



**Cuadrilla**



# A MESSAGE FROM OUR CHIEF EXECUTIVE

Cuadrilla has led the way in exploring for and demonstrating the potential of shale gas resources in the UK.

We hope that the next few years will be about starting to realise the recovery of those domestic natural gas resources in a safe and environmentally responsible way. We strongly believe that natural gas from shale has the potential to create thousands of jobs, generate very significant tax revenues, reduce our reliance on imported coal and gas, and improve the UK's balance of payments. We also believe that increasing UK domestic gas supplies will exert downward pressure on UK gas prices.

Natural gas will, I believe, remain a very important part of our energy supply mix for many decades to come. It is essential for heating our homes and businesses, supplying industry and with other sources as a fuel supply to a balanced electricity generation mix. I am convinced that the potential of shale gas resources in the UK is significant, with the prospect of real and lasting benefits for local communities, the wider Lancashire economy and for the UK as a whole.

FRANCIS EGAN  
Chief Executive Officer



## CONTENTS

2	Message from CEO
3	Shale gas
4	Environmental protection
6	Shale gas operations and environmental monitoring
8	Monitoring seismic activity
9	Regulation and safety
10	Production phase
11	Benefits
12	Contact us



# SHALE GAS

What is shale?

Shale is a fine-grained sedimentary rock composed mostly of consolidated clay or mud and is the most frequently occurring sedimentary rock. Most of the target shale from the Bowland Basin in Lancashire is almost 300 million years old and lies more than a mile beneath the surface. Because of its very fine-grained composition shale is practically impermeable; it is exceedingly difficult for gas or liquid to flow through it or out of it.

What is shale gas?

Shale gas is natural gas that is stored in shale. Gas can be stored in shale by different mechanisms:

- Within the pores of the rock
- Within a naturally occurring system of fractures within the shale
- Adsorbed onto the shale minerals and organic matter within the shale

What is the process for getting stored gas out of the shale?

The gas can be extracted by hydraulically fracturing the shale rock. This involves pumping fracturing fluid, made up of mostly water and sand, and one or more chemicals which are approved for use by the Environment Agency (EA), under high pressure down a wellbore drilled into the shale rocks. This opens up minute gaps or cracks, many of which are already there, in the rock formations.

The cracks are held open by the particles of sand contained in the fracturing fluid and as such the fractures created are typically a grain of sand wide. Fracturing the shale rock opens newly created and existing pathways in the rock. This creates more channels through which the natural gas can flow out of the rock and into the well.

The composition of fracturing fluid Cuadrilla plans to use for its exploratory wells is: 99.95% water and sand, 0.04% polyacrylamide, 0.00005% sodium tracer.

The EA has also in the past approved the use of a dilute hydrochloric acid which could be used in a diluted solution at the start of the fracturing treatment. The use of biocide at levels similar to those used to treat drinking water has also been approved. We are not however planning to use either dilute hydrochloric acid or biocide in planned exploration wells and neither was in fact required during hydraulic fracturing at our Preese Hall exploration well.

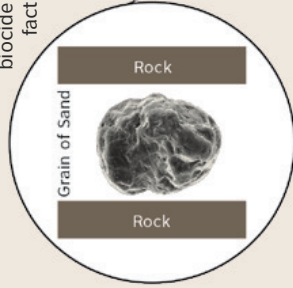


Image of rock fracture held open by a grain of sand

The fracturing fluid and its contents are all approved by the EA and details are published and can be viewed on each of the EA and Cuadrilla websites. This form of disclosure has subsequently become best-practice for the industry, as recommended by the United Kingdom Onshore Operators Group (UKOOG).



# ENVIRONMENTAL PROTECTION

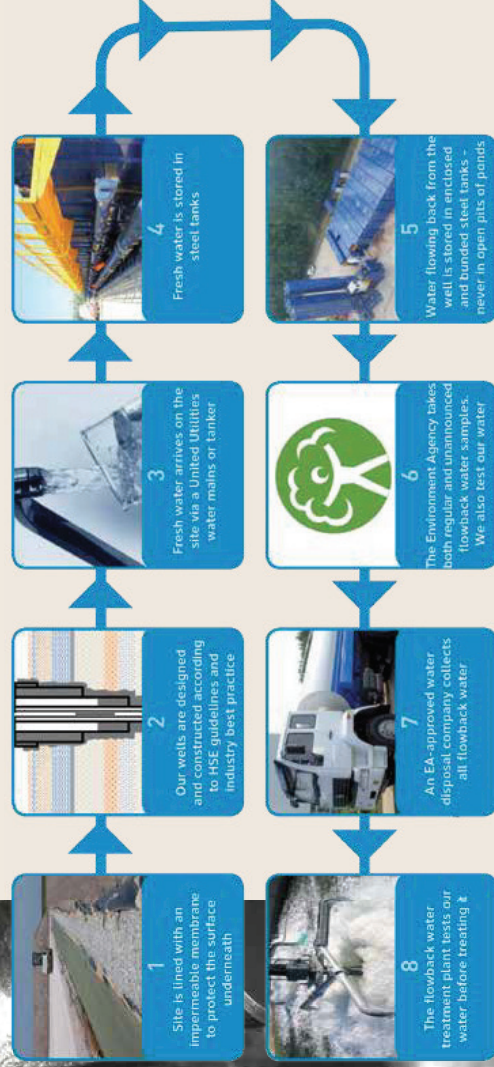
## Water protection

Safeguarding of groundwater is central to our protection of the environment. We plan to use a fracturing fluid mix that will meet a “non-hazardous to groundwater” environmental classification.

During site preparations, an impermeable membrane is placed across the entire exploration well site. This prevents any potential spills at surface leaching into the ground water. The membrane holds all site surface water (e.g. from rainfall) which runs off into a pre-prepared channel and is tested prior to disposal. All fluid used for hydraulic fracturing on site is stored in banded steel tanks before it is used. Our fracturing fluid must be approved and is subject to testing by the EA at whatever frequency the EA decides.

When our fracturing fluid returns to the surface it can contain very low levels of naturally occurring radioactive materials (NORM) such as those found around the UK at surface outcrops of granite and shale rock.

All water which flows back to the surface from the well is likewise stored in banded tanks. It is subject to testing by the EA before an EA-approved water disposal company removes all waste water for testing and treatment at an EA licensed wastewater plant.



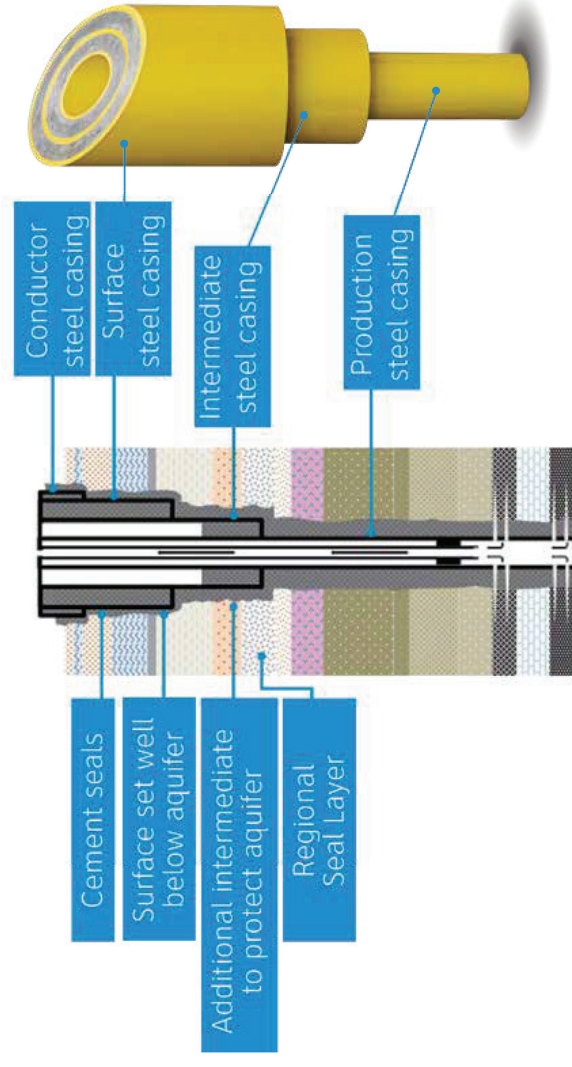
Water life cycle

# ENVIRONMENTAL PROTECTION

## Protecting aquifers

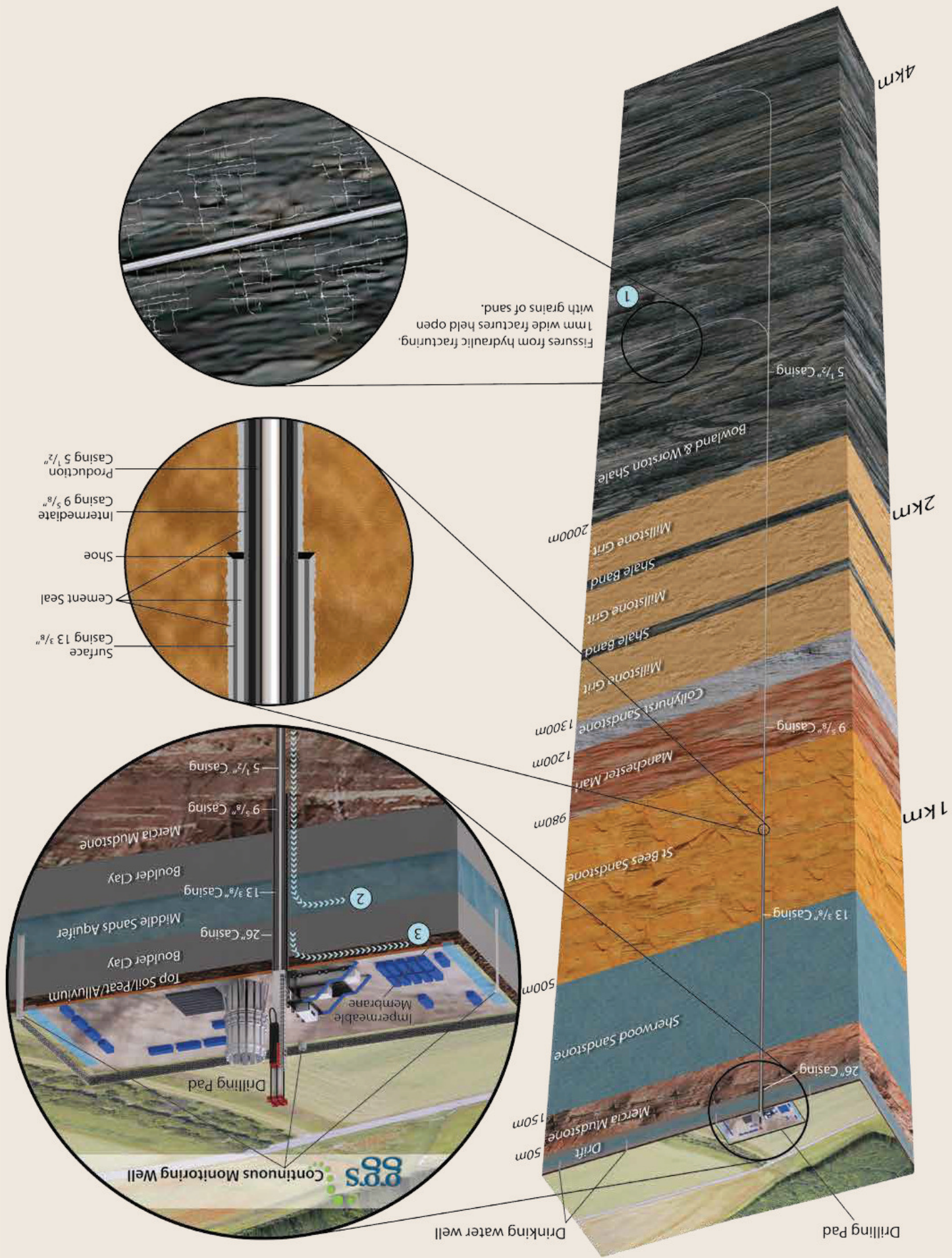
Cuadrilla uses industry best practice well design as laid down in Oil & Gas UK's *Well Integrity Guidelines*, the United Kingdom Onshore Operator's Group UK *Onshore Shale Gas Well Guidelines* and the American Petroleum Institute's *Guidance Document HF1*. All of these specifically address the integrity of well barriers, notably those preventing well fluids coming into contact with aquifers.

## Comprehensive well design





# SHALE GAS OPERATIONS AND ENVIRONMENTAL MONITORING





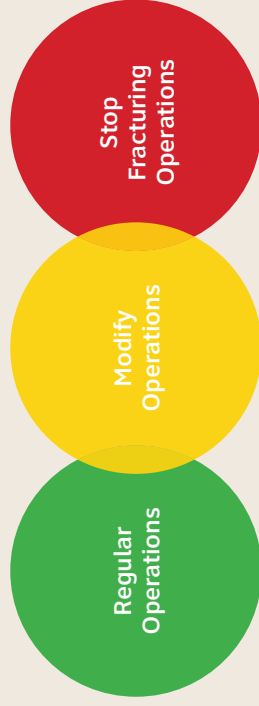
# SEISMIC MONITORING

Cuadrilla is putting in place around each of its exploration wells early detection systems capable of picking up tiny seismic events deep beneath the surface (well below the level that can be felt at surface). This is part of a monitoring and control system developed in conjunction with and approved by the Government. It is designed to prevent the possibility of any tremors at surface during the hydraulic fracturing process that could cause public concern or any damage.

The development of Cuadrilla's monitoring system has been informed by the experience of similar systems in the Netherlands and Germany. Cuadrilla will install a seismometer network around every one of its exploration wells.

## The traffic light system

This system monitors any minute underground seismic activity, feeding back information in real time during hydraulic fracturing. This is in accordance with the recommendations of the Government following the joint report by the Royal Society and the Royal Academy of Engineering. The data gathered will allow us to adjust our hydraulic fracturing procedure, and the process is designed to prevent any surface vibrations that could give cause for concern or cause any damage.



# REGULATION & SAFETY

Maintaining the highest standards of safety and environmental protection is the top priority at each and every one of our operational sites.

Our operations are regulated by the Department of Energy and Climate Change (DECC), the Environment Agency (EA), the Health and Safety Executive (HSE) and Lancashire County Council.

These regulators work closely with Cuadrilla to ensure our operations are safe and conducted in an environmentally responsible way. In addition an independent well examiner must assess and approve all of Cuadrilla's well designs before Cuadrilla submit these for review to the HSE.

During operations, Cuadrilla is subject to visits from the EA and HSE both on an announced and unannounced basis. Officials from DECC also plan to attend Cuadrilla's exploration well sites during hydraulic fracturing operations.



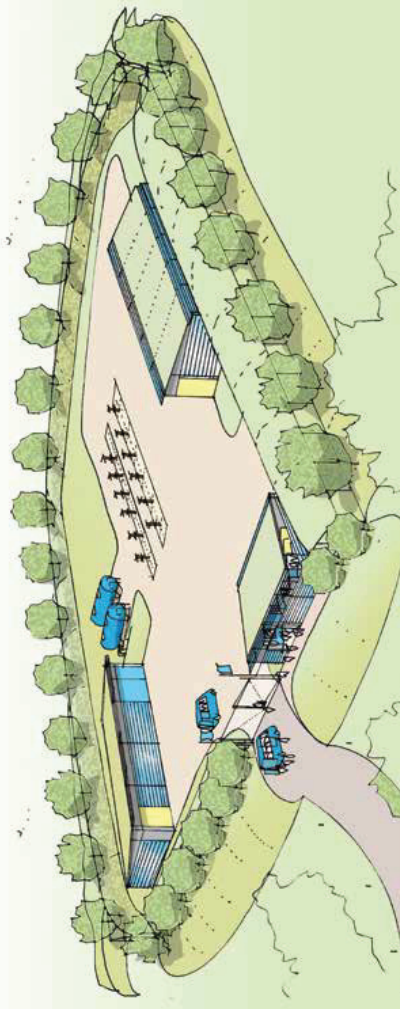
# PRODUCTION PHASE

At the moment we are in the exploration stage looking for gas and all of our sites are temporary, with the exception of the producing site Elswick which has been extracting natural gas from the Sherwood sandstone since 1993.

Cuadrilla has a licence to explore for shale gas in the Bowland Basin as part of the Department of Energy and Climate Change's four-yearly Onshore Licencing Round.

Cuadrilla is currently conducting the exploration phase of the Bowland Basin in Lancashire. Our current focus is to determine how much of the very large quantity of natural gas we have discovered in the shale rock that might be possible to extract from the shale. This will lead – in time – to increasingly accurate commercial estimates of how much the gas is worth and the likely benefits to Lancashire and the UK as a whole.

Design concept of a producing Resource Hub - Following drilling and hydraulic fracturing



# BENEFITS

The Institute of Directors

The IoD's report '*Getting Shale Gas Working*' in the IoD's May 2013 report, sponsored by Cuadrilla, highlighted the potential economic benefits that a properly regulated shale gas industry can bring to Lancashire and to Britain. The report stated that:

"Shale gas could represent a multi-billion pound investment, create tens of thousands of jobs, reduce imports, generate significant tax revenue and support British manufacturing. It could potentially meet a third of the UK's gas demand with a very small surface footprint."

In addition, the IoD stated that:

"In the central scenario gas import dependency could be reduced from 76% to 37% in 2030, and the cost of net gas imports in 2030 could fall from £15.6 billion to £7.5 billion (2012 prices)"

Cuadrilla's commitment to community benefit

We share the views that have been advanced by community representatives that local people must reap long-term benefits from shale gas.

Cuadrilla will work with Government and local representatives on the scope and structure of a future fund for communities in Lancashire.







## HOW TO CONTACT US

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