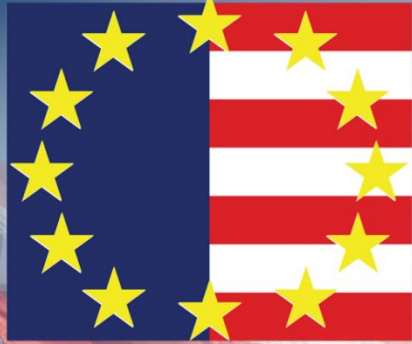


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**CONFERENCE ON HEALTH  
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# **HYDRAULIC FRACTURING**

**BAKKEN SAFETY TOUR | 2016**  
AUGUST 31 - SEPTEMBER 2

**Mark Quint**

Geoscientist

Oil and Gas Authority

UNITED KINGDOM



Oil & Gas  
Authority

# Role of the Oil & Gas Authority in Licensing, Consents and the Regulation of Induced Seismicity

Hydraulic Fracturing Bakken Safety Tour 2016

[mark.quint@oga.gsi.gov.uk](mailto:mark.quint@oga.gsi.gov.uk)



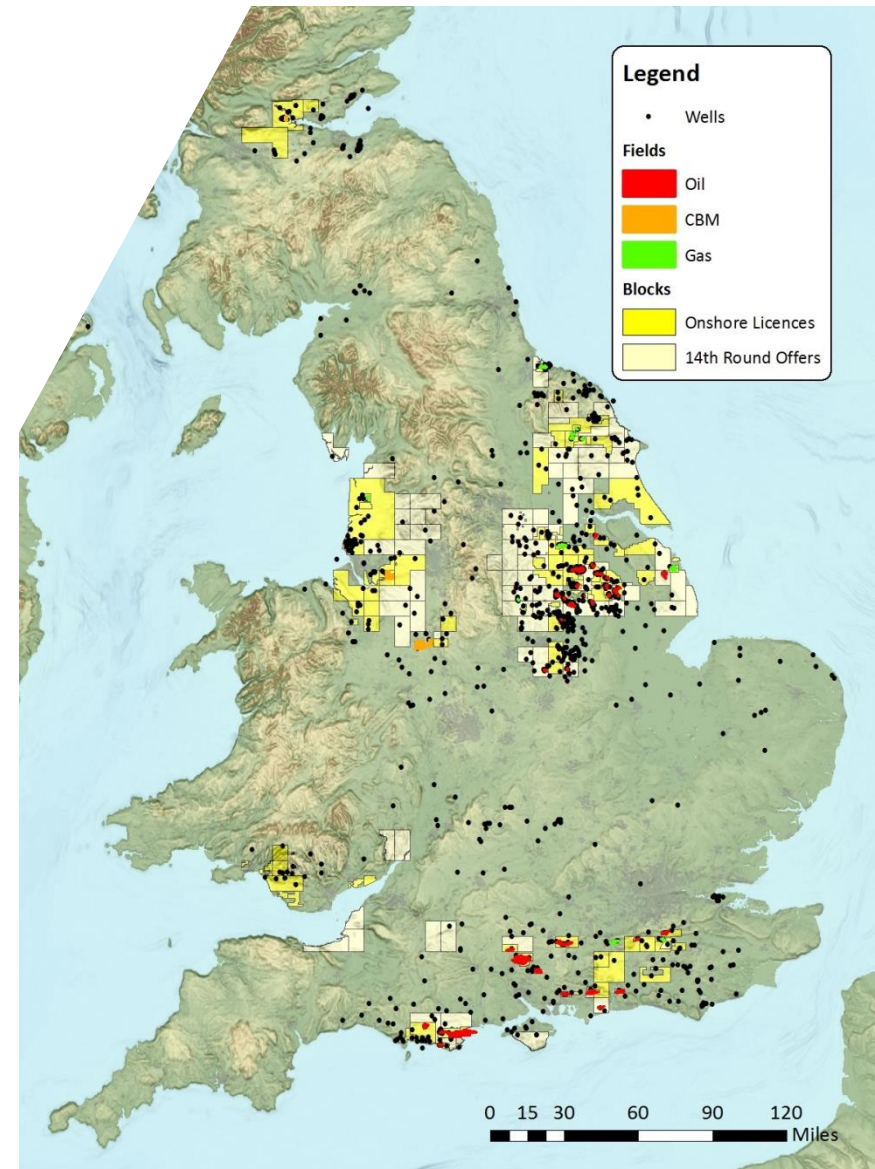
# Introduction

- Onshore oil and gas in the United Kingdom
- Role of the Oil & Gas Authority
  - Licencing Process
  - Consenting for Operations
- Regulation of Induced Seismicity
  - Hydraulic Fracture Plan
  - Traffic Light System



# Onshore Oil and Gas in the UK

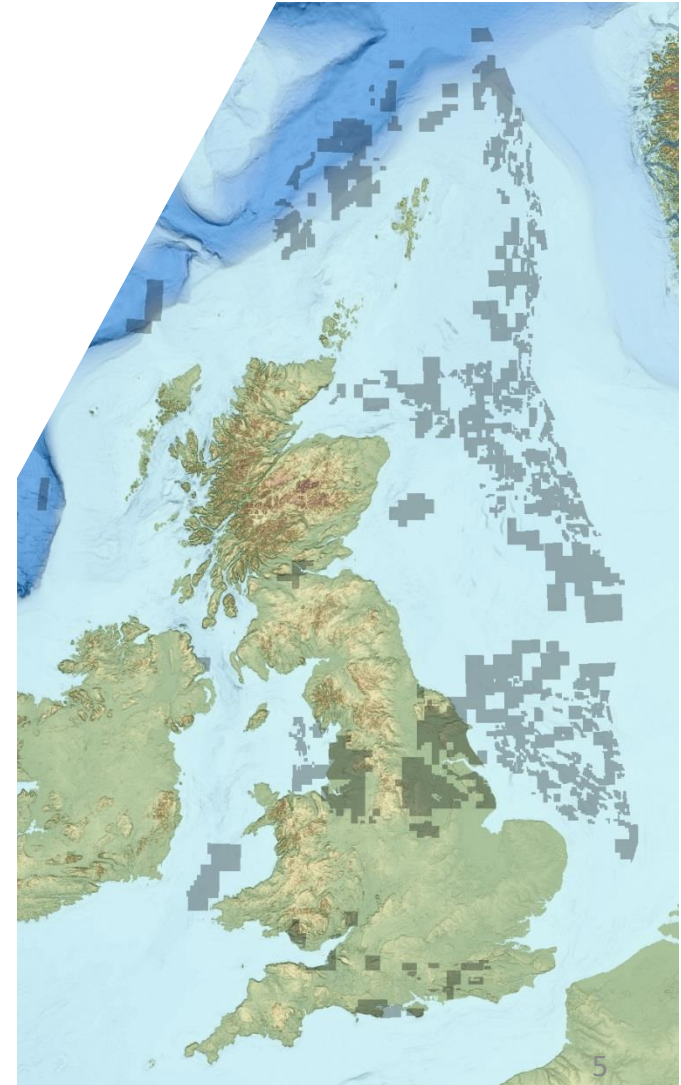
- Crown Ownership
  - Petroleum (Production) Act 1934
- Over 2,200 wells drilled
- Producing fields
  - 30 Oil fields
  - 8 Gas fields
  - 2 Coalbed Methane fields
- 2014 Onshore Production
  - <1% of annual UK production
  - 5.9 million barrels of oil
  - 1.6 billion cubic feet of gas





# The Oil & Gas Authority

- We work with government and industry to make sure that the UK gets the maximum benefit from its oil and gas reserves
- We're responsible for regulating oil and gas operations in the UK  
This includes:
  - oil and gas licensing
  - oil and gas exploration and production
  - oil and gas fields and wells
  - oil and gas infrastructure
  - carbon storage licensing
- We cover both offshore UKCS and **onshore** operations in England





# Responsibilities for the OGA

- Licensing process
- Operator competence
- Seismicity
- Shale geology
- Prospectivity
- Subsidence
- Fracture size and propagation
- Offshore / onshore comparisons

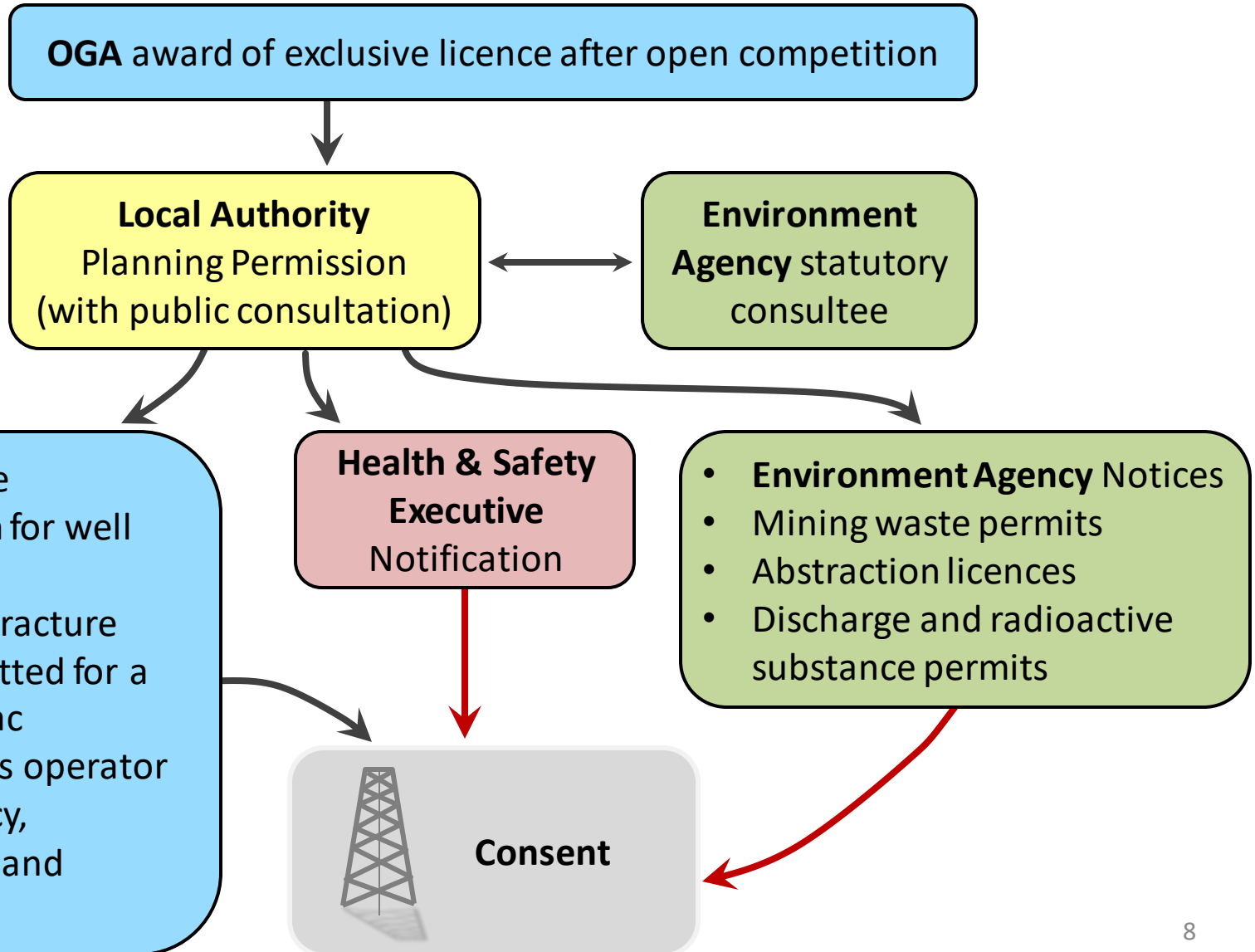


# Collaboration between Regulators





# Regulatory Process in England







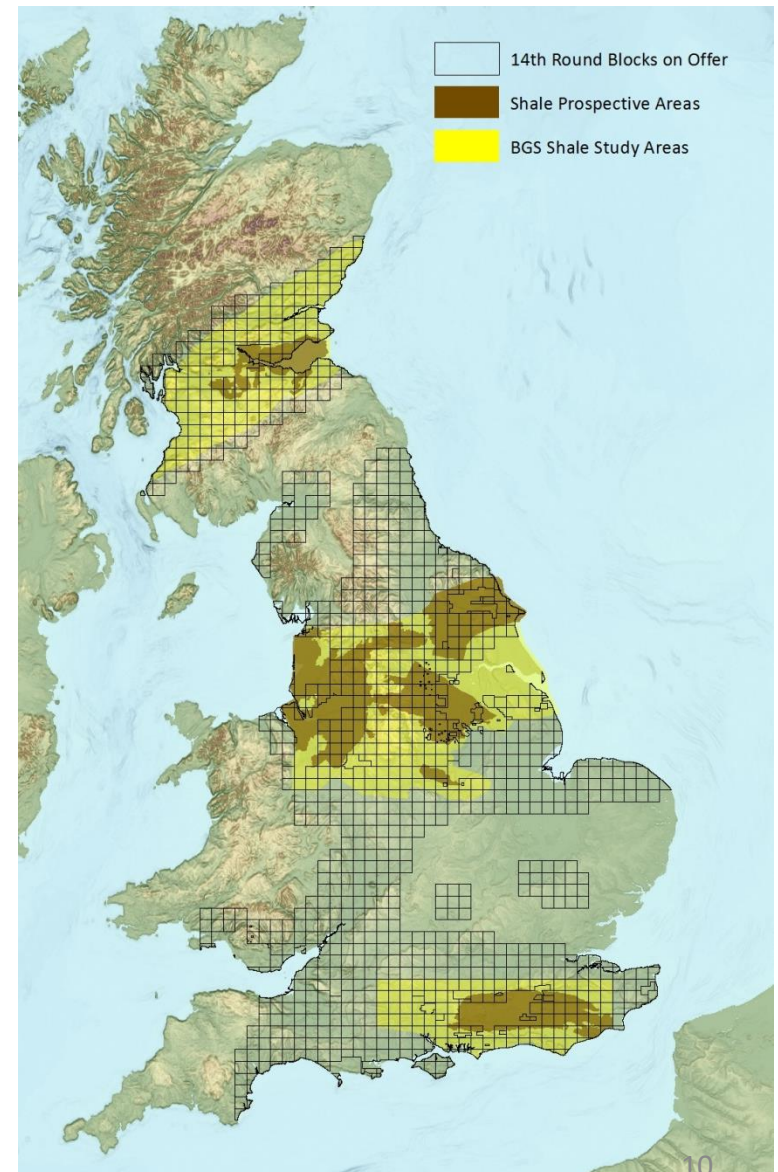
# Petroleum Exploration & Development Licence

- A PEDL grants exclusive rights “**to search and bore for and get petroleum**” in all the various stages of oil and gas exploration, appraisal; production and eventually decommissioning of the wells.
- PEDL licence covers conventional oil and gas, tight gas, coalbed methane (CBM), mine vent gas, oil shale and **shale gas**. A PEDL licence does not allow for underground coal gasification (UCG) or CO<sub>2</sub> sequestration.
- **Licences do not give permission for operations**, only grant exclusivity to licensees within a defined area.
- Drilling, fracking or production require **local planning permission, Access agreement(s)** with relevant landowner(s), **Environment Agency permits, HSE scrutiny** and **OGA well consent** before any operations can commence



# 14<sup>th</sup> Licence Round

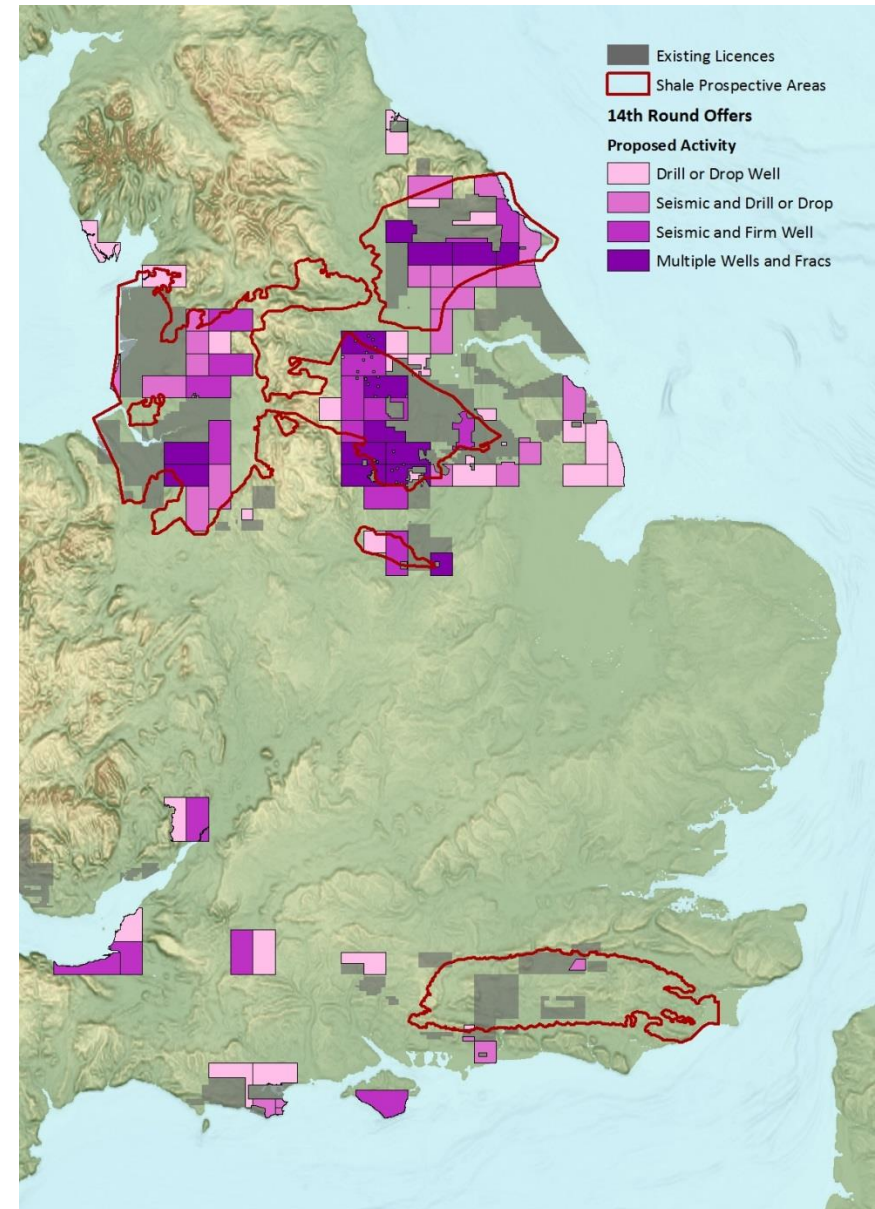
- 295 blocks were applied for by 71 applicants.
- Considered **financial viability and capacity**
  - 95 applications
  - 15 rejected
- Interviews held with applicants
- Blocks marked against published Scheme
- Reduced to 159 blocks after evaluation of:
  - **environmental sensitivity awareness**
  - **operator competency**
  - decision not to award licences in Scotland and Wales
- Habitats Regulations Assessment (HRA) completed on all the blocks
- After Public consultation, 159 blocks were offered in Dec 2015





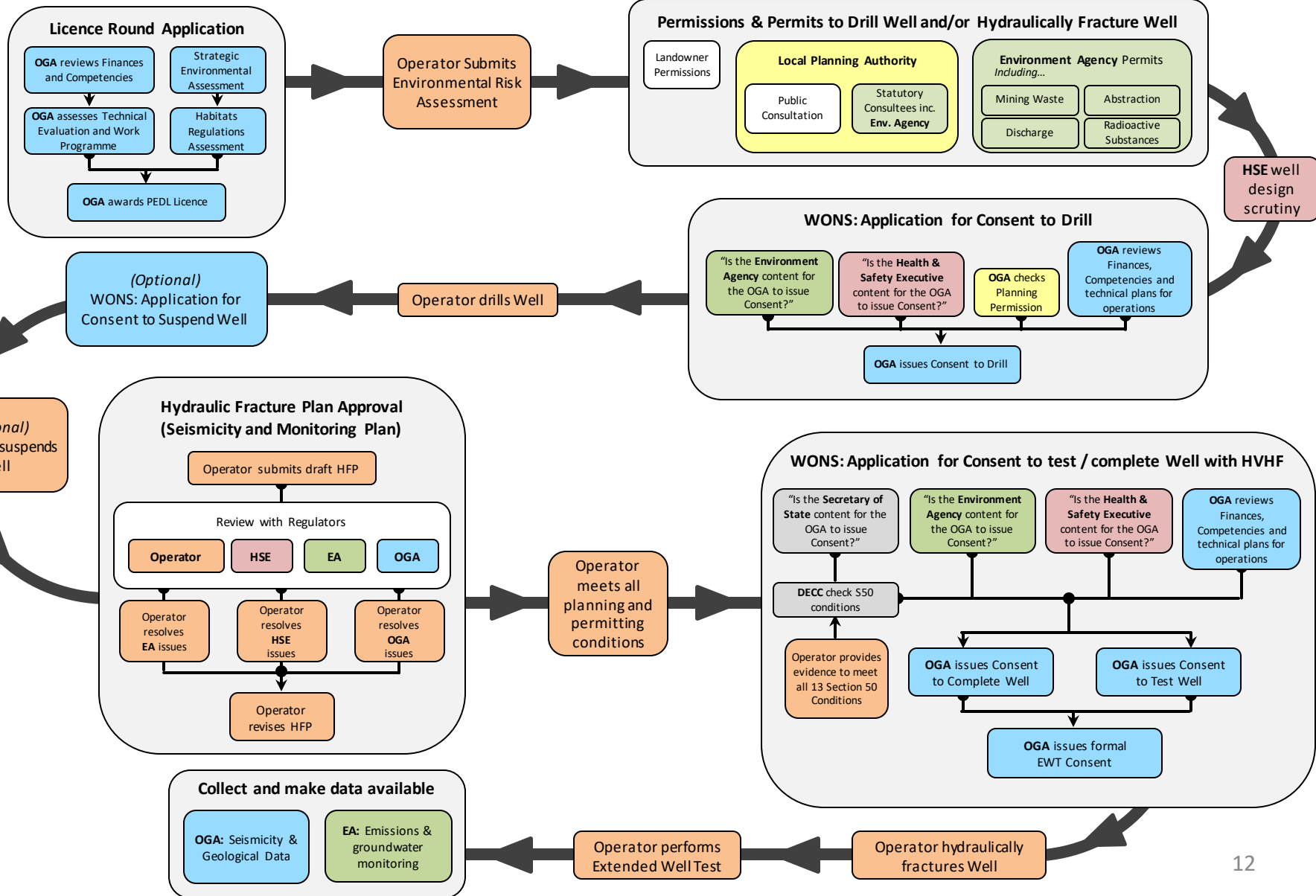
# Round Results

- Total Work Programme bid:
  - 57 Drill or Drop wells
  - 40 Firm vertical wells
  - 14 Firm hydraulically fractured horizontal wells
  - Over 2,100 km of 2D
  - Over 2,000 km<sup>2</sup> of 3D
- The award of a Petroleum Exploration and Development Licence (PEDLs) do not automatically give permission for operations to begin.
- The necessary planning and regulatory consents will be required before any activities can take place.





# Detailed Consent Process





Oil & Gas  
Authority

# Regulating induced seismicity: The Hydraulic Fracture Plan (HFP) and Traffic Light System



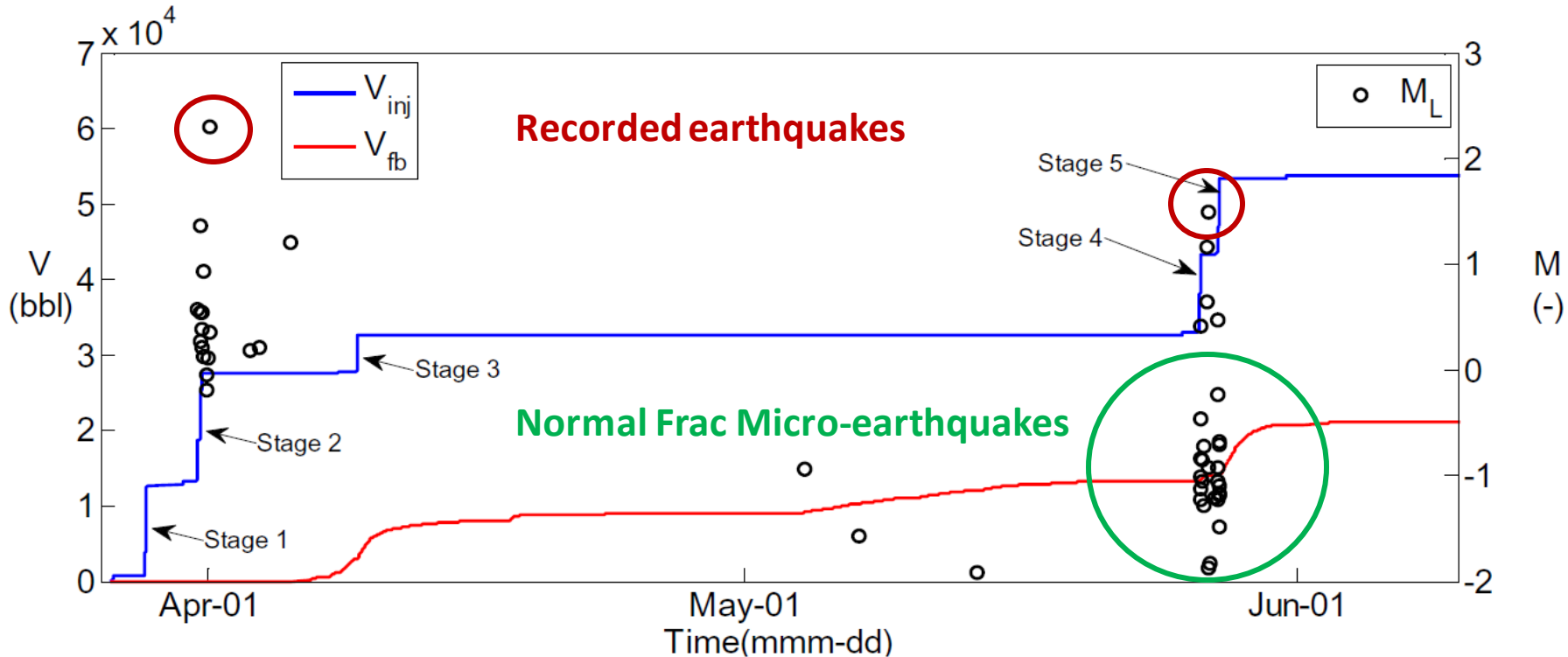
# Background – Preese Hall-1

- Preese Hall-1 was the first HVHF test in the United Kingdom
- Two small earthquakes were recorded in the Blackpool area in Spring 2011 during frac operations
  - Tremors measured Magnitude 2.3 and 1.5 on the Richter scale
- Moratorium on Hydraulic Fracturing imposed by government until 2012
- Report by the Royal Society recommended the introduction of new regulatory requirements





# Induced Seismicity – Preese Hall-1

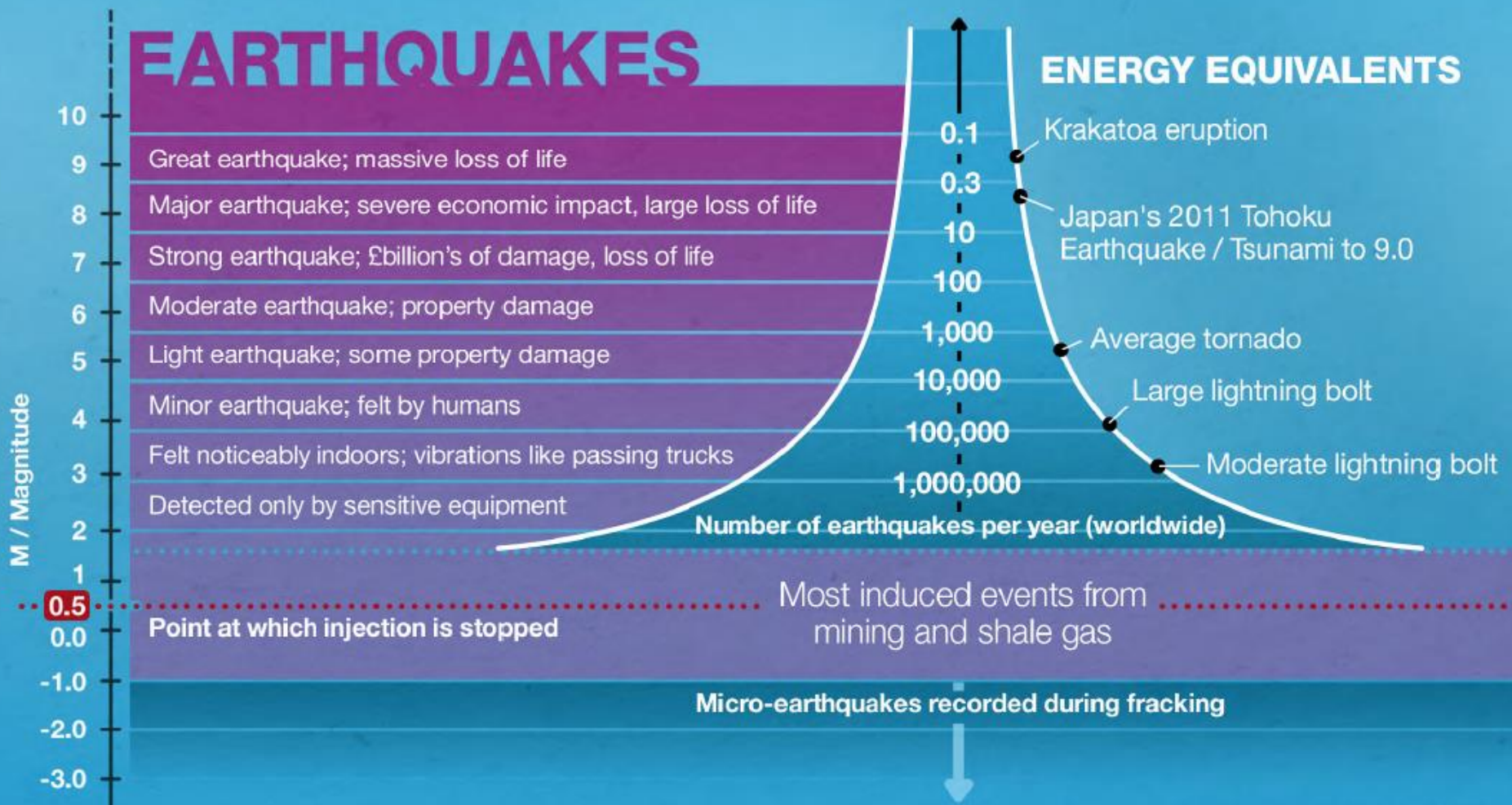


**Figure 24: Overview of injection volume and seismicity of all treatment stages in well PH1. More small events were recorded in May because the monitoring system was improved with local stations.**

Geomechanical Study of Bowland Shale Seismicity, C.J. de Pater and S Baisch, 2011



# Richter Earthquake Magnitude



**Log scale** – a whole number increase represents a tenfold increase in seismic energy



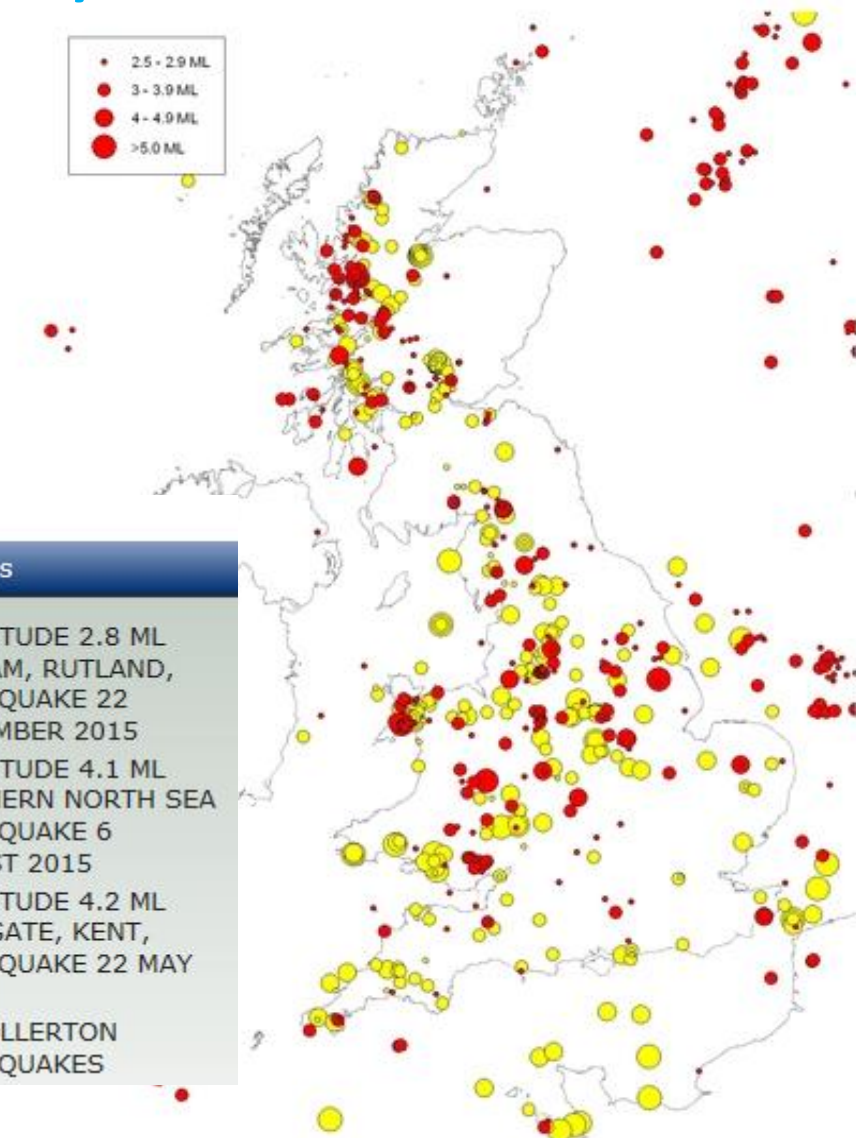


# Historical seismicity in Britain

Date	Depth	Mag	Region
2008/02/27	17.8	5.2	MARKET RASEN,LINCS
2007/04/28	5.3	4.3	FOLKESTONE,KENT
2002/09/22	14.0	4.7	DUDLEY,W MIDLANDS
2001/10/28	14.4	4.1	MELTON MOWBRAY,LEICS
2000/09/23	14.4	4.2	WARWICK,WARWICKSHIRE
1999/03/04	19.0	4.0	ARRAN,STRATHCLYDE
1994/02/15	7.3	4.0	NORWICH,NORFOLK
1990/04/02	14.1	5.1	BISHOP'S CASTLE,SHROPS
1986/09/29	23.3	4.1	OBAN,STRATHCLYDE
1984/08/18	21.0	4.3	LLEYN PENIN,NW WALES
1984/07/29	21.2	4.0	LLEYN PENIN,NW WALES
1984/07/19	20.7	5.4	LLEYN PENIN,NW WALES
1979/12/26	4.5	4.7	LONGTOWN,CUMBRIA
1976/11/03	2	4.5	WIDNES
1975/11/27	11	4.1	KINTAIL
1974/08/10	22	4.4	KINTAIL

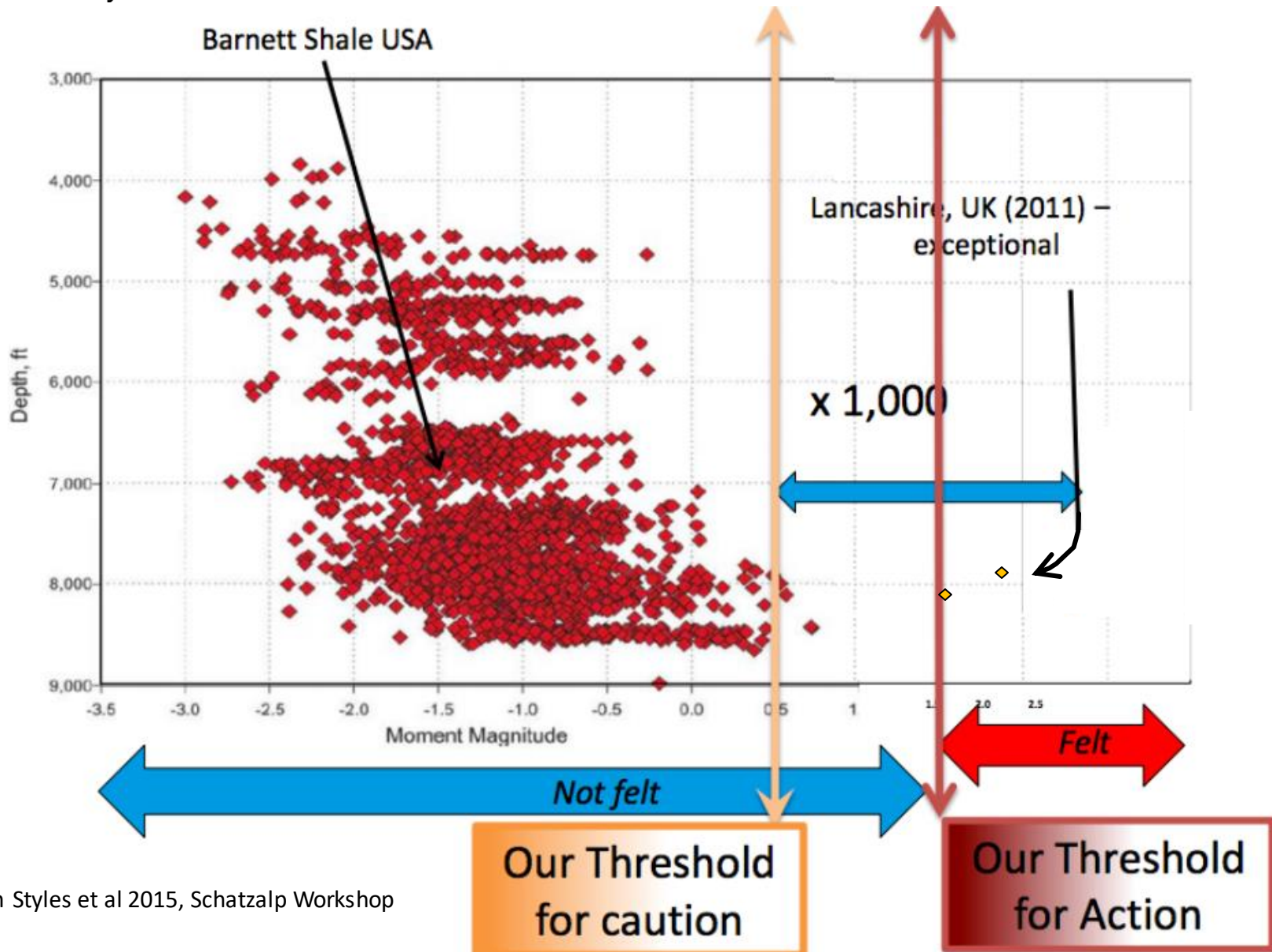
## Latest News

- ❑ MAGNITUDE 2.8 ML OAKHAM, RUTLAND, EARTHQUAKE 22 SEPTEMBER 2015
- ❑ MAGNITUDE 4.1 ML SOUTHERN NORTH SEA EARTHQUAKE 6 AUGUST 2015
- ❑ MAGNITUDE 4.2 ML RAMSGATE, KENT, EARTHQUAKE 22 MAY 2015
- ❑ NEW OLLERTON EARTHQUAKES





# Basis for Traffic Light System

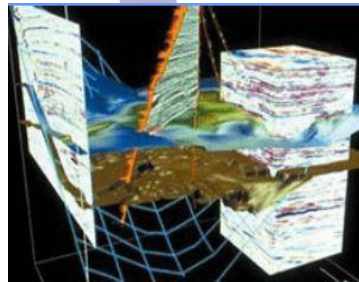
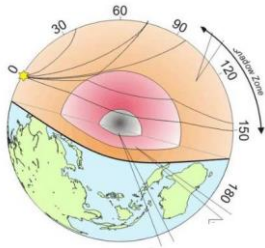




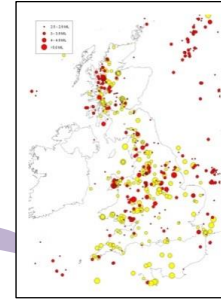
# Hydraulic Fracture Plan: Seismicity & Monitoring Plan

HFP must be agreed for operations, including stages, pumping rates, pressures and volumes to mitigate induced seismicity .

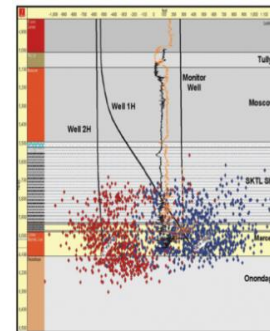
Monitor background seismicity and model injection extent and effect on stress field



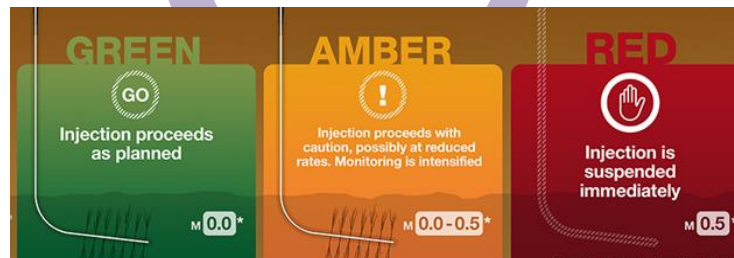
3D seismic to map the subsurface & identify faults



BGS long term earthquake monitoring



Evaluation of location, orientation and extent of the induced fractures

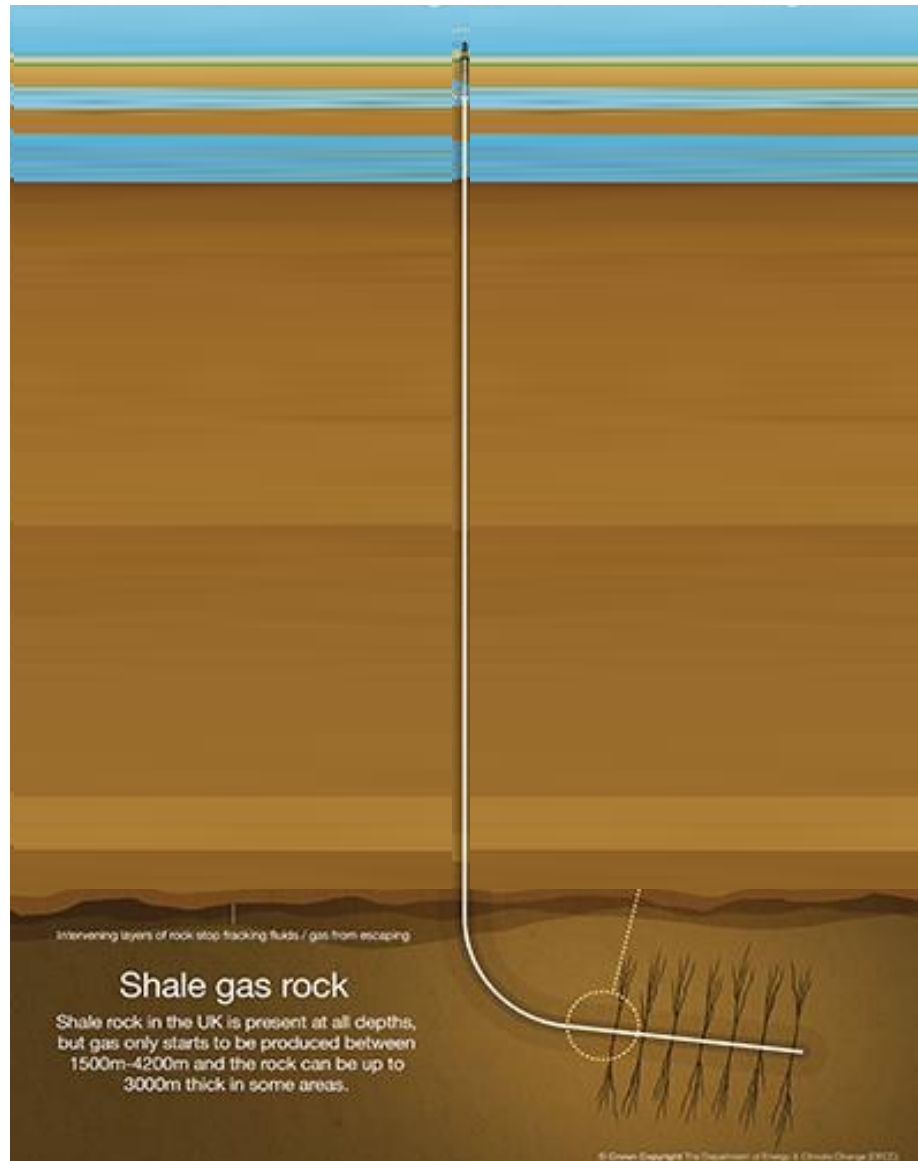


Traffic Light System real time earthquake monitoring during fracking



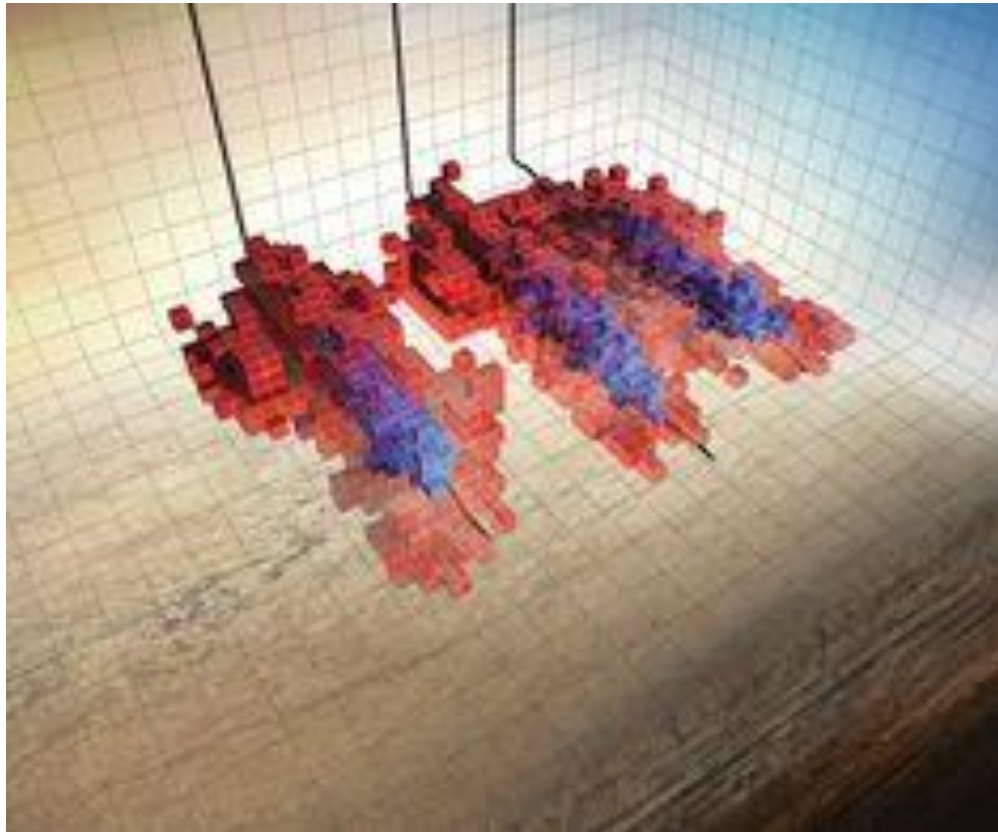
# Seismic and Monitoring Plan

- 1) A depth structure map showing **mapped faults** near the well and along the well path, with a summary assessment of faulting and formation stresses in the area and the risk that operations could reactivate existing faults.
- 2) Information on the local background seismicity and assessment of the risk of induced seismicity.
- 3) Summary of the **planned operation**, including perforation stages, pumping pressures and volumes and predicted extent at each stage.





# Area affected by Hydraulic Fracturing

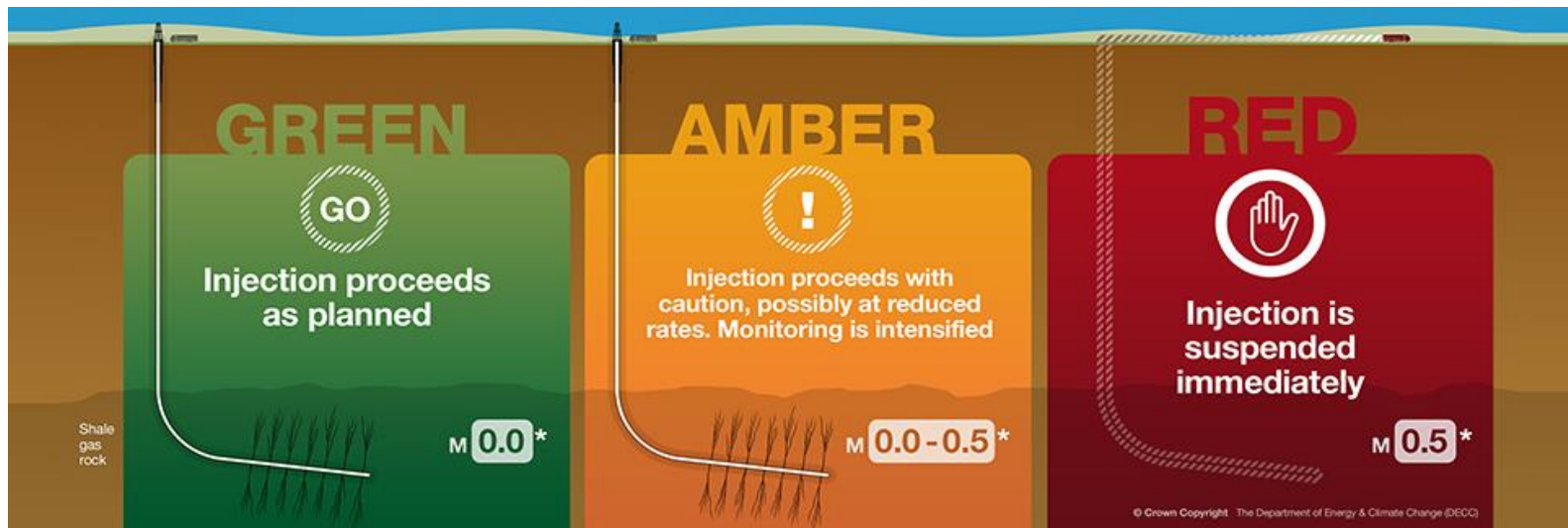


4) Proposed method for monitoring fracture height to **identify where the fractures are** within the target formation and ensure that they are not near the EA permitted boundary



# Traffic Light Scheme

5) A description of proposed **real-time traffic light scheme** for seismicity





# Summary

- The OGA is responsible for both offshore UKCS and **onshore** operations in England
- OGA make checks at key **consent** stages i.e. Drilling, Fracking, Field Development
- Regulators work closely together in evaluating applications for hydraulic fracturing

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