Overview

- There is a lot of concern and conflicting information/opinions about fracking

  - Does that mean we should not exploit unconventional hydrocarbons?
  - What should we be concerned about?
  - What can we do about those concerns? Can the environmental impacts be understood and managed?

- What would shale gas development look like?

- Environmental and health preliminary risk assessment
  - Priority areas for regulation
  - Can impacts be controlled?
  - Further research
  - Managing the environmental risks of fracking
Shale gas and oil extraction in the UK today

Wytch Farm, Dorset
The only site in the UK where fracking for oil production has taken place in the past 5 years

Beckingham, Nottinghamshire

- Hydraulic fracturing is not a new activity
- **High volume** hydraulic fracturing is a new activity
- Defined as >1,000 m³ fluid per stage
Stages in shale gas field development

- **Stage 1:** Site identification & preparation
- **Stage 2:** Well design, drilling, casing & cementing
- **Stage 3:** Technical hydraulic fracturing
- **Stage 4:** Well completion, management of wastewater
- **Stage 5:** Well production (refracturing may be carried out)
- **Stage 6:** Well abandonment

Stages in shale gas well development
Well pad during hydraulic fracturing

New York State DEC, 2011
Well pad during production phase

Photograph: Chesapeake Energy Corp
Associated infrastructure

Photograph: Noah Addis, Public Source [www.publicsource.org](http://www.publicsource.org)

Photograph: J and DR Pew
Associated infrastructure

Redd compressor station, Pennsylvania

Houston Gas processing and cryogenic plant, Pennsylvania

Photographs: marcellus-shale.us and MarkWest Energy Partners LP
Associated infrastructure

Produced water storage facility, Texas
Photograph: Eastern Research Group
Shale gas field during production phase

From
www.fractracker.org
What could shale gas development in the UK look like?

- 23 – 65 trillion m$^3$ of gas in the Bowland shale
  - Much less than this would be economically recoverable
- Annual consumption in the UK: 0.09 trillion m$^3$
- 290 – 1100 million tonnes of oil in Weald basin; no shale gas potential
  - 10% - 35% of estimated North Sea reserves

- Scottish central belt
  - 1.4 – 3.8 trillion m$^3$ gas
  - 400 – 1500 million tonnes oil
- UK Shale gas reserves are much thicker than US reserves, so will need new techniques
What could shale gas development in the UK look like?

- Institute of Directors 2013
  - “each £1 million of capex and opex leads to the creation of 20 jobs in total (direct, indirect and induced).”
  - Up to 50 operating rigs, with up to 400 laterals drilled per year
  - Estimated investment up to £3.7 billion per year, resulting in 74,000 jobs created nationally with a peak in 2028
  - Peak annual production: c.44% of current annual consumption
What could shale gas development in the UK look like?

- Shale gas production scenarios

![Graph showing annual and cumulative production scenarios for shale gas in the UK over the years from 2010 to 2040. The graph includes lines for annual production (Mid and Low) and cumulative production (Mid and Low).](image-url)
Environmental impacts

Support to the identification of potential risks for the environment and human health arising from hydrocarbons operations involving hydraulic fracturing in Europe

Shale gas risk assessment for Maryland
European Commission study

- DG ENV commissioned an initial assessment of the environmental and health risks and impacts associated with the use of hydraulic fracturing.

- Study aims
  - To enable objective evaluation of potential impacts
  - To support legislative gap analysis at European level
  - To identify priority areas for future research

- Comprehensive study:
  - Literature review and consultation
  - Risk screening and prioritisation
  - Regulatory gap analysis
  - Industry and regulatory mitigation measures

- Extended to apply to State of Maryland
  - Also considered downstream infrastructure
  - Evaluation of Best Practical Measures
  - Evaluation of confidence/uncertainty
Environmental and health preliminary risk assessment: Individual well

<table>
<thead>
<tr>
<th>Environmental aspect</th>
<th>Site identification and preparation</th>
<th>Well design drilling, casing, cementing</th>
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## Environmental and health preliminary risk assessment: Cumulative

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Environmental and health preliminary risk assessment: Cumulative; With BPMs

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Environmental and health preliminary risk assessment findings

● Enables regulatory attention to be focused on key risks

● Cumulative impacts require consideration at initial stages of exploration
  ➢ Very high: Land take (not expected to be so high in UK)
  ➢ High: Groundwater contamination risk, accidents/spillages, water resources, air pollution, noise, traffic

● Management of groundwater contamination risks is critical:
  ➢ Systematic processes needed to characterise geological conditions
  ➢ 600 m separation between fracturing zone and groundwater
  ➢ Quality and monitoring of casing and cementing is key
  ➢ Baseline environmental monitoring required
  ➢ Lack of data on impacts of repeated fracturing or induced seismicity on well integrity

● Flowback water treatment/re-use/disposal in the UK

● Best practice measures reduce, but do not eliminate, environmental risks

● Priority areas for future research
  ➢ Biodiversity impacts
  ➢ Long-term post-abandonment phase
Managing the environmental risks of fracking

● Are there reasons to be concerned?
  ➢ There are real and unfamiliar environmental and health risks
  ➢ The risks are not yet fully understood
  ➢ Risks and impacts can be mitigated, but not fully eliminated

● To frack, or not to frack – is no longer an environmental question

● To frack safely or not is the question
  ➢ We have a long history of managing industrial pollution
  ➢ Robust planning and regulatory controls are needed and available
  ➢ We have the opportunity to prepare:
    o Baseline surveys
    o Specific regulatory frameworks

● Webinar coming up in December on risk management
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