

Operations at Preston New Road

Keeping you informed

Assessment of seismic activity

Hydraulic fracturing has started at Cuadrilla's Preston New Road site. The Environment Agency (EA), Health and Safety Executive (HSE) and the Oil and Gas Authority (OGA), as the Shale Environmental Regulator Group, are active in regulating the site during operations.

We are assessing operations to ensure that Cuadrilla is meeting the conditions in the agreed [Hydraulic Fracture Plan](#) and that the traffic light system is being followed. We have received a number of questions on what this assessment involves and how we can be confident that operations are safe.

Were these seismic events expected?

Yes, we knew that very low level seismic events deep underground were possible during hydraulic fracturing operations and this is what has been happening recently at Preston New Road. There are several thousand minor seismic events like these occurring naturally in the UK every year and can only be detected at the surface with specialist equipment.



Seismic waves are recorded using seismometers or geophones. The image (left) shows the array of borehole geophones before they were positioned in the second well at the site. They measure the fracturing of rock. This equipment can detect the very small levels of micro seismic activity underground. Additionally there are surface monitoring seismic sensors.

Can I feel a seismic event of 0.5 Magnitude?

No, events of 0.5 Magnitude can only be detected by specialist equipment and will not be felt. Usually people can only feel seismic event greater than magnitude 2.0, which may feel like the vibrations from a passing truck. Events deep underground usually result in smaller ground motion at the earth's surface. Ground motion is also measured as part of the Hydraulic Fracture Plan.

For more information, please see here <http://www.bgs.ac.uk/downloads/start.cfm?id=661>



What magnitude is deemed too high?

Each site requires a site specific assessment as the geology will differ from site to site and so a decision to stop hydraulic fracturing operations would be based on understanding of the local situation at that time.

For instance if there is a loss of well integrity following a seismic event which could cause pollution of the environment, the EA would require operations to be suspended and would only allow operations to proceed if Cuadrilla could demonstrate that there had been no impact on the environment.

Earthquake magnitude is a useful indicator as it can be calculated quickly but it doesn't always fully reflect the resulting ground motion, which is dependent on such things as depth, distance and surface geology. A larger deep event may result in little ground motion at the surface, but under certain geological conditions, a shallow smaller event may be felt in some locations. The limits of ground motion agreed in the Hydraulic Fracture Plan are chosen to minimise disturbance.

Is the Traffic Light System working?

Yes, the Traffic Light System is working. The threshold for pausing and stopping operations is set at a level far below a tremor that could be felt at the surface. Following any seismic event during injection operations that exceed the magnitude 0.5 threshold, Cuadrilla is required to immediately pause injection, reduce pressure in the well and monitor for a minimum of 18 hours for any further events.

What is a Hydraulic Fracture Plan?

The [Hydraulic Fracture Plan](#) (HFP) sets out the steps that Cuadrilla takes to minimise seismic risks, and to monitor and control the hydraulic fracturing process.

Cuadrilla was required to carry out detailed geological studies to assess the risk of seismic activity, and to control any hydraulic fracturing operations taking place near identified geological faults. The EA has to be assured that any risks to groundwater are appropriately controlled. The OGA must also be satisfied that controls are in place to minimise the risk of disturbance from a seismic event.

What assessment is being done by regulators after traffic light events?

We are taking a cautious approach and have strict controls in place so that even low level seismic activity results in a pause in operations to allow us to review the event and ensure that the operator's approved plan is still valid.

During the pauses under a red traffic light event, the OGA compares the location, magnitude and ground motion of these minor seismic events to the approved plan. To date, the OGA has been satisfied that these events have all been in line with the geological understanding set out in the Hydraulic Fracture Plan and that Cuadrilla are managing the risk of induced seismicity.

The EA makes sure that hydraulic fracturing is monitored in a way that manages any risk to groundwater by studying information on faults and how the shale rock is fracturing.

The OGA have commissioned experts from the British Geological Survey to monitor operations 24/7. In addition, when the OGA and EA staff have been on site we have been able to monitor results in close to real time. The EA and OGA consider the magnitude, ground motion, injection rates and proximity of the location of the seismic activity in relation to the boundary set in the environmental permit.

Operations are progressing in accordance with the agreed strict controls in the Hydraulic Fracture Plan and in line with the traffic light system.



What is the risk to groundwater or drinking water?

The EA has fully assessed the risk of operations at Preston New Road before deciding to issue a permit. There is no plausible risk to people's drinking water from the hydraulic fracturing operation. The layer of rock that is being fractured is more than 2 kilometres beneath the surface, and several layers of impermeable rock lie between it and the shallow water table.

We have assessed that there is no groundwater in the shale and we do not expect fractures to enter the layer of Millstone Grit above. If fractures were to go beyond the underground permitted boundary (set at the upper boundary of the shale rock) the impact is likely to be materially insignificant. The environmental permit does not allow for any chemicals that are hazardous to groundwater to be used in hydraulic fracturing fluid.

How do you know that there has been no loss of well integrity?

Pressures in the well are monitored constantly during hydraulic fracturing operations.

The HSE need to be satisfied that well integrity is maintained throughout operations. The failure of any safety barrier in the well must be reported to HSE, even if it doesn't result in an escape of liquid or gas from the well.

It receives regular reports from Cuadrilla on well pressure and a report detailing operations on the well each week, including any integrity testing. HSE's team of specialist wells inspectors inspect these reports to ensure that they are in line with the notification supplied by Cuadrilla before hydraulic fracturing commenced.

Traffic Light System

The Traffic Light System was introduced to mitigate the risk of induced seismicity (caused by human activity) from hydraulic fracturing, by ensuring that the operator proceeds with caution if an “Amber” (0 to < 0.5 M_L) magnitude event is detected, or by pausing injection operations in the case of a “Red” ($\geq 0.5 M_L$) magnitude event.

Managing onshore induced seismicity

Hydraulic Fracture Plan (HFP)



Operator sets out how it will control and monitor the fracturing process

Identifies and assesses the locations of existing faults to prevent hydraulic fracturing from taking place near them

HFP must be agreed with OGA and Environment Agency

OGA must be satisfied controls are in place to minimise disturbance

Monitoring



Before and during operations, the operator must carry out seismic monitoring as agreed in HFP

May include additional recording to measure levels of ground motion close to nearby dwellings and other structures

Where magnitude/ground motion are in line with the HFP, this confirms geological understanding and injection can resume, subject to any mitigation as part of the agreed HFP

Management – “traffic light system”



$M \geq 0.5$

Operator must suspend injection, reduce pressure and monitor seismicity and ground motion for any further events before potentially resuming

$M \geq 0.0$ to < 0.5

Injection proceeds with caution, possibly at reduced rates. Monitoring is intensified

$M < 0.0$

Injection proceeds as planned

