate regulatory body rather than the operator. Developers should be required to meet stringent standards for minimising emissions, and these standards should be regularly tightened in line with best practice.

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Version 1.2 – amended 20 March 2014

All references for this report are included in the full
evidence review.

Cover: drilling equipment at a shale gas drill site, Southport by Cernan Elias (Alamy).

The Royal Society for the Protection of Birds (RSPB) is a registered charity:
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